National Park Service
U.S. Department of the Interior

Northeast Region
Philadelphia, Pennsylvania

Vegetation Classification and Mapping at Gateway National Recreation Area

Technical Report NPS/NER/NRTR—2008/107



Cover photo: Maritime Dunes at Fort Tilden in Gateway National Recreation Area.
Photograph by: Gregory J. Edinger, NY Natural Heritage Program.

Vegetation Classification and Mapping at Gateway National Recreation Area

Technical Report NPS/NER/NRTR—2008/107

Gregory J. Edinger[1], Aissa L. Feldmann[1], Timothy G. Howard[1], John J. Schmid[1], Elizabeth Eastman[2], Ery Largay[3], and Lesley A. Sneddon[3]

[1] New York Natural Heritage Program
625 Broadway, 5th Floor
Albany, New York 12233-4757

[2] North Carolina State University
Center for Earth Observation
Campus Box 7106
Raleigh, NC 27695-7106

[3] NatureServe
11 Avenue de Lafayette, 5th Floor
Boston, MA 02111

February 2008

U.S. Department of the Interior
National Park Service
Northeast Region
Philadelphia, Pennsylvania

The Northeast Region of the National Park Service (NPS) comprises national parks and related areas in 13 New England and Mid-Atlantic states. The diversity of parks and their resources are reflected in their designations as national parks, seashores, historic sites, recreation areas, military parks, monuments and memorials, and rivers and trails. Biological, physical, and social science research results, natural resource inventory and monitoring data, scientific literature reviews, bibliographies, and proceedings of technical workshops and conferences related to these park units are disseminated through the NPS/NER Technical Report (NRTR) and Natural Resources Report (NRR) series. The reports are a continuation of series with previous acronyms of NPS/PHSO, NPS/MAR, NPS/BSO-RNR, and NPS/NERBOST. Individual parks may also disseminate information through their own report series.

Natural Resources Reports are the designated medium for information on technologies and resource management methods; "how to" resource management papers; proceedings of resource management workshops or conferences; and natural resource program descriptions and resource action plans.

Technical Reports are the designated medium for initially disseminating data and results of biological, physical, and social science research that addresses natural resource management issues; natural resource inventories and monitoring activities; scientific literature reviews; bibliographies; and peer-reviewed proceedings of technical workshops, conferences, or symposia.

Mention of trade names or commercial products does not constitute endorsement or recommendation for use by the National Park Service.

This report was accomplished under Cooperative Agreement H4525020034; Modification No. 001 dated September 15, 2004, with assistance from the NPS. The statements, findings, conclusions, recommendations, and data in this report are solely those of the author(s), and do not necessarily reflect the views of the U.S. Department of the Interior, National Park Service.

Print copies of reports in these series, produced in limited quantity and only available as long as the supply lasts, or preferably, file copies on CD, may be obtained by sending a request to the address on the front cover. Print copies also may be requested from the NPS Technical Information Center (TIC), Denver Service Center, PO Box 25287, Denver, CO 80225-0287. A copy charge may be involved. To order from TIC, refer to document D-452.

Please cite this publication as:

Edinger, G. J., A. L. Feldmann, T. G. Howard, J. J. Schmid, E. Eastman, E. Largay, and L. A. Sneddon. 2008. Vegetation Classification and Mapping at Gateway National Recreation Area. Technical Report NPS/NER/NRTR—2008/107. National Park Service. Northeast Region. Philadelphia, PA.

NPS D-452 March 2008

Table of Contents

Page

Figures v

Tables vii

Appendixes ix

Acknowledgments xi

Executive Summary xiii

Introduction 1

General Background 1

National Vegetation Classification 1

Project Area 3

Park-specific Information 3

Location and Regional Setting 3

Park Environmental Attributes 6

Materials and Methods 13

Planning and Scoping 13

Preliminary Data Collection and Review of Existing Information 13

Preliminary Vegetation Map Production 13

Aerial Photography Acquisition and Processing 14

Field Data Collection and Classification 15

Accuracy Assessment 23

Results 32

Vegetation Classification and Characterization 33

Vegetation Association Descriptions 35

Vegetation Map Production 35

Table of Contents (continued)

Page

Accuracy Assessment 35

Project Deliverables 38

Discussion 43

Vegetation Classification and Characterization 43

Vegetation Association Map Production 45

Palustrine and Estuarine Wetland Maps 46

Literature Cited 51

Figures

Page

Figure 1. Location of Gateway National Recreation Area in Kings, Queens, and Richmond counties, New York, and Monmouth County, New Jersey. 4

Figure 2. Location of Gateway National Recreation Area on 1:24,000 USGS topographic quadrangle maps. 5

Figure 3. Ecoregion sections and subsections of the Gateway National Recreation Area. 7

Figure 4a. Bedrock geology of the Gateway National Recreation Area. 9

Figure 4b. Surficial geology of the Gateway National Recreation Area. 10

Figure 5a. Location of 119 vegetation plots sampled in 2003 and 2004 within the Jamaica Bay Unit of Gateway National Recreation Area. 19

Figure 5b. Location of 22 vegetation plots sampled in 2003 and 2004 within the Staten Island Unit of Gateway National Recreation Area. 20

Figure 5c. Location of 37 vegetation plots sampled in 2003 and 2004 within the Sandy Hook Unit of Gateway National Recreation Area. 21

Figure 6. Ground control points used to calculate horizontal positional accuracy of the Gateway National Recreation Area photomosaics. 25

Figure 7a. Location of 328 accuracy assessment (AA) destination points and 209 AA points sampled 2006 within the Jamaica Bay Unit of Gateway National Recreation Area. 29

Figure 7b. Location of 25 accuracy assessment (AA) destination points and 25 AA points sampled in 2006 within the Staten Island Unit of Gateway National Recreation Area. 30

Figure 7c. Location of 105 accuracy assessment (AA) destination points and 97 AA points sampled within the Sandy Hook Unit of Gateway National Recreation Area. 31

Figure 8a. Distribution of vegetation associations and Anderson Level II categories within the Jamaica Bay Unit of Gateway National Recreation Area. 39

Figures (continued)

Page

Figure 8b. Distribution of vegetation associations and Anderson Level II categories within the Staten Island Unit of Gateway National Recreation Area. 40

Figure 8c. Distribution of vegetation associations and Anderson Level II categories within the Sandy Hook Unit of Gateway National Recreation Area. 41

Figure 9a. Palustrine and Estuarine Wetlands within the Jamaica Bay Unit of Gateway National Recreation Area. 47

Figure 9b. Palustrine and Estuarine Wetlands within the Staten Island Unit of Gateway National Recreation Area. 48

Figure 9c. Palustrine and Estuarine Wetlands within the Sandy Hook Unit of Gateway National Recreation Area. 49

Tables

Page

Table 1. Number of polygons, mapped hectares, and number of plots sampled in 2003 and 2004 by national vegetation association and Anderson Level II categories on the 2006 revised preliminary vegetation map (pre-accuracy assessment) at Gateway National Recreation Area. 16

Table 2. Number of polygons, mapped hectares, number of accuracy assessment destination points, and number of accuracy assessment points sampled in 2006 by vegetation cover type and Anderson Level II categories on the 2007 final vegetation map (post-accuracy assessment) at Gateway National Recreation Area. 26

Table 3. Gateway National Recreation Area datasets plots vs. species. 33

Table 4. Contingency matrix and calculated errors for the thematic accuracy assessment of the vegetation association map of the Gateway National Recreation Area. 42

Table 5. Summary of products resulting from the vegetation classification and mapping of vegetation at Gateway National Recreation Area. 38

Appendixes

Page

Appendix A. Key information for Gateway National Recreation Area Photomosaics. 57

Table A1. Gateway National Recreation Area – Jamaica Bay Unit photomosaic key attributes. 57

Table A2. Gateway National Recreation Area – Staten Island Unit photomosaic key attributes. 58

Table A3. Gateway National Recreation Area – Sandy Hook Unit photomosaic key attributes. 59

Appendix B. NY Natural Heritage Vegetation Plot Form and Hand-Held DataBase (HHDB) screen shots. 61

Figure B1. Screen shots of NY Natural Heritage Hand-Held DataBase. Vegetation plot data and accuracy assessment point data were digitally collected in the field using this software. 65

Figure B2. Screen shots of NY Natural Heritage Hand-Held DataBase. Survey site information, plot and point spatial data, and vegetation cover data were digitally collected in the field using this software. 66

Figure B3. Screen shots of NY Natural Heritage Hand-Held DataBase. Data on the physical characteristics and soils for plots were digitally collected in the field using this software. 67

Appendix C. Plants observed in Gateway National Recreation Area during vegetation plot and thematic accuracy assessment sampling. 69

Appendix D. Dichotomous field key to the vegetation associations of Gateway National Recreation Area. 81

Appendix E. Local and global descriptions of vegetation associations. 101

Acknowledgments

We would like to thank the following people for their time and assistance with this project. Kathryn Mellander, Doug Adamo, George Frame, Kim Tripp, Edgardo Castillo, and Michael Byer of the National Park Service provided invaluable expertise on park resources, critical review of draft vegetation classification and mapping documents, and legal access to portions of the park restricted to the public. Chris Olijnik, George Frame, Tim Chu, and Patricia Rafferty provided boat access to the salt marsh areas in Jamaica Bay. Kathryn Mellander provided assistance and expertise with National Park Service GIS resources. Kathy Sawyer and Kim Tripp were very helpful in arranging park housing, scheduling meetings, providing keys, parking permits, and general logistics. Elizabeth Johnson of the NPS Northeast Region office provided guidance from the inception of this project and exhibited flexibility, patience, and understanding throughout the whole process.

Timothy Howard (NY Natural Heritage) assisted with plot data collection, plant identification, database programming and management, and statistical analyses. Stephen Young (NY Natural Heritage) contributed his valuable botanical expertise to this project. John Schmid (NY Natural Heritage) prepared all report maps (except Figure 6), generated accuracy assessment points to survey, reviewed GIS digital layers, and completed GIS metadata requirements. Jennifer Garrett, formerly with NY Natural Heritage, assisted with initial report template preparation. Tara Seoane (NY Natural Heritage) assisted with report formatting.

Elizabeth Eastman of the North Carolina State University Center for Earth Observation provided the sections of the report pertaining to the production and positional accuracy assessment of the park's photomosaics.

Ery Largay and Lesley Sneddon (NatureServe) assisted with the crosswalks to the National Vegetation Classification System, provided global community descriptions, and report review.

We thank the following members of the Sandy Hook team that assisted on this project: Kathleen Strakosch Walz (NJ Natural Heritage) for plot data collection, plant identification, map and report review, and accuracy assessment field assistance; Karl Anderson and Linda Kelly for plot data collection and plant identification; and William Olson (environmental consultant) for field assistance and botanical expertise.

Stephanie Perles and Gregory Podniesinski (PA Natural Heritage) provided NPS vegetation mapping project consultation, sample final reports, and metadata templates. In an effort to achieve consistency from state to state, sections of the text in this report were adapted with permission from previously completed NPS vegetation mapping reports (e.g., Perles et al. 2006). The contributions of all of these individuals are greatly appreciated.

Executive Summary

Vegetation classification and mapping of vegetation associations were conducted at the Gateway National Recreation Area, creating current digital geospatial databases for the park.

Thirty-five vegetation associations that occur within the park were identified and described in detail. The diversity of vegetation associations is primarily a result of the following four factors: 1) the geologic history of the region, especially the effect of glaciation; 2) the park's position on the northeastern U.S. coastal plain; 3) its proximity to the ocean and maritime ecological processes, such as diurnal tides, storm overwash, salt spray, and high winds; and 4) its setting within an urban landscape with an intensive human land use history along with its associated problems, such as invasive species, fragmentation, habitat loss, pollution, channel dredging, land filling, etc.

In 2003, a preliminary vegetation map of Gateway National Recreation Area was created showing NY ecological communities (Edinger et al. 2002) that was used to plan the vegetation plot sampling strategy. After plot sampling in 2003 and 2004, statistical analyses were conducted on these data in order to refine the classification and map. Prior to accuracy assessment (AA) field sampling, a revised preliminary map was created showing National Vegetation Classification (NVC) vegetation associations and Anderson Level II land cover classes. This revised map was used in spring 2006 to plan the thematic AA strategy. After AA field sampling in summer 2006, a final map was created in 2007 showing corrected NVC associations and Anderson II land cover classes. Thematic AA for the vegetation association map was calculated with a contingency matrix. The Kappa index for the 2006 revised preliminary map was 0.6201, with the overall percent accuracy calculated as 63.75%.

The 2006 revised preliminary map and the final 2007 post-AA maps were created, following the USGS/NPS Vegetation Mapping Program protocols (TNC and ESRI 1994a, 1994b; ESRI et al. 1994). All map polygons, vegetation sampling plots, and AA sampling points were labeled with the NVC vegetation association code, NY ecological community name, and Anderson Level II land cover class and code. A detailed classification was created with global and local descriptions and other relevant information for each NVC association surveyed or mapped at the park. A dichotomous field key was developed for these vegetation associations to assist with field recognition and classification. A CD with all plot and accuracy assessment point photographs taken during this project was compiled. In addition, a separate map of palustrine and estuarine wetlands of the park was created from the final vegetation association map.

Despite the degraded landscape and developed areas in and around the park, Gateway National Recreation Area has several vegetation associations with biodiversity significance at the state and global level. The rarest association in the park is the maritime holly forest in the Sandy Hook Unit, New Jersey. At 231 acres it is the largest one of only two known occurrences in the world, with the other located at Sunken Forest on Fire Island National Seashore, New York. The low salt marsh in Jamaica Bay is currently the largest (1,237 acres) example in the state documented by NY Natural Heritage, and the maritime dunes at Breezy Point are of good quality and considered significant from a statewide perspective. All of the vegetation associations at the

park provide habitat for a wide array of species and present numerous opportunities for nature study and recreation for visitors.

Keywords: vegetation association, vegetation classification, vegetation mapping, Gateway National Recreation Area, Jamaica Bay Unit, Breezy Point, Fort Tilden, Jacob Riis Park, Floyd Bennett Field, Plumb Beach, Canarsie Pier, Spring Creek, Jamaica Bay Wildlife Refuge, Staten Island Unit, Great Kills Park, Miller Field, Fort Wadsworth, Sandy Hook Unit.

Introduction

General Background

One of the goals of the National Park Service's Inventory and Monitoring (I&M) Program is to provide current and accurate information for effective, long-term management of the natural resources held in trust (NPS 2003). The I&M Program recommends that 12 basic natural resource inventories be developed for each park that contains significant natural resources. These park inventories provide crucial baseline information for the proper stewardship of natural and cultural resources. A map of each park's vegetation, based on aerial photography less than five years old, is one of the 12 inventories recommended by the program (NPS 2003).

To ensure that vegetation mapping is standardized across the National Park Service (NPS), The Nature Conservancy (TNC) and Environmental Systems Research Institute (ESRI) in conjunction with NatureServe, the Federal Geographic Data Committee (FGDC), and the Ecological Society of America (ESA) Vegetation Subcommittee, developed a protocol for creating vegetation maps in national parks. This protocol included the Standardized National Vegetation Classification System (TNC and ESRI 1994a), Field Methods for Vegetation Mapping (TNC and ESRI 1994b), and Accuracy Assessment Procedures (ESRI et al. 1994). This protocol was adopted by the United States Geological Survey (USGS)/NPS Vegetation Mapping Program as the standard and has been implemented at Gateway National Recreation Area.

The goal of the vegetation mapping effort at Gateway National Recreation Area was to produce an up-to-date digital geospatial vegetation database for the park and to provide a vascular plant species list, a dichotomous key for vegetation associations, and descriptions of the vegetation associations in the park. Baseline information on plant community structure and composition is critical to developing desired conditions and park management goals relating to native plant communities, nonnative plant and insect species, and effects of other disturbances. The identification and description of plant communities also provide habitat information important to understanding associated organisms, including animals, protozoans, bacteria, and fungi. A map of vegetation associations may allow inferences about the location and abundance of species that are associated with each community.

National Vegetation Classification

This report also describes the park's vegetation in the context of a national and regional vegetation classification. The Nature Conservancy, in conjunction with NatureServe, the Federal Geographic Data Committee, and the Ecological Society of America Vegetation Subcommittee, developed the National Vegetation Classification System (NVCS) in order to standardize vegetation classification and facilitate the comparison of vegetation types throughout the United States and internationally. The NVCS is a systematic approach to classifying existing natural vegetation using physiognomies and floristics. This classification system has a hierarchical structure (Grossman et al. 1998).

The basic unit of vegetation classification in the NVCS is the association. An association is defined as a plant community type that is relatively homogeneous in composition and structure,

and occurs in a uniform habitat. Each association is assigned a unique Community Element Global code, or CEGL code, by NatureServe. For example, the Northern Bayberry - Beach Plum Shrubland Association (CEGL006295) is a common shrubland type along the Atlantic coast from Maine to New Jersey. Associations are also assigned global rarity ranks that indicate their conservation status and relative risk of extirpation (Grossman et al.1998). The Maritime Holly Forest at Sandy Hook is an example of a globally rare association with only two currently documented examples in the world (i.e., Sandy Hook and Sunken Forest at Fire Island National Seashore). Associations from the NVCS are often equivalent to communities in state-specific vegetation classifications such as Ecological Communities of New York State (Edinger et al. 2002) or Classification of Vegetation Communities of New Jersey: Second Iteration (Breden et al. 2001) and Draft New Jersey Ecological Community Crosswalk: A Tool for the Identification of Habitats Across Jurisdictional Boundaries (Walz et al. 2007). NVCS associations can usually be crosswalked with communities in state classifications.

Several associations that share one or more dominant or characteristic species can be grouped to form an alliance. Alliances are generally more wide-ranging geographically than associations, covering multiple habitats and broader species composition. For example, the Northern Bayberry - Beach Plum Shrubland Association (CEGL006295) mentioned previously is grouped with other similar bayberry-dominated shrubland associations into the Northern Bayberry – (Beach Plum) Shrubland Alliance. An association with unique species composition or environmental niche can be assigned to its own alliance, such that the alliance only contains one association instead of multiple associations.

One level above alliance is the formation, representing vegetation types that share a common physiognomy within broadly defined environmental factors (Grossman et al.1998). For example, Temperate Cold-Deciduous Shrubland is a common formation that encompasses numerous shrubland types in the northeastern and midwestern United States, including the Northern Bayberry – (Beach Plum) Shrubland Alliance mentioned above.

The NVCS was developed by ecologists of the Natural Heritage Program network and The Nature Conservancy after many years of literature review, data collection, and data analysis. This collaborative effort culminated in the publication of International Classification of Ecological Communities: Terrestrial Vegetation of the United States (Grossman et al. 1998). The International Classification of Ecological Communities, now known as the International Vegetation Classification, of which the NVCS is a subset, has been revised and refined since 1998, and is now managed by NatureServe in continued collaboration with the network of Natural Heritage Programs. The classification is housed in the Biotics database (NatureServe 2004) and is updated regularly. The upper levels of the NVCS were adopted as a standard by the Federal Geographic Data Committee to support the production of uniform statistics on vegetation at the national level (FGDC 1996). The Vegetation Mapping Program of the National Park Service adopted the alliance level, and where possible, the association level, as the mapping unit for national parks.

Project Area

Park-specific Information

The Gateway National Recreation Area was established in 1972 to preserve and protect scarce and/or unique natural, cultural, and recreational resources. Gateway National Recreation Area now covers about 10,768 ha (26,607 ac) of land and water. More than eight million people visit the park each year to enjoy fishing, boating, sailing, swimming, sunbathing, nature-viewing, photography, hiking, cycling, and learning about aviation and military history.

Gateway National Recreation Area has an international reputation as a birding "hot spot" (Drennan 1981; Fowle and Kerlinger 2001). In particular, the salt marsh complex within Jamaica Bay Wildlife Refuge has long been recognized as productive bird habitat and in 1997 the area was designated as an "Important Bird Area" by Audubon New York (Burger and Liner 2005).

A detailed account of the physiography and relief, climate, geology, land use history, vegetation, wildlife, hydrology, beach and dune formation, and tidal marshes at the park can be found in the Soil Survey of Gateway National Recreation Area, New York and New Jersey (USDA NRCS 2001). A comprehensive guide to Gateway National Recreation Area (Tanacredi and Badger 1995) provides information on history, geology, plant, sea life, birds, ecology, and recreational activities. General information on the cultural and natural history of Gateway National Recreation Area can also be found in NPS park brochures as well as NPS official web sites (e.g., http://www.nps.gov/gate/).

Location and Regional Setting

Gateway National Recreation Area extends from Sandy Hook, New Jersey, along the south side of Staten Island, to Jamaica Bay and Breezy Point in New York. The park includes portions of Kings, Queens, and Richmond counties in New York and Monmouth County in New Jersey (Figure 1). The park covers portions of eight 1:24,000 USGS topographic quadrangle maps (Figure 2). Gateway National Recreation Area is comprised of three Units: the Jamaica Bay Unit (2,509 ha [6,200 ac]) and Staten Island Unit (384 ha [950 ac]) in New York, and the Sandy Hook Unit (809 ha [2, 000 ac]) in New Jersey. These three units are described briefly below.

Jamaica Bay Unit

The Jamaica Bay Unit is comprised of several disjunct parcels in and around Jamaica Bay that straddle the Kings County and Queens County line (NYC Boroughs of Brooklyn and Queens, respectively) and includes several salt marsh islands (Figure 1). The Jamaica Bay Unit includes Breezy Point, Fort Tilden, and Jacob Riis Park on the Rockaway Beach barrier peninsula (sand spit); Floyd Bennett Field, Plumb Beach, and Canarsie Pier along the east side of Jamaica Bay; with Spring Creek and Jamaica Bay Wildlife Refuge occupying the central and eastern portions of the Bay. The Jamaica Bay Unit is located on the following USGS 7.5 minute topographic quadrangle maps: Brooklyn, Jamaica, Coney Island, and Far Rockaway (Figure 2).

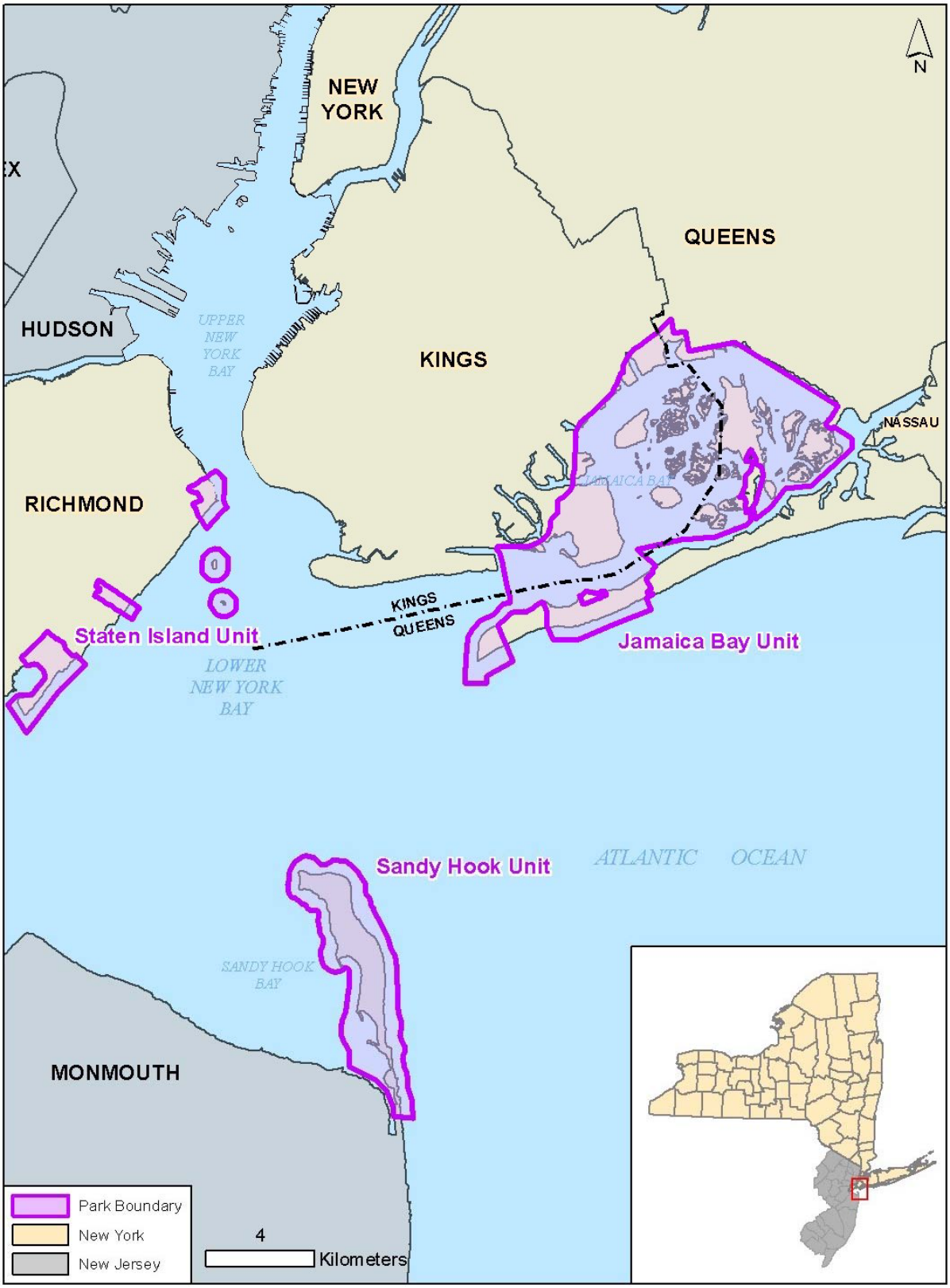


Figure 1. Location of Gateway National Recreation Area in Kings, Queens, and Richmond counties, New York, and Monmouth County, New Jersey.

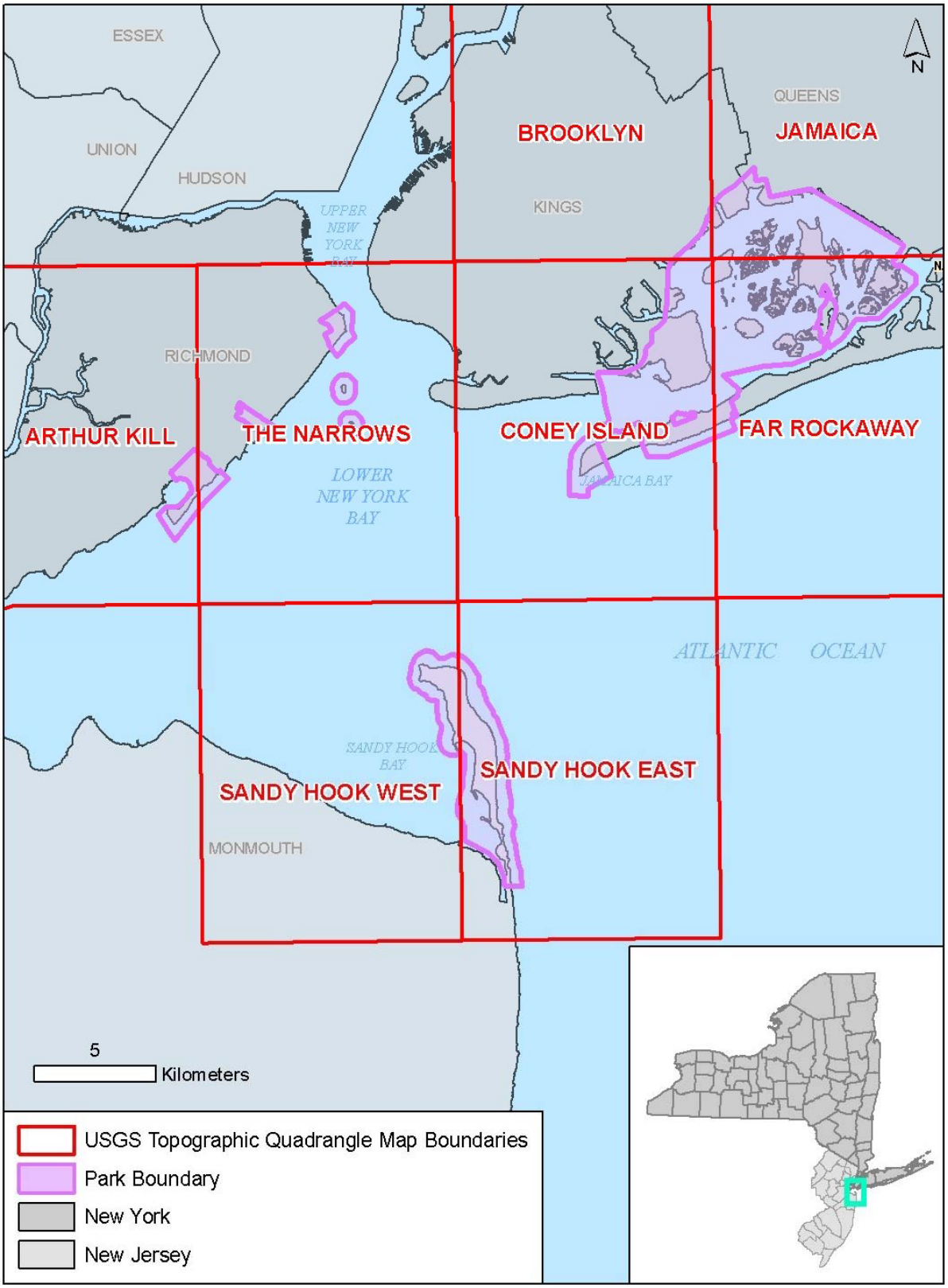


Figure 2. Location of Gateway National Recreation Area on 1:24,000 USGS topographic quadrangle maps.

Staten Island Unit

The Staten Island Unit is comprised of three separate sites along the south shore of Staten Island (Richmond County) (Figure 1). Great Kills Park is located near the midpoint of Staten Island's south shore, Miller Field is about two miles northeast of Great Kills, and Fort Wadsworth is located at the west base of the Verrazano Narrows Bridge. Hoffman and Swinburne Islands are also part of this unit. The Staten Island Unit is located on the Arthur Kill and The Narrows USGS 7.5 minute topographic quadrangle maps (Figure 2).

Sandy Hook Unit

Sandy Hook is a six-mile-long barrier beach peninsula at the northern tip of the New Jersey Shore that juts north into the New York Lower Bay with Sandy Hook Bay along the west side (Figure 1). The peninsula is of variable width, ranging from less 200 m (656 ft) wide at the southern base to 1,800 m (5,905 ft) wide at the northern, widest point with an average width of 1,368 m (4,488 ft [0.85 mi]). Sandy Hook is located in the northern part of Monmouth County, New Jersey. The Sandy Hook Unit is located on the Sandy Hook East and Sandy Hook West USGS 7.5 minute topographic quadrangle maps (Figure 2).

Park Environmental Attributes

Ecoregions

The distribution of plant and animal species in New York and New Jersey closely corresponds with ecoregional boundaries. These areas of ecological homogeneity are defined by similarities in soil, physiography, climate, hydrology, geology, and vegetation. The ecoregions are based on (TNC) classifications for the U.S. and are modified from USDA Forest Service ecoregions (Bailey 1995). There are seven TNC Ecoregions and 34 Ecoregion Subsections in New York. There are three TNC Ecoregions and eight Ecoregion Subsections in New Jersey. At Gateway National Recreation Area, the Jamaica Bay and Staten Island units are within the Long Island Coastal and Moraine Subsection of the North Atlantic Coast Ecoregion. Sandy Hook is within the New Jersey Inner Coastal Plain Subsection of the North Atlantic Coast Ecoregion (Figure 3).

Geology

A general overview of the geology of the New York City Region is available online from USGS http://3dparks.wr.usgs.gov/nyc/. This Web site includes descriptive abstracts for several Gateway National Recreation Area sites including Sandy Hook, Breezy Point, Jamaica Bay, Plumb Beach, and the South Beach of Staten Island (Great Kills Park). In addition, a detailed account of the park's geology can be found in the Soil Survey of Gateway National Recreation Area, New York and New Jersey (USDA NRCS 2001).

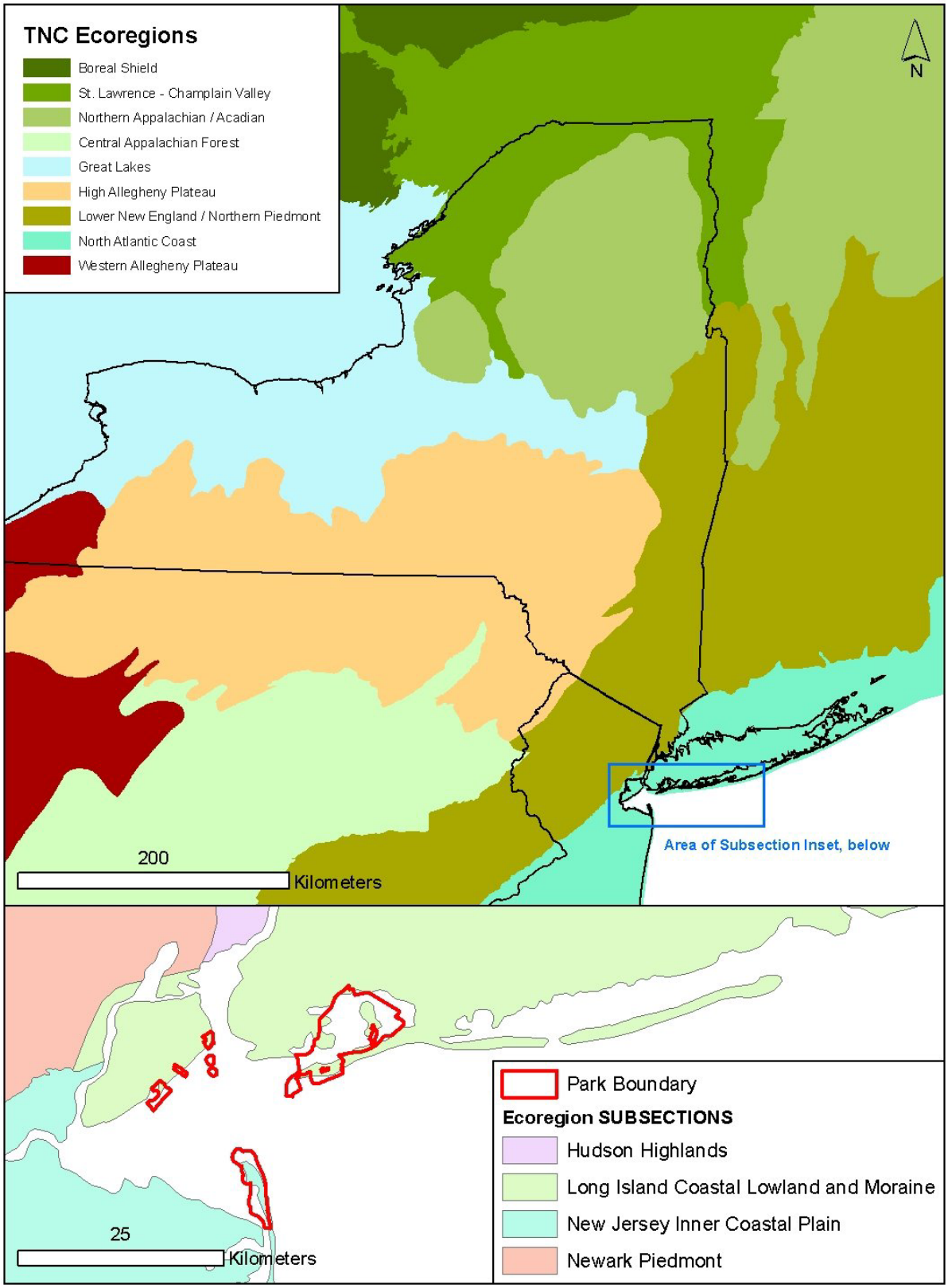


Figure 3. Ecoregion sections and subsections (Bailey 1995) of the Gateway National Recreation Area.

In summary, the bedrock for the Jamaica Bay and Staten Island units consists of Cretaceous age strata, including the Raritan Formation, the Monmouth Group, the Matawan Group, and the Magothy Formation (all unconsolidated sediments) (Fisher et al. 1970) (Figure 4a). The surficial geology of these two units is primarily outwash sand and gravel with small amounts of till moraine at Fort Wadsworth and significant areas of artificial fill (e.g., Floyd Bennett Field and Great Kills Park) (Cadwell 1989) (Figure 4b). It is interesting to note that the Coastal Plain section of New York City was glaciated, whereas Sandy Hook and points south are unglaciated (USDA NRCS 2001). The surficial geology of the Sandy Hook Unit is Holocene age Beach and Nearshore Marine Sand (Stanford 2000).

Topography

A detailed account of the park's physiography and relief features can be found in the Soil Survey of Gateway National Recreation Area, New York and New Jersey (USDA NRCS 2001). Two opposing sand spits, Breezy Point to the east and Sandy Hook to the west, serve as the "gates" to New York Harbor. Most of the park's landscapes are typically flat to mildly undulating and describe the sandy maritime and tidal landscape. Elevations for these areas are low (ranging from zero to under 15.2 m [50 ft]) with the exception of Fort Wadsworth on Staten Island which has hills and bluffs with elevations reaching 45.7 m (150 ft) (USDA NRCS 2001).

Soils

A detailed account of the park's soils can be found in the Soil Survey of Gateway National Recreation Area, New York and New Jersey (USDA NRCS 2001). In summary, the southern portions of Great Kills and Miller Field are mapped as sand "Beaches" by USDA NRCS.

The northern portions of Great Kills Park, Miller Field, and all of Fort Wadsworth in the Staten Island Unit are mapped as the Bernardston soil series by USDA NRCS. "The Bernardston series consists of very deep, well drained soils formed in till derived mainly from dark gray phyllite, slate, or schist. The soils are moderately deep to dense till. They are nearly level to very steep soils on uplands. Saturated hydraulic conductivity is moderately high or high in the solum and low to moderately high in the substratum" (excerpted from http://ortho.ftw.nrcs.usda.gov/osd/dat/B/BERNARDSTON.html).

Jamaica Bay Wildlife Refuge and the salt marsh islands within Jamaica Bay are mapped as the Ipswich soil series by USDA NRCS. "The Ipswich series consists of very deep, very poorly drained soils formed in thick organic deposits. They are on level tidal marshes subject to inundation by salt water twice daily. Saturated hydraulic conductivity is moderately high to very high" (excerpted from http://www2.ftw.nrcs.usda.gov/osd/dat/I/IPSWICH.html). The remaining portions of the Jamaica Bay Unit are mapped as "Urban Land" with soils of variable texture by USDA NRCS.

The Sandy Hook Unit contains six different soil series as mapped in the Monmouth County Soil Survey by USDA NRCS. The soil series are Appoquinimink-Transquaking-Mispillion complex (tidal marshes), Hooksan sand (barrier beaches), Hooksan poorly drained variant sand (depressions), Psamments (waste substratum), Udorthents (excavated borrow materials), and Udorthents-Urban Land Complex (excerpted from http://www.nj.gov/dep/gis/soilsshp.html#MON).

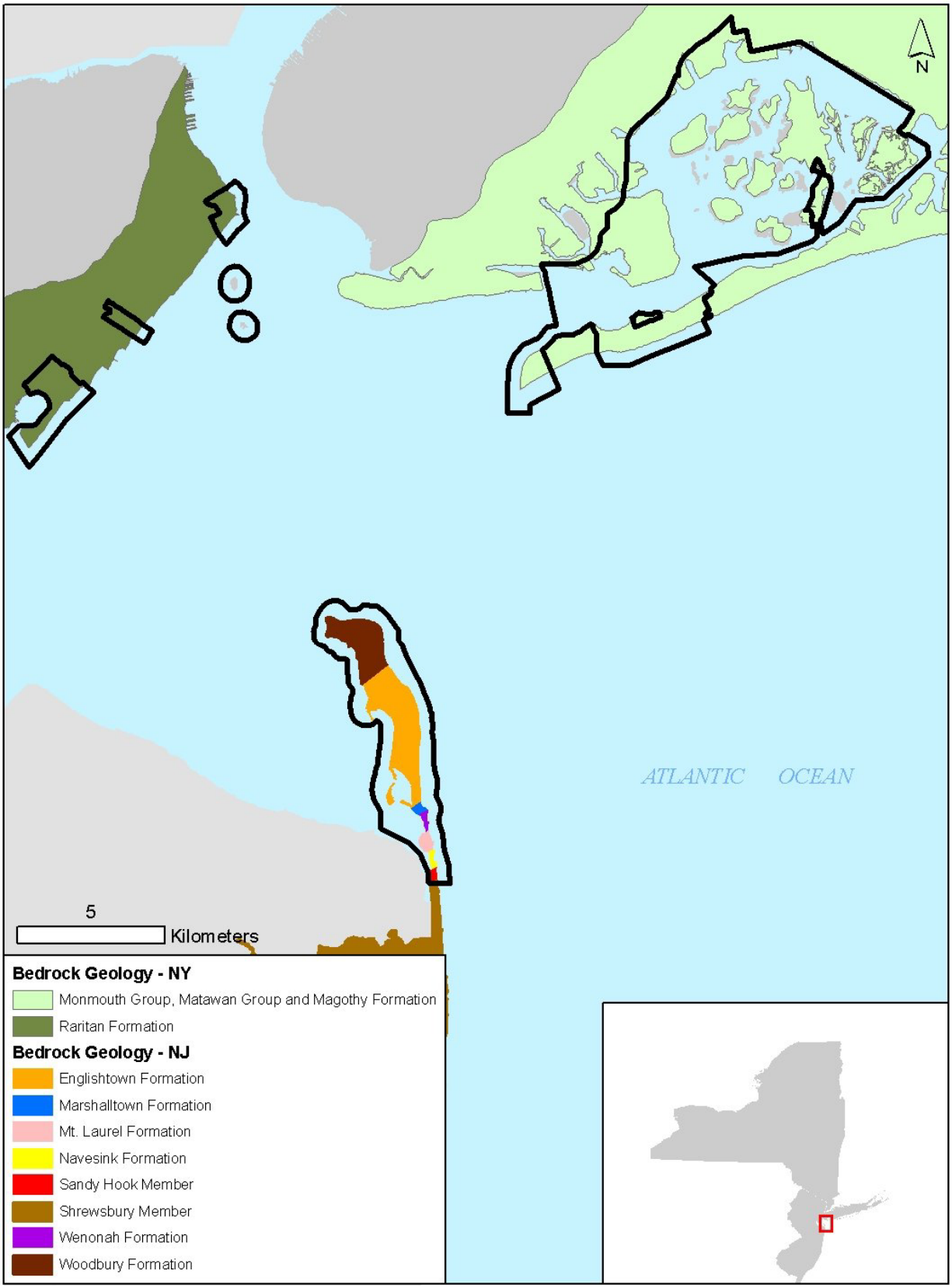


Figure 4a. Bedrock geology (Fisher et al. 1970) of the Gateway National Recreation Area.

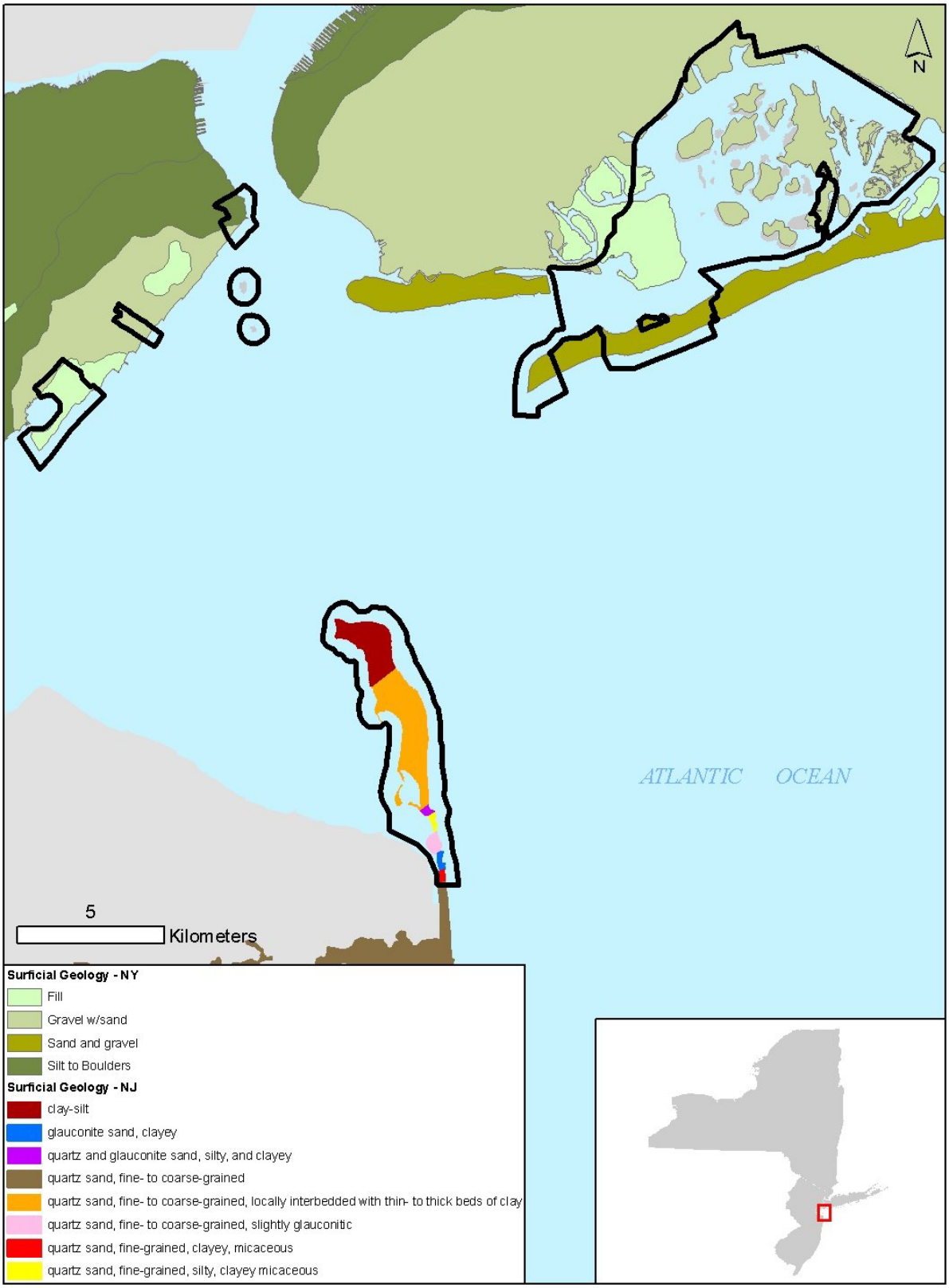


Figure 4b. Surficial geology (Cadwell 1989; Stanford 2000) of the Gateway National Recreation Area.

The final vegetation association map was compared to the Gateway National Recreation Area soil map (USDA NRCS 2001) in order to correlate soil types to vegetation types. Soil types are reported in the environmental description for each vegetation association.

Hydrology

For estuarine communities, semidiurnal tides of the bays and ocean are the most important hydrologic feature at Gateway National Recreation Area. While there are freshwater ponds and wetlands in the park, they are few in number and small in size. The wetlands and water bodies at Gateway National Recreation Area are predominately marine and estuarine communities dependent on the twice daily inundation of saltwater. A detailed account of the park's hydrology including surface water, water infiltration and runoff, aquifers, groundwater, and water quality can be found in the Soil Survey of Gateway National Recreation Area, New York and New Jersey (USDA NRCS 2001).

Ecological Processes and Maritime Influence

The maritime plant associations at Gateway National Recreation Area are heavily influenced by coastal processes including strong salt spray, high winds, and dune deposition, shifting, and overwash processes. Maritime associations generally contain stunted "salt-pruned" trees and shrubs with contorted branches and wilted leaves plus usually have a dense vine layer. These communities often occur as narrow bands (e.g., <50 m [164 ft] wide) parallel to the shoreline and contain plants that are adapted to these conditions (Edinger et al. 2002).

There is a wealth of literature on the subject of barrier dune systems, longshore sand movement, and the dune overwash process (e.g., Godfrey and Godfrey 1976; Leatherman 1979; Zaremba and Leatherman 1984; Oertel 1985; Clark 1986; Oertel et al. 1992; Hayden et al. 1995). There are areas within the park where these dune processes are intact (e.g., oceanside of Breezy Point and northern tip of Sandy Hook) and other areas where these processes may need to be restored. In addition, there may be cases where these ecological processes conflict with existing and proposed developed areas. It is beyond the scope of this vegetation mapping project to make specific management recommendations regarding dune restoration in and around the park. A detailed account of the park's longshore sand movement, sand supply, and dune formation can be found in the Soil Survey of Gateway National Recreation Area, New York and New Jersey (USDA NRCS 2001).

Materials and Methods

Planning and Scoping

Several steps were taken to prepare for the vegetation classification and mapping at Gateway National Recreation Area. On May 12, 2003, NY Natural Heritage ecologist Aissa Feldmann met with NPS staff Kathy Mellander, Bryan Milstead, Mike Byer, and George Frame at the Staten Island Unit of Gateway National Recreation Area. The project timeline, mapping product specifications, access issues, natural resource management needs, available applicable GIS layers, and applicable previous and current research conducted at the park were discussed. Afterwards, a reconnaissance tour of selected sites was undertaken in order to become familiar with broad ecological patterns and to determine field survey logistics.

Preliminary Data Collection and Review of Existing Information

Previous studies conducted at Gateway National Recreation Area were obtained from the park's natural resource manager and NY Natural Heritage files and reviewed for information pertinent to the park's vegetation (e.g., Venezia and Cook 1991). These reports included previous vegetation classifications and floristic studies at the Jamaica Bay Unit (Stalter and Cerniglia et al. 1982; Stalter 1983; Greller 1984; Stalter and Greller 1988; Wijesundara 1997; Stalter and Lamont 2002; Stalter and Munir 2002), the Staten Island Unit (Stalter and Schmidt et al. 1982; Robinson et al. 1994), and Sandy Hook (Stalter and Lamont 2000). General information on the cultural and natural history of Gateway National Recreation Area was obtained from various books, reports, and NPS park brochures (e.g., Tanacredi and Badger 1995) as well as NPS official web sites (e.g., http://www.nps.gov/gate/).

In addition, shapefiles containing digital information on bedrock geology, soils, water bodies, wetlands, roads and trails, park boundaries, and parcel ownership were obtained from the park's GIS specialist (e.g., USDA NRCS 2001; Tanacredi et al. 2002).

Data layers available to NY Natural Heritage via New York State Department of Environmental Conservation in digital and hard copy formats were reviewed to refine photo interpretation: soil maps (USDA NRDC 2001; STATSGO - NY State Soil Survey Geographic Database), bedrock and surficial geology maps (Fisher et al. 1970; Cadwell 1989; NYS Museum digital geology data), wetland maps (National Wetlands Inventory Data for NY State; NY State Regulatory Freshwater Wetland data), state tidal wetland maps (NY Department of State, Division of Coastal Resources), the NJ Natural Heritage Program Biotics database and Geographic Manual Files, and the NY Natural Heritage Biotics database.

Preliminary Vegetation Map Production

Final digital orthorectified photomosaics of Gateway National Recreation Area were not available in time to digitize the preliminary vegetation map prior to the 2003 field season. As a contingency plan, the preliminary vegetation map was developed for the park by first reviewing readily available, in-house 1995 color infrared National Aerial Photography Program aerial photos and then screen digitizing NY Natural Heritage ecological community (Edinger et al. 2002) boundaries using 1994-99 digital orthophoto quarter quadrangles (DOQQs) as the base

layer. Our first set of deliverables for this project, including the preliminary community delineations on in-house digital imagery for Gateway National Recreation Area draft classification, were sent to NPS on May 16, 2003.

The NY Natural Heritage ecological communities (Edinger et al. 2002) on the preliminary vegetation map were differentiated based on vegetation structure, leaf phenology, and hydrologic regime because these characteristics can be easily identified on aerial photography. NY natural communities are roughly equivalent to the association level in the National Vegetation Classification System (NVCS). However, in some cases a few NY Natural Heritage communities may be comprised of several NVCS associations. This 2003 preliminary map was developed as a guide for vegetation plot sampling efforts.

Photointerpretation

The 2003 preliminary vegetation map and subsequent revised maps were created through aerial photograph interpretation. Aerial photograph interpretation is the act of examining aerial photographs in order to identify objects; in this case vegetation types (Avery 1978). The photographs (color infrared, stereo pair, hard copy photographs) were examined through a stereoscope, which provides the viewer with a three-dimensional view. The DOQQs were also examined onscreen in ArcView 3.2 (ESRI 1992-2000). In addition, digital topographic quad maps were examined in ArcView 3.2. Historical aerial photographs of Sandy Hook from 1932, 1940, and 1957 were examined to determine land use history and ecological community succession trajectories. Using information gathered from aerial photographs, the DOQQs, and the topographic maps, polygons representing different ecological communities were digitized onscreen using ArcView 3.2. The screen digitizing process permitted the simultaneous use of aerial photography and supplemental digital data layers that are useful in delineating NVC association boundaries, including USGS quadrangle maps, Department of Transportation road coverages, hydrology coverages, and NPS boundaries. Kathryn Mellander, GIS Specialist at Gateway National Recreation Area, provided the park's legislated boundary minus the excluded parcels and with edits by her and the Gateway National Recreation Area Lands Officer. The Northeast Region is in the process of contracting for boundary surveys for its parks and Gateway National Recreation Area is not scheduled at this time (Kathryn Mellander, pers. comm.).

Aerial Photography Acquisition and Processing

William Frament, USDA Forest Service (Northeastern Area State and Private Forestry, Durham, NH) acquired color infrared, stereo pair 1:8,000 scale aerial photography for digital orthorectified photomosaics of Gateway National Recreation Area on December 17, 2002, during leaf-off conditions. Hoffman and Swinburne islands of the Staten Island Unit were excluded from this air photo coverage, and thus excluded from the vegetation map. Frament scanned the aerial photographs at 600 dpi and delivered the scanned image files, in TIFF format, and the hard copy photographs to North Carolina State University (NCSU). The photographs, the camera calibration certificate, and a shapefile of photo centers provided by Frament are stored in the archive that NCSU maintains for the NPS Northeast Region Inventory & Monitoring Program.

Separate photomosaics were produced for each of three park Units—Jamaica Bay, Sandy Hook, and Staten Island—from 143, 22, and 27 aerial photographs, respectively. For each photomosaic, scanned .tif images of the relevant aerial photographs were imported into ERDAS IMAGINE Version 8.7 .img format (Leica Geosystems Geospatial Imaging 2003) where a photo block was created using a digital elevation model and digital orthophoto quarter quadrangles (DOQQs) obtained from the USGS as reference. Each photo block was manipulated until it could be triangulated with a root mean square error of less than 1. Single frame orthophotos (one for each aerial photograph) were then generated within IMAGINE and exported to .lan format. The .lan files were imported into ER Mapper Version 6.4 native (.ers) format (Earth Resource Mapping Ltd. 2003) and ER Mapper was used to define cutlines, color balance and mosaic the images, generate band interleaved by line (.bil) image and header files for each photomosaic, and convert the .bil images to IMAGINE .img format. The .img images were compressed using MrSID Version 1.4 software (LizardTech, Inc. 2000) with a 20:1 compression ratio. The final photomosaics, in both .img and MrSID formats, are stored in the NCSU archive.

Photomosaics Metadata

A metadata record for each digital orthorectified photomosaic was prepared in accordance with the current Federal Geographic Data Committee standards (FGDC 1998a). Metadata were produced in notepad and parsed using the USGS metadata compiler (USGS 2004). After all errors and omissions identified by the parser were corrected, the metadata compiler was used to generate final TXT, HTML, and XML versions of each metadata record which are stored in the data archive. Key information for the Gateway National Recreation Area photomosaics is summarized in Tables A1, A2, and A3 of Appendix A.

Field Data Collection and Classification

All vegetation plot sampling followed the USGS/NPS Vegetation Mapping Program and NY Natural Heritage protocols (TNC and ESRI 1994b; Edinger et al. 2000). To determine the number of plots to sample, the 2003 preliminary vegetation map was used as a guide. The number of vegetation cover types and the number of polygons per cover type were examined (Table 1). The USGS/NPS Vegetation Mapping Protocol suggests that each vegetation association should be sampled at least three times in order to capture the naturally occurring variation within the park (TNC and ESRI 1994b). Therefore, at least three polygons of each vegetation cover type were selected for sampling. For vegetation cover types with less than three polygons, each polygon was selected for sampling. For vegetation cover types with numerous polygons, or for types that covered large areas, polygons were selected that represented different aerial photograph signatures and environmental settings in order to capture the natural range of variability of the vegetation. The three plot goal was not met for several associations despite having three or more mapped polygons (Table 1). For example, Brackish Meadow (CEGL006150) occurred as a tight cluster of five small polygons and one plot was intended to represent that cluster. Similarly, Coastal Salt Pond Marsh (CEGL006398) was found in three patches around a coastal salt pond and treated as one occurrence. In other cases, we simply lost track of the plot per association total, especially in the Sandy Hook Unit where we had five different people sampling plots (e.g., Japanese Sedge Maritime Dunes CEGL006615 and North Atlantic Coastal Plain Vine Dune CEGL003886). North Atlantic Coast Estuarine Intertidal Mudflats are unvegetated and are primarily defined by its substrate and it seemed

Table 1. Number of polygons, mapped hectares, and number of plots sampled in 2003 and 2004 by national vegetation association and Anderson Level II categories on the 2006 revised preliminary vegetation map (pre-accuracy assessment) at Gateway National Recreation Area.

	Number of Polygons	Mapped Hectares within the Park Boundary	Number of Plots Sampled 2003-2004
Association Common Name (NVC code)			
Beachgrass - Panicgrass Dune Grassland (CEGL004043)	2	4.60	2
Japanese Black Pine Forest (CEGL006012)	15	19.47	3
Brackish Meadow (CEGL006150)	5	19.25	1
Coastal Salt Pond Marsh (CEGL006398)	3	1.42	1
Early-Successional Woodland/Forest (CEGL006303)	59	160.80	6
Mid-Atlantic Maritime Salt Shrub (CEGL006848)	33	9.91	9
Japanese Knotweed Gravelbar (CEGL008472) [a]	1	0.13	0
Japanese Sedge Maritime Dunes (CEGL006615)	11	17.15	2
Lesser Duckweed Herbaceous Vegetation (CEGL003305)[b]	0	0.00	1
Little Bluestem Old Field (CEGL006333)	27	85.62	8
Maritime Holly Forest (CEGL006376)	20	94.29	8
Maritime Red-cedar Woodland (CEGL006212)	21	119.85	5
North Atlantic Coast Backdune Grassland (CEGL006161)	38	25.15	11
North Atlantic Coast Estuarine Intertidal Mudflats (CEGL006614)	16	4.19	1
North Atlantic Coastal Plain Vine Dune (CEGL003886)	17	2.97	1
North Atlantic High Salt Marsh (CEGL006006)	33	30.64	8
North Atlantic Low Salt Marsh (CEGL004192)	276	458.63	4
North Atlantic Upper Ocean Beach (CEGL004400)	81	229.44	4
Northeastern Atlantic Brackish Interdunal Swale (CEGL006342)	5	0.86	2
Northeastern Modified Successional Forest (CEGL006599)	17	56.34	7
Northeastern Old Field (CEGL006107)	3	10.77	8
Northeastern Pin Oak - Swamp White Oak Forest (CEGL006240)	1	4.69	1
Northeastern Successional Shrubland (CEGL006451)[b]	0	0.00	1
Northern Bayberry Dune Shrubland (CEGL006295)	63	60.21	5
Northern Beach Heather Dune Shrubland (CEGL006143) [b]	0	0.00	1
Northern Beachgrass Dune (CEGL006274)	122	226.58	28
Northern Tall Maritime Shrubland (CEGL006379)	84	294.02	22
Overwash Dune Grassland (CEGL004097)	26	65.85	10
Reed-grass Tidal Marsh (CEGL004187)	122	365.12	7
Salt Panne (Salicornia Type) (CEGL004308)	20	6.51	4
Successional Maritime Forest (CEGL006145)	13	48.27	5
Woolgrass Marsh (CEGL006349)[b]	0	0.00	1
Unclassified Associations and Mosaics			
Corynephorus canescens Grassland[c]	1	1.34	
Marine Intertidal Mudflats/Low Salt Marsh (degraded) - *mosaic* [d]	19	37.20	
Saltwater Tidal Creek/Marine Intertidal Mudflats - *mosaic* [d]	40	87.86	

Table 1. Number of polygons, mapped hectares, and number of plots sampled in 2003 and 2004 by national vegetation association and Anderson Level II categories on the 2006 revised preliminary vegetation map (pre-accuracy assessment) at Gateway National Recreation Area (continued).

	Number of Polygons	Mapped Hectares within the Park Boundary	Number of Plots Sampled 2003-2004
Anderson Level II Category			
05. Water (artificial pond)	4	65.08	
05. Water (natural pond)	5	3.75	
11. Residential	1	0.13	
12. Commercial and Services	50	773.83	
14. Transportation, Communications, and Utilities	14	143.60	
54. Bays and Estuaries	12	6,546.92	
73. Sandy Areas other than Beaches	9	8.09	
76. Transitional Areas	1	2.02	1
Grand Total	1,290	10,092.55	178

[a] The Japanese Knotweed Gravelbar was not a recognized vegetation association at the time of plot sampling, thus no plots were sampled in this type. However, two observation points were sampled in this type during accuracy assessment (Table 2).

[b] Associations with zero polygons and zero mapped hectares were not represented on the 2006 revised preliminary map. Once the plots were properly reclassified after accuracy assessment, the polygons were relabeled on the 2007 final vegetation association map provided in this report.

[c] The *Corynephorus canescens* Grassland was later classified as North Atlantic Coast Backdune Grassland in the 2007 final vegetation association map provided in this report.

[d] Two cover types were treated as mosaics of two associations on the 2006 revised preliminary map (i.e., there were polygons labeled as a combination of Marine Intertidal Mudflats and Low Salt Marsh and there were other polygons labeled as a combination of Saltwater Tidal Creek and Marine Intertidal Mudflats). During accuracy assessment we attempted to relabel these polygons with one of the dominant mosaic associations (e.g., if the Saltwater Tidal Creek/Marine Intertidal Mudflats polygon was mostly Marine Intertidal Mudflats it was relabeled as such). If the two types could be clearly discerned on the air photo, the polygon was split into the two respective types (e.g., [a] Marine Intertidal Mudflats/Low Salt Marsh mosaic could be split into a Marine Intertidal Mudflats polygon and a Low Salt Marsh polygon).

excessive to sample redundant plots with no vegetation cover for this type. Polygons that represented cultural types labeled with Anderson Level II categories (Anderson et al. 1976) were not sampled.

Field Survey

Within each polygon selected for sampling, a plot was established in an area that most represents the existing vegetation association (Mueller-Dombois and Ellenberg 1974). All vegetation data were collected following NatureServe's accepted natural heritage sampling protocols (TNC and ESRI 1994b; Walz 1999; Edinger et al. 2000), with 20×20 m (65.6×65.6 ft) plots in forests and woodlands, 10×10 m (32.8×32.8 ft) plots in shrublands and herbaceous vegetation. The vegetation was visually divided into eight strata: emergent trees (variable height), tree canopy (variable height), tree subcanopy (>5 m [16.4 ft]), tall shrub (2–5 m [6.6–16.4 ft]), short shrub (<2 m [6.6 ft]), herbaceous, non-vascular, and vines. The percent cover was estimated for each species in each stratum. Specimens of species that were not identifiable in the field were collected for later identification. The diameter at breast height (1.3 m [4.25 ft]) was measured with a dbh tape for all trees larger than 10 cm (3.9 in) in diameter that were rooted in the plot. The diameters were recorded by species and strata.

In addition to floristic information, the following environmental variables were recorded at each plot: slope, aspect, topographic position, hydrologic regime, soil stoniness, average soil texture, and soil drainage. Any unvegetated area of the plot was characterized by the exposed substrate. Notes were taken on the plot representativeness of the surrounding vegetation and any other significant environmental information, such as landscape context, herbivory, stand health, recent disturbance, or evidence of historic disturbance. Plot data and reference observation point data were collected digitally in the field using an iPAQ hand-held computer with software (Hand-Held Database – HHDB) and imported to the Field Form Database (FFDB) developed by NY Natural Heritage. Prior to the development of the HHDB and FFDB plot data were collected on paper forms. A sample plot form and screen shots from the HHDB used for this project are included in Appendix B.

A digital photograph was taken at most of the plot sampling locations. The location of each plot was recorded with a Garmin 12 Map GPS unit. The datum on the GPS unit was set to North American Datum of 1983 (NAD 83) and the coordinate system was set to Universal Transverse Mercator (UTM) zone 18.

Plot sampling was conducted from June 23 to October 8, 2003 and from June 19 to October 6, 2004. Plot sampling was conducted by Aissa Feldmann (NY Natural Heritage), Tim Howard (NY Natural Heritage), and Kathleen Strakosch Walz (NJ Natural Heritage) with assistance from Karl Anderson and Linda Kelly. In total, 178 plots and 48 reference observation points were sampled throughout the park (Figures 5a–c). The distribution of plots by NVC vegetation association is shown in Table 1.

Vegetation Classification and Characterization

Of the 178 plots sampled at Gateway NRA, 172 plots from the NY Natural Heritage FFDB were edited for accuracy and exported into an Excel spreadsheet format compatible with PC-ORD

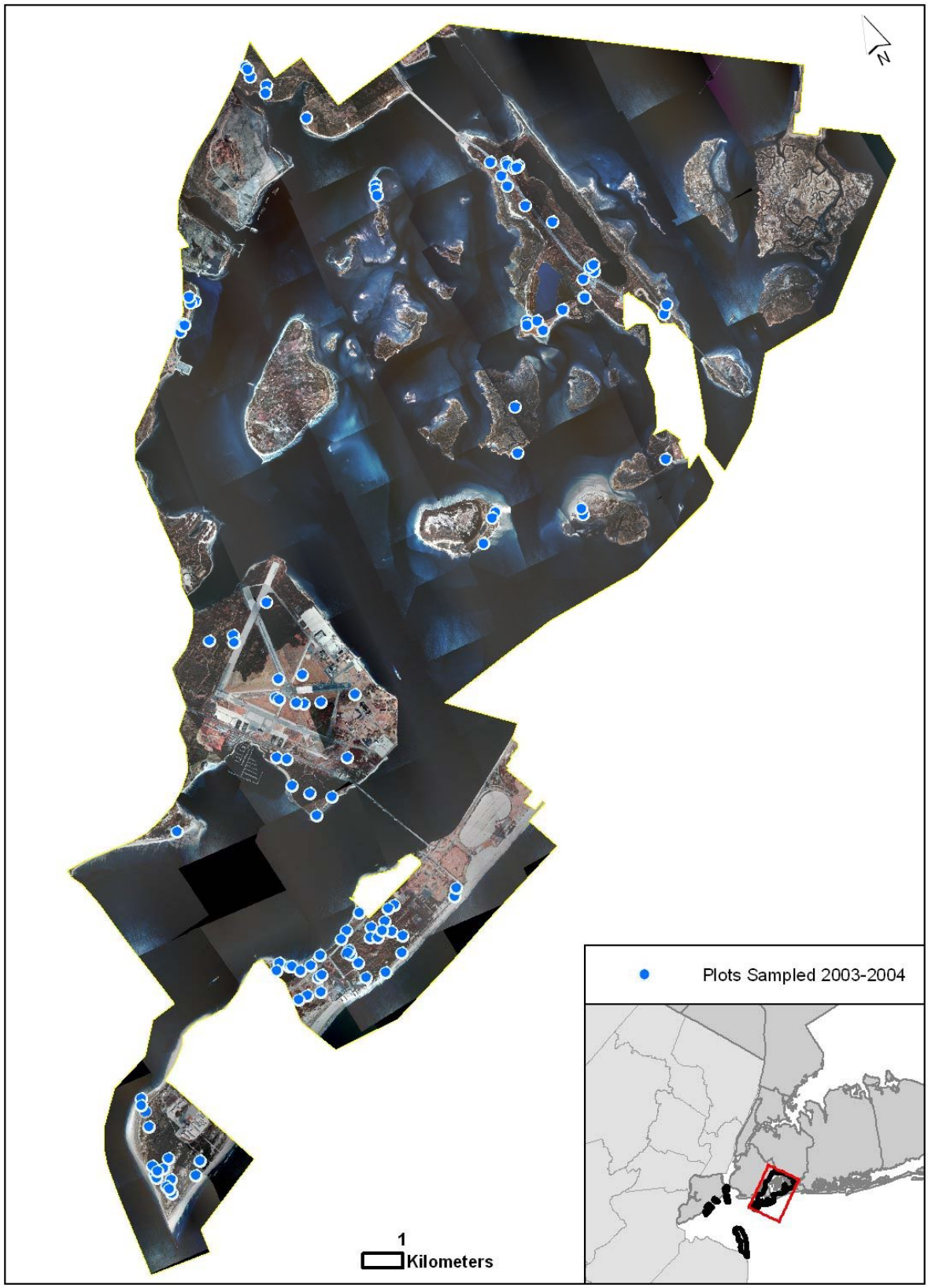


Figure 5a. Location of 119 vegetation plots sampled in 2003 and 2004 within the Jamaica Bay Unit of Gateway National Recreation Area.



Figure 5b. Location of 22 vegetation plots sampled in 2003 and 2004 within the Staten Island Unit of Gateway National Recreation Area.

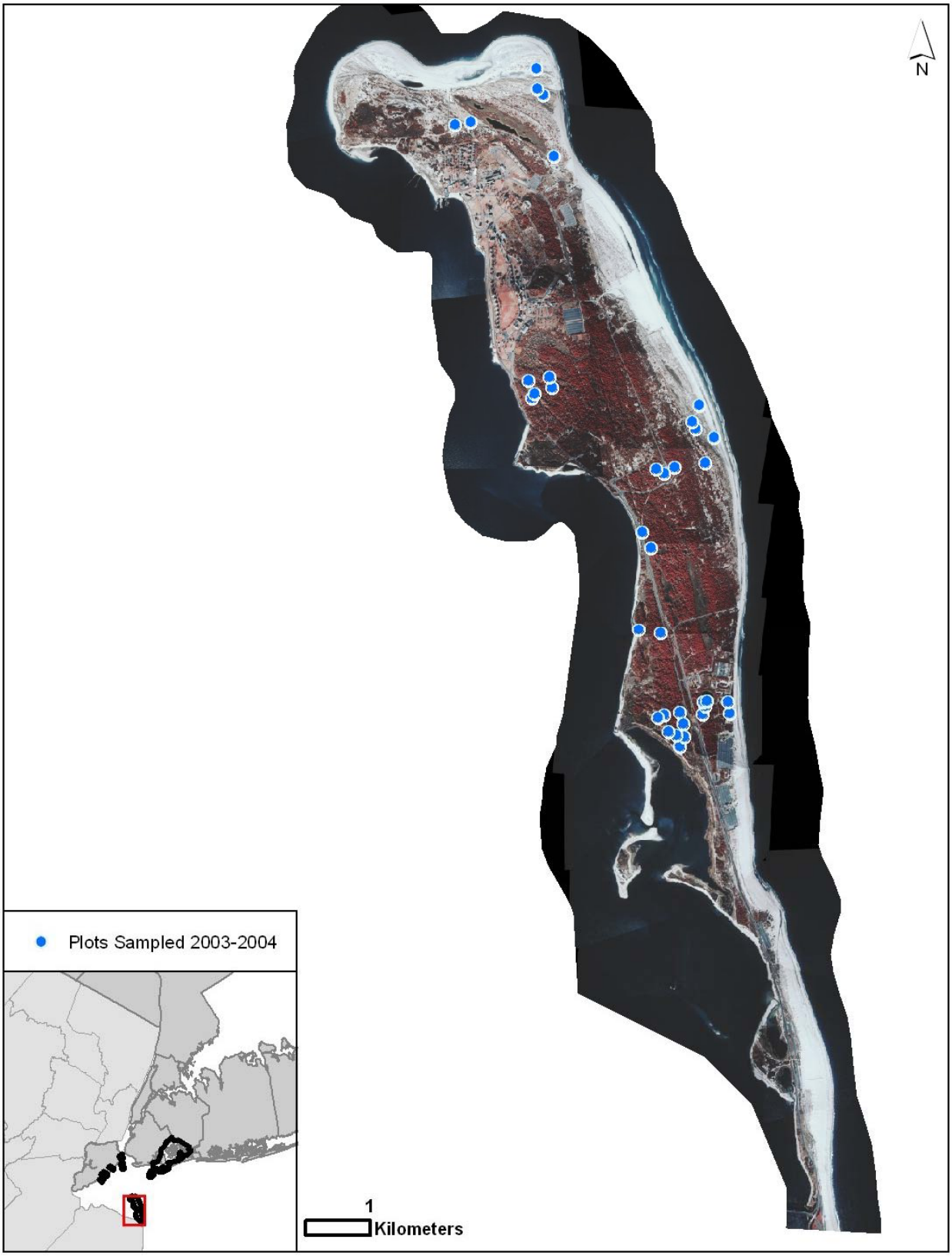


Figure 5c. Location of 37 vegetation plots sampled in 2003 and 2004 within the Sandy Hook Unit of Gateway National Recreation Area.

version 4.0 Multivariate Analysis software (McCune and Mefford 1999). The six plots that were excluded from PC-ORD analysis were excluded for the following reasons: plot 4a was sampled in the ecotone of two associations; plot 4an was sampled in a pond and at that time it was uncertain whether or not aquatic types would be included in the NVC (this type was later added to the NVC); plot 4m was sampled in a marine intertidal mudflat dominated by a non-vascular plant, sea-lettuce (*Ulva lactuca*), and at that time it was uncertain whether or not types dominated by marine macro algae would be included in the NVC (this type was later added to the NVC); plot 5ag was sampled within a recently mowed field and many species could not be accurately identified; plot 5c had an incomplete species list; plot 2a was dominated by a nonnative, invasive species mugwort (*Artemesia vulgaris*) and was sampled as reference plot. The FFDB export program automatically assigns standardized codes based on the PLANTS 3.5 database developed by the Natural Resource Conservation Service in cooperation with the Biota of North America Program (USDA NRCS 2004). The common and scientific names of plants observed during the vegetation plot sampling are listed alphabetically by Family in Appendix C. Some tree and shrub seedlings and immature herbaceous plants could only be identified to the genus level and are therefore listed in Appendix C as such.

After local, park-specific, descriptions had been developed for the preliminary vegetation associations, based on the analyses described above, these associations were then crosswalked to the National Vegetation Classification System (NVCS). The NVCS was developed by ecologists of the Natural Heritage Program network and The Nature Conservancy after many years of literature review, data collection, and data analysis. This collaborative effort culminated in the publication of the International Classification of Ecological Communities: Terrestrial Vegetation of the United States (Grossman et al.1998). The International Classification of Ecological Communities, now known as the International Vegetation Classification, of which the NVCS is a subset, has been revised and refined since 1998, and is now managed by NatureServe in continued collaboration with the network of Natural Heritage Programs. The classification is housed in the Biotics database (NatureServe 2004) and is updated regularly. The upper levels of the NVCS were adopted as a standard by the Federal Geographic Data Committee to support the production of uniform statistics on vegetation at the national level (FGDC 1996). The Vegetation Mapping Program of the National Park Service adopted the alliance level, and where possible, the association level, as the mapping unit for national parks.

Based on the multivariate analyses, the preliminary park-specific local vegetation associations were qualitatively compared to existing associations in the National Vegetation Classification System by searching for alliances sharing similar dominant species, as well as physiognomy and environmental setting. Total floristic composition was used to determine the appropriate association within the alliance. Global information on the associations from the NVCS was then appended to the local descriptions to provide resource managers with a broader context for the vegetation in the park. During spring 2006, Ery Largay and Lesley Sneddon of NatureServe assisted with labeling plots with correct NVC association codes.

A park-specific dichotomous key to the NVC associations was created (Appendix D) to accompany the classification and vegetation associations descriptions (Appendix E) and for use by park natural resource managers and others. A dichotomous key is a tool for identifying unknown entities, in this case, vegetation associations. It is structured by a series of couplets, two statements that describe different, mutually exclusive characteristics of the associations.

Choosing the statement that best fits the association in question leads the user to the correct association. The dichotomous key should be used in conjunction with the detailed vegetation association descriptions to confirm that the association selected with the key is appropriate.

2006 Revised Preliminary Vegetation Map (pre-accuracy assessment)

Following the vegetation plot data analysis, the preliminary vegetation map was edited and refined to produce a revised preliminary vegetation map prior to thematic accuracy assessment. Using ArcMap 9.2 (ESRI 1999-2006), polygon boundaries were revised on screen based on the plot data, field observations, classification analyses, aerial photography signatures, and topographic maps. Each polygon was assigned the NVC Community Element Global (CEGL) code of a preliminary vegetation association based on the information sources listed above. Second, third, and fourth CEGL code choices were entered in cases of uncertainty, or for polygons representing mosaics of two or more types.

Accuracy Assessment

Two sources of potential error in the vegetation map include: 1) horizontal positional accuracy, in which a location on the photomosaic does not accurately align with the same location on the ground due to errors in orthorectification or triangulation; and 2) thematic accuracy, in which the vegetation type assigned to a particular location on the map does not correctly represent the vegetation at the same location in the park due to mapping error. The USGS/NPS Vegetation Mapping Program protocols (ESRI et al. 1994) were followed to assess the positional accuracy of the digital photomosaic and the thematic accuracy of the 2006 revised preliminary vegetation map.

Photomosaic Positional Accuracy Assessment

The horizontal positional accuracies of the Jamaica Bay, Sandy Hook, and Staten Island photomosaics were assessed using guidelines of the USGS/NPS Vegetation Mapping Program (ESRI et al. 1994). Well-defined positional accuracy ground control points were placed throughout all quadrants of each photomosaic in ArcMap 9.2 (ESRI 1999-2006). Ground control points and zoomed-in screenshots of each point were plotted on hard copy maps with the appropriate photomosaic as a background. These maps and plots were used to locate the ground control points in the field. Field staff recorded the ground control point coordinates with a Trimble Pro XRS GPS unit with real-time differential correction. Mapped ground control points that were physically inaccessible were also noted. The field crew collected accuracy assessment data at 31 ground control points for the Jamaica Bay photomosaic, at 39 ground control points for the Sandy Hook photomosaic, and at 23 ground control points for the Staten Island photomosaic. Prior to calculating accuracy, three Jamaica Bay ground control points, three Sandy Hook ground control points, and two Staten Island ground control points were identified as outliers with SAS's JMP program and removed. Thus, the final accuracy estimates for the Jamaica Bay, Sandy Hook, and Staten Island photomosaics are based on 28, 36, and 21 ground control points, respectively. For each photomosaic, the field-collected GPS ground control point coordinates were compared to the coordinates obtained from the photomosaic viewed in ArcMap 9.2. Both pairs of coordinates for each point were entered into a spreadsheet in order to calculate horizontal accuracy (in meters). The accuracy calculation formula is based on root mean square

error (FGDC 1998b; Minnesota Governor's Council on Geographic Information and Minnesota Land Management Information Center 1999). Figure 6 shows the distribution of the 85 ground control points within the three park units.

Thematic Accuracy Assessment

The thematic accuracy of the 2006 revised preliminary map was assessed by NY Natural Heritage. A stratified random sampling approach was used, distributing the sampling effort across the revised preliminary vegetation association map (Table 1). Polygons labeled with Anderson Level II categories (Anderson et al. 1976) were not included in the thematic accuracy assessment sampling.

The vegetation associations listed in Table 1 were determined before thematic accuracy assessment. Several changes were made to the classification after accuracy assessment; therefore, the preliminary association names in Table 1 do not fully match the final list of association in Table 2 and the descriptions presented in Appendix E.

In the stratified random sampling approach, the number of accuracy assessment destination points per association varied according to the rarity of the vegetation association, both in terms of number of polygons and polygon size. The following rules were used to determine the number of accuracy assessment destination points assigned to each association (ESRI et al. 1994) and applied to the 2006 revised preliminary map with the number of polygons and mapped hectares presented in Table 1:

Scenario A: The class is abundant. It covers more than 50 ha (123.5 ac) in total area and consists of at least 30 polygons. In this case, it is recommended that 30 polygons be selected at random from the set of the association's polygons. One sampling point will be assigned to each of the 30 selected polygons.

Scenario B: The association is relatively abundant. It covers more than 50 ha (123.5 ac) in total area but consists of fewer than 30 polygons. In this case, it is recommended that 20 polygons be selected at random from the set of the association's polygons, and that one sampling point be assigned to each of the 20 selected polygons. If the association contains less than 20 polygons, some polygons will contain multiple sampling points. The number of sampling points assigned to each polygon is determined by the relative area of that polygon compared with the other polygons in that association.

Scenario C: The association is relatively rare. It covers less than 50 ha (123.5 ac) in total area but consists of more than 30 polygons. In this case, it is recommended that 20 polygons be selected at random from the set of the association's polygons. One sampling point will be assigned to each of the 20 selected polygons.

Scenario D: The class is rare. It has 5–30 polygons and covers less than 50 ha (123.5 ac). In this case, it is recommended that five polygons be selected at random from the set of the association's polygons. One sampling point will be assigned to each of the five selected polygons.

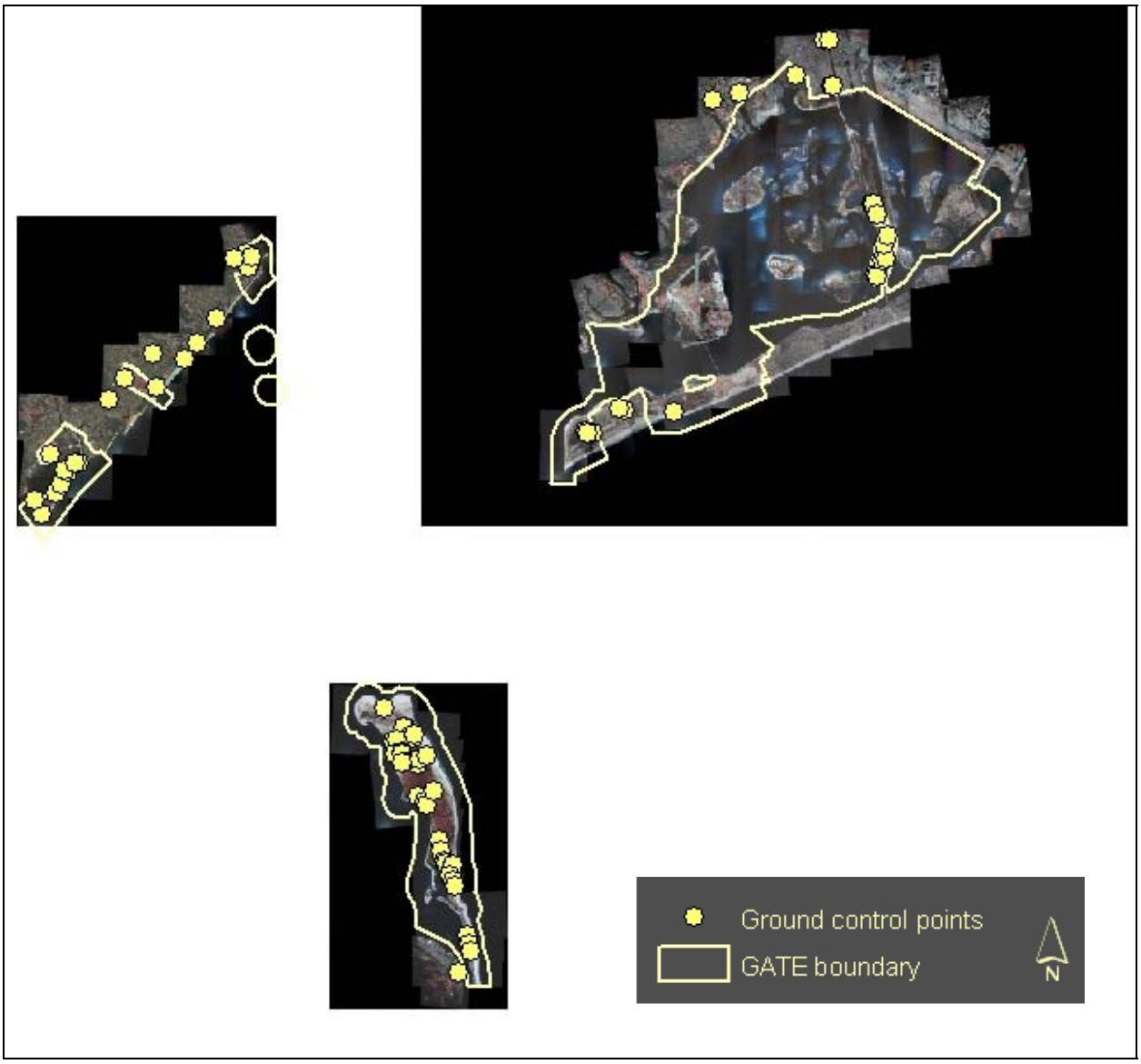


Figure 6. Ground control points used to calculate horizontal positional accuracy of the Gateway National Recreation Area photomosaics.

Table 2. Number of polygons, mapped hectares, number of accuracy assessment destination points, and number of accuracy assessment points sampled in 2006 by vegetation cover type and Anderson Level II categories on the 2007 final vegetation map (post-accuracy assessment) at Gateway National Recreation Area.

	Number of Polygons	Mapped Hectares within the Park Boundary	Number of Accuracy Assessment Destination Points [a]	Number of Accuracy Assessment Points Sampled 2006
Association Common Name (NVC code)				
Beachgrass - Panicgrass Dune Grassland (CEGL004043)	3	37.33	2	2
Brackish Meadow (CEGL006150)	12	10.67	5	3
Coastal Salt Pond Marsh (CEGL006398)	4	1.46	3	0
Early-Successional Woodland/Forest (CEGL006303)	47	144.63	30	14
Hardwood Plantation (CEGL006613)[b]	1	0.50	0	1
Japanese Black Pine Forest (CEGL006012)	18	19.27	5	5
Japanese Knotweed Gravelbar (CEGL008472)	2	0.49	1	2
Japanese Sedge Maritime Dunes (CEGL006615)	10	16.37	5	4
Little Bluestem Old Field (CEGL006333)	27	71.35	20	8
Maritime Holly Forest (CEGL006376)	23	107.79	20	15
Maritime Red-cedar Woodland (CEGL006212)	36	119.43	21	18
Mid-Atlantic Maritime Salt Shrub (CEGL006848)	37	9.78	20	11
Mixed Forb Marsh (CEGL006446)[b]	1	0.12	0	0
North Atlantic Coast Backdune Grassland (CEGL006161)	58	44.33	23	26
North Atlantic Coast Estuarine Intertidal Mudflats (CEGL006614)	58	3912.87	10	4
North Atlantic Coastal Plain Vine Dune (CEGL003886)	20	10.20	5	4
North Atlantic High Salt Marsh (CEGL006006)	39	32.01	20	14
North Atlantic Low Salt Marsh (CEGL004192)	288	459.01	30	20
North Atlantic Upper Ocean Beach (CEGL004400)	100	158.20	30	13
Northeastern Atlantic Brackish Interdunal Swale (CEGL006342)	7	2.67	5	2
Northeastern Modified Successional Forest (CEGL006599)	28	65.90	20	26
Northeastern Old Field (CEGL006107)	16	70.08	3	12
Northeastern Pin Oak - Swamp White Oak Forest (CEGL006240)	1	4.69	1	1
Northeastern Successional Shrubland (CEGL006451)[b]	2	11.97	0	1
Northern Bayberry Dune Shrubland (CEGL006295)	74	94.01	30	11
Northern Beach Heather Dune Shrubland (CEGL006143)	7	3.59	0	6
Northern Beachgrass Dune (CEGL006274)	136	259.71	29	15
Northern Tall Maritime Shrubland (CEGL006379)	115	377.89	30	33
Overwash Dune Grassland (CEGL004097)	38	67.12	20	17
Red Maple - Blackgum Basin Swamp (CEGL006014)[b]	1	0.12	0	0
Reed-grass Tidal Marsh (CEGL004187)	125	353.07	30	9
Salt Panne (Salicornia Type) (CEGL004308)	20	4.88	5	0
Southern New England Red Maple Seepage Swamp (CEGL006406)[b]	1	1.22	0	1
Successional Maritime Forest (CEGL006145)	29	106.20	5	17
Woolgrass Marsh (CEGL006349)[b]	2	0.44	0	0
Subtotal	1,387	6,579.37	428	315

Table 2. Number of polygons, mapped hectares, number of accuracy assessment destination points, and number of accuracy assessment points sampled in 2006 by vegetation cover type and Anderson Level II categories on the 2007 final vegetation map (post-accuracy assessment) at Gateway National Recreation Area (continued).

	Number of Polygons	Mapped Hectares within the Park Boundary	Number of Accuracy Assessment Destination Points [a]	Number of Accuracy Assessment Points Sampled 2006
Anderson Level II Category				
00. Unclassified (Hoffman and Swinburne Island boundaries)	2	164.72	0	0
05. Water (artificial pond)	4	65.09	0	0
05. Water (natural pond)	5	3.79	0	0
11. Residential	1	0.13	0	0
12. Commercial and Services	50	773.92	0	1
14. Transportation, Communications, and Utilities	16	143.76	0	0
54. Bays and Estuaries[c]	62	6540.46	30	8
72. Beaches	60	127.26	0	6
73. Sandy Areas other than Beaches	22	8.78	0	0
74. Bare Exposed Rock	20	5.62	0	1
76. Transitional Areas	1	2.03	0	0
Subtotal	243	7,835.56	30	16
Total	1,630	14,414.93	458	331

[a] Number of points determined by USGS/NPS Vegetation Mapping Program protocol (ESRI et al. 1994). These numbers were determined using the 2006 revised preliminary map with the number of polygons and mapped hectares presented in Table 1 (e.g., Maritime Red-cedar Woodland only had 21 AA destination points because there were only 21 polygons for this type on the 2006 revised preliminary map and in Table 1). This table shows number of polygons and ha for the 2007 final vegetation map (post-accuracy assessment).

[b] Seven associations were identified as new to the park based on accuracy assessment data collection and revised plot classifications. Hardwood Plantation, Mixed Forb Marsh, Red Maple-Blackgum Basin Swamp, and Southern New England Red Maple Seepage Swamp were identified as new via accuracy assessment, thus they have zero AA destination points in Table 2. Northeastern Successional Shrubland, Northern Beach Heather Dune Shrubland, and Woolgrass Marsh were identified as new via revised plot classifications, thus they have zero polygons and zero hectares mapped in Table 1.

[c] Some portions of this cover type were treated as a mosaic of two associations on the 2006 revised preliminary map (i.e., there were polygons labeled as a combination of Saltwater Tidal Creek and Marine Intertidal Mudflats). During accuracy assessment we attempted to relabel these polygons with one of the dominant mosaic associations (e.g., if the Saltwater Tidal Creek/Marine Intertidal Mudflats polygon was mostly Marine Intertidal Mudflats it was relabeled as such). If the two types could be clearly discerned on the air photo, the polygon was split into the two respective types. Polygons that were determined to be primarily Saltwater Tidal Creek were treated as an Anderson Level II cover class because the NVC does not currently classify unvegetated aquatic associations.

Scenario E: The association is very rare. It has fewer than five polygons and occupies less than 50 ha (123.5 ac) of the total area. In this case, it is recommended that one sampling point be assigned to each polygon.

In order to randomly select the polygons in Scenarios A, B, C, and D, the Create Random Selection tool in Hawth's Analysis Tools was used in ArcGIS 9.2 (ESRI 1999-2006; Beyer 2006). For all of the scenarios, the Generate Random Points tool in Hawth's Analysis Tools was used to randomly determine the location of the Accuracy Assessment Destination Point in the polygon.

Before random points were determined, however, a transition zone was created 15 m (49 ft) in from the polygon boundary to serve as a "buffer" to prevent the placing of random sampling points too close to the polygon boundaries and to avoid ecotones. The value of 15 m (49 ft) was established because it is the average error of the GPS units used by staff for this project. Therefore, no Accuracy Assessment Destination Points were placed within 15 m (49 ft) of a polygon boundary, unless the transition zone completely subsumed the polygon, which occurred in several situations, because a given polygon was either too small, or too narrow, to support a 15 m (49 ft) transition zone. In these cases, the entire polygon was used as the sample "point" with the exact location of the field survey left to the discretion of the ecologist performing the accuracy assessment. These sample locations are spatially represented by the centroid of each of these polygons, in the Accuracy Assessment shapefile, and differentiated by unique identification in the attribute table. Four Hundred Fifty-eight (458) Accuracy Assessment Destination Points were generated prior to conducting field sampling in 2006 (Figures 7a-c; Table 2) and applied to the 2006 revised preliminary map with the number of polygons and mapped hectares presented in Table 1.

From July 12 to October 19, 2006 we attempted to navigate to as many of the 458 GIS generated Accuracy Assessment Destination Points as possible using a Magellan SporTrak GPS unit (26 field days total). The datum on the GPS units was set to North American Datum of 1983 (NAD 83) and the coordinate system was set to Universal Transverse Mercator (UTM) zone 18. In most cases, three vectors (i.e., bearing and distance) were used to get within 10 m (32.8 ft) of destination points for open communities, or 20 m (65.6 ft) for forested communities, while remaining entirely within the target polygon as best as possible. These cut-off levels were selected based on the plot size recommended for those types. Accuracy assessment data were collected digitally in the field using an iPAQ hand-held computer with data entry software (NY Natural Heritage Hand-Held Database [HHDB]) and imported to the NY Natural Heritage Field Form Database (FFDB). Sample screen shots from the HHDB used for accuracy assessment part of this project are included in Appendix B. We were able to sample 331 (72%) accuracy assessment points out of the 458 GIS generated Accuracy Assessment Destination Points, and an additional 37 reference observation points were also sampled at Gateway National Recreation Area in 2006 (Figures 7a-c; Table 2).

We tabulated the mapped and observed vegetation associations into a contingency matrix to evaluate the thematic accuracy of the vegetation association map. We calculated the overall percent accuracy and Kappa index (ESRI et al. 1994) to assess overall thematic accuracy. Percent accuracy was calculated by dividing the number of correctly classified accuracy assessment points by the total number of accuracy assessment points. We followed the formulas

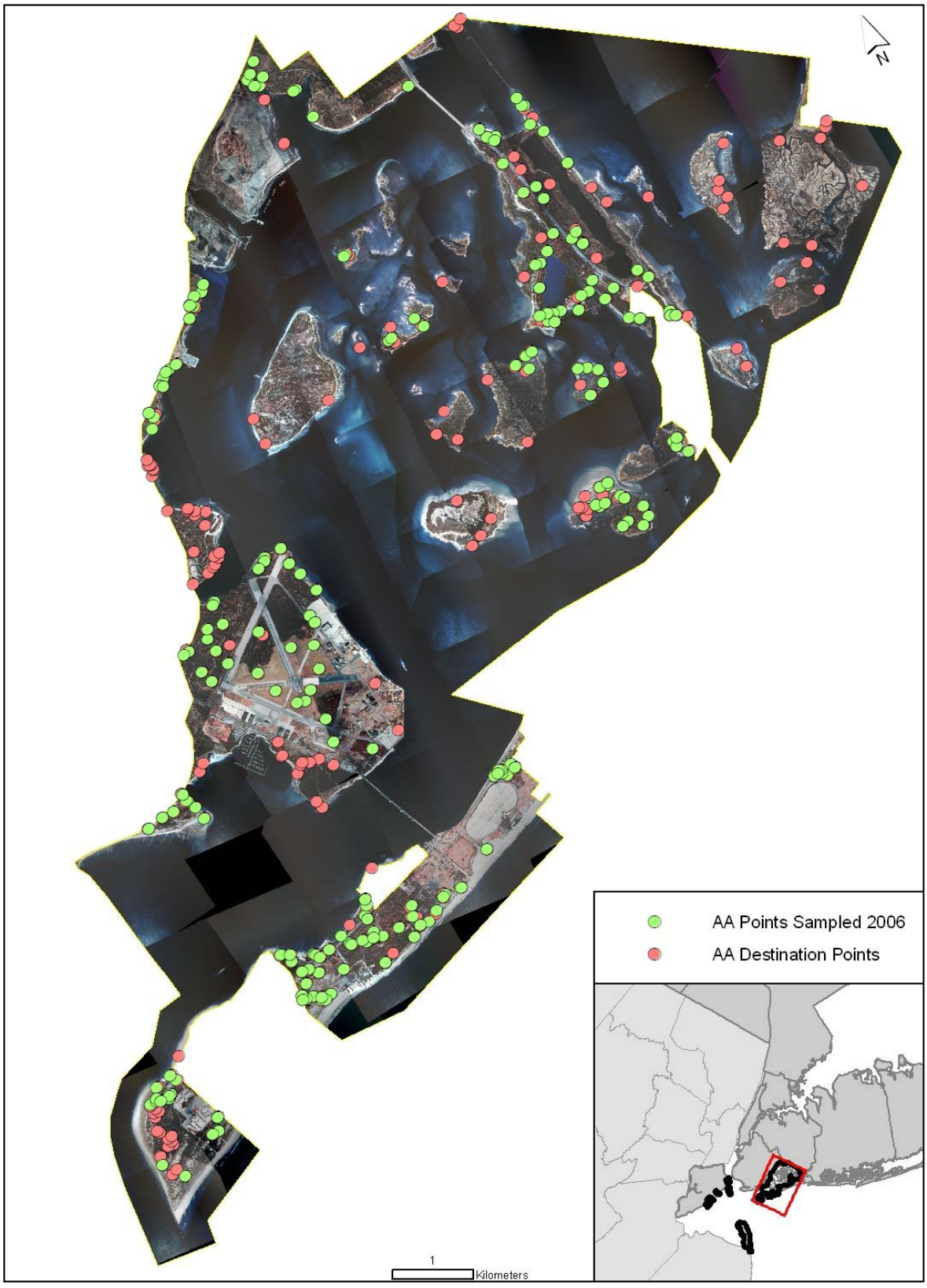


Figure 7a. Location of 328 accuracy assessment (AA) destination points and 209 AA points sampled in 2006 within the Jamaica Bay Unit of Gateway National Recreation Area.

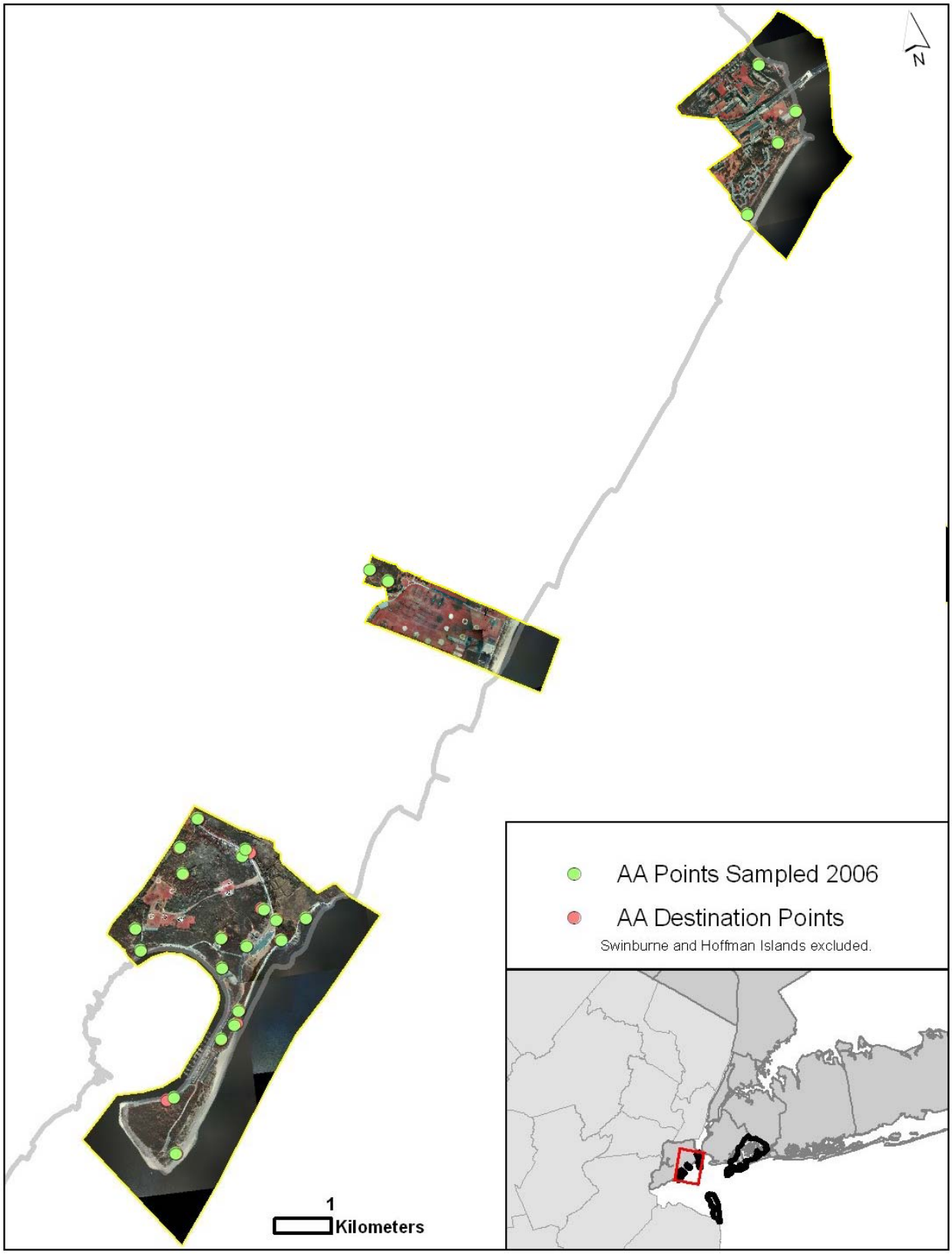


Figure 7b. Location of 25 accuracy assessment (AA) destination points and 25 AA points sampled in 2006 within the Staten Island Unit of Gateway National Recreation Area.

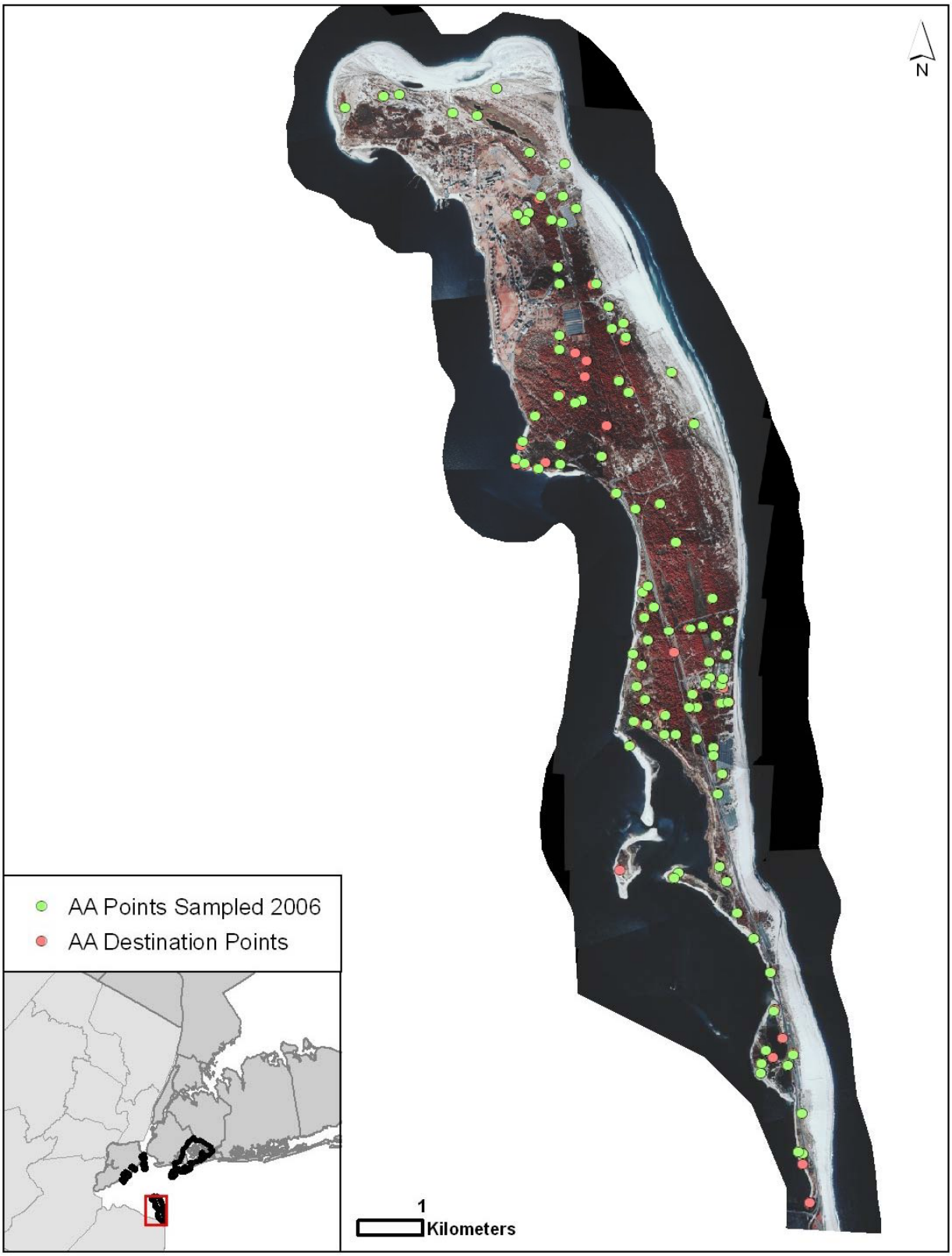


Figure 7c. Location of 105 accuracy assessment (AA) destination points and 97 AA points sampled within the Sandy Hook Unit of Gateway National Recreation Area.

by Foody (1992 [in ESRI et al. 1994]) for the calculation of the Kappa index. The Kappa index account that a certain number of correct classifications will occur by chance (Foody 1992) and is preferred over the simpler overall accuracy estimate. The USGS/NPS vegetation mapping protocol sets a standard of 0.80 or better for the Kappa index of vegetation association maps (ESRI et al. 1994).

We also calculated errors of omission and errors of commission for each map unit. Both of these errors are calculated by dividing the number of correctly classified points in one map unit by the total number of points sampled in that map unit. Errors of omission indicate the probability that an accuracy assessment point classification will be correct and are calculated by mapped vegetation type. Errors of commission indicate the probability that a mapped vegetation type actually represents the vegetation on the ground. This error is calculated by observed vegetation type. The errors of omission and errors of commission for mapped vegetation associations should meet a standard of 80% correct, or less than 20% error, according to the USGS/NPS Vegetation Mapping Protocol (ESRI et al. 1994). We evaluated whether each mapped vegetation type and each observed vegetation type met the 80% standard, as well as the percentage of vegetation types, overall, that met the standard.

Results

Vegetation Classification and Characterization

The vegetation associations of the Gateway National Recreation Area were classified using PC-ORD version 4.0 Multivariate Analysis package (McCune and Mefford 1999). Plot data were exported from the NY Natural Heritage Field Form Database (FFDB) and transferred into a Microsoft Excel spreadsheet for data preparation prior to PC-ORD analyses. The following six datasets were created for Gateway National Recreation Area:

1. all plots/species separated by strata
2. all plots/species separated by strata/no exotics
3. all plots/species lumped (i.e., not separated) across strata
4. all plots/species lumped across strata/no exotics
5. woody plant-dominated plots/species lumped across strata/no exotics
6. herbaceous-dominated plots/species lumped across strata/no exotics

The following three programs with indicated settings were run from PC-ORD software package for all datasets (18 total results, Table 3):

1. NMS: Non-metric Multidimensional Scaling (Kruskal and Wish 1978; Clarke 1993), Autopilot mode, Medium Speed vs. Thoroughness, and Sorensen (Bray-Curtis) distance measure.
2. CA: Hierarchical Cluster Analysis, Relative Euclidian linkage method, and Ward's Method distance measure.
3. TWINSPAN: Two-Way Indicator Species Analysis (Hill and Gauch 1979) with default settings.

Table 3. Gateway National Recreation Area datasets plots vs. species

	1. All plots/ Separate strata	2. All plots/ Separate strata/ No exotics	3. All plots/ Lumped strata	4. All plots/ Lumped strata/ No exotics	5. Woody plots/ Lumped strata/ No exotics	6. Herbaceous/ Lumped strata/ No exotics
NMS/ Autopilot/ Medium/Sor.	172 [a] x 305	170 x 219	172 x 226	170 x 162	72 x 101	98 x 104
CA/ Rel. Euc./ Wards Meth	172 [a] x 305	170 x 219	172 x 226	170 x 162	72 x 101	98 x 104
TWINSPAN (default settings)	172 [a] x 305	170 x 219	172 x 226	170 x 162	72 x 101	98 x 104

[a] Only 172 of the 178 plots sampled were included. The six plots that were excluded from PC-ORD analysis were excluded for the following reasons: plot 4a was sampled in the ecotone of two associations; plot 4an was sampled in a pond and at that time it was uncertain whether or not aquatic types would be included in the NVC (this type was later added to the NVC); plot 4m was sampled in a marine intertidal mudflat dominated by a non-vascular plant, sea-lettuce (*Ulva lactuca*), and at that time it was uncertain whether or not types dominated by marine macro algae would be included in the NVC (this type was later added to the NVC); plot 5ag was sampled within a recently mowed field and many species could not be accurately identified; plot 5c had an incomplete species list; plot 2a was dominated by an nonnative, invasive species mugwort (*Artemesia vulgaris*) and was sampled as a reference plot.

Due to the large size of the dataset, it is impractical to include graphical representations of these analyses in this report. For a detailed discussion of the statistical techniques used in this study, please refer to McCune and Grace (2002). The results of these classification analyses were evaluated against each other and compared to Ecological Communities of New York State (Edinger et al. 2002) and the National Vegetation Classification System (NVCS). Several steps were followed to achieve this goal.

First, local (i.e., park-specific) descriptions were written for each association using vegetation cover data collected from plots determined to be the same association based on the statistical analyses. For example, all plots that were dominated by American beachgrass (*Ammophila breviligulata*) tended to cluster together in the statistical analyses and were used to write the local description for the Northern Beachgrass Dune association.

Second, these local descriptions were compared to existing NVC global association descriptions and crosswalked to the closest NVC association. The local vegetation associations were qualitatively compared to existing associations in the National Vegetation Classification System by searching for alliances sharing similar dominant species, as well as physiognomy and environmental setting. Total floristic composition was used to determine the appropriate association within the alliance. All available tools were used to properly classify the plots, such as published keys to the associations (Sneddon and Neid 2004), published subsets of the International Ecological Classification Standard (e.g., NatureServe 2005), the NatureServe Explorer website (http://www.natureserve.org/explorer/index.htm), and directly communicating with regional NatureServe ecologists familiar with the NVC (e.g., Lesley Sneddon and Ery Largay).

Third, after all of the plots were properly crosswalked to the best NVC association and correctly labeled, then the preliminary vegetation map (originally labeled with NY Natural Heritage ecological community names) was updated so that all polygons were labeled with an NVC association name based on the plot data analyses. For example, all polygons that had a Northern Beachgrass Dune plot sampled within its boundaries were also labeled as Northern Beachgrass Dune.

Lastly, polygons that were not field sampled were labeled with the closest NVC association name based on the comparison of air photo signatures of polygons that had ground-truthed plot data. For example, a maritime dune polygon without a plot that is near a polygon that has a plot and has a similar photo signature and landscape setting was also labeled Northern Beachgrass Dune. This process was completed for all polygons and associations resulting in the 2006 revised preliminary vegetation map that was assessed for accuracy. Each vegetation association was assigned a common name based on the Ecological Communities of New York State (Edinger et al. 2002). If no appropriate name existed in Edinger et al. (2002), the National Vegetation Classification System common name was used, or a park-specific common name was created in the case of successional and cultural vegetation types not easily handled by Edinger et al. (2002) or the NVCS. The list of the vegetation associations on the 2006 revised preliminary vegetation map derived from these steps is presented in Table 1.

Vegetation Association Descriptions

Detailed local descriptions for 35 vegetation associations were written based on plot data, compositional statistics, photographs of each plot, thematic accuracy assessment data, the ecologists' field observations at the Gateway National Recreation Area, and the other research cited in the local descriptions (Appendix E). These vegetation associations were then crosswalked to the National Vegetation Classification System (NVCS) which contains range-wide global descriptions for each association. Associations that are park-specific local vegetation types not represented in the NVCS include Hardwood Plantation (CEGL006613) and Japanese Sedge Maritime Dunes (CEGL006615). These cannot be attributed with a global description. Detailed local and global descriptions of the vegetation associations are contained in Appendix E. Each association is also crosswalked to Ecological Communities of New York State (Edinger et al. 2002). The ecological community classification for New Jersey utilizes the NVCS as its standard (Walz et al. 2007), therefore, each NVCS association description was representative and an additional crosswalk was not needed.

A dichotomous key was also developed for the vegetation associations of the Gateway National Recreation Area (Appendix D). The dichotomous key should be used in conjunction with the detailed vegetation association descriptions to confirm that the association selected with the key is appropriate. This key and the detailed vegetation association descriptions may be used by park resource managers and others to identify vegetation associations in the park

Vegetation Map Production

Based on the accuracy assessment sampling data and the final classification of 35 vegetation associations, the association level map was revised again to correct errors and create more accurate vegetation association polygon boundaries. In this final revision, accuracy assessment data, plot data, field observations, aerial photography signatures, and topographic maps were used to revise polygon boundaries and attributes.

The resulting final vegetation association map is shown for each park unit in Figures 8a-c (located at the end of the Results section due to size) and a summary of the vegetation association distribution and abundance is provided in Table 2. Since Hoffman and Swinburne islands of the Staten Island Unit were excluded from the air photo coverage, they were excluded from the final vegetation map as well. Polygons that were attributed with Anderson Level II categories (Anderson et al. 1976) retained their attributes in the final map.

Accuracy Assessment

Positional Accuracy

Positional accuracies of the Jamaica Bay, Sandy Hook, and Staten Island photomosaics are 2.40, 2.08, and 3.25 meters, respectively, all of which meet the Class 2 National Map Accuracy Standard (FGDC 1998b). A copy of the spreadsheet for each photomosaic, containing the x and y coordinates for each ground control point and the accuracy calculation formula, is stored in the NCSU archive.

Thematic Accuracy

Thematic accuracy assessment for the vegetation association map was calculated with a contingency matrix (Table 4 [located at the end of the Results section due to size]). We used the final vegetation association classification in the contingency table to simplify the record keeping of correct and incorrect sampling points. We calculated errors of omission for only the associations mapped in the revised preliminary map as these were the only associations to which accuracy assessment plots had been directed. Six new types were encountered during accuracy assessment; three types were added to the classification as new associations (Southern New England Red Maple Seepage Swamp [CEGL006406], Northeastern Successional Shrubland [CEGL006451], Hardwood Plantation [CEGL006613]) and three types were kept at the Anderson II classification level (marine intertidal gravel/sand beach, paved road/path, and marine riprap/artificial shore). Thus, we calculated errors of omission for all 29 of the initially mapped vegetation associations. We calculated errors of commission for 28 of the 34 vegetation associations observed during accuracy assessment. The six vegetation types for which we could not calculate errors of commission were new to the classification and new to the vegetation map as noted above. One additional mapped vegetation association, salt panne (CEGL004308) was mapped in the initial map; however, this type was not encountered via the randomly assigned accuracy assessment points and with no encounters, we could not calculate an error of commission for this type.

Based on the contingency matrix (Table 4) the Kappa index for the preliminary association map was 0.6201, with the overall percent accuracy calculated as 63.75%. This falls below the USGS/NPS vegetation mapping protocol requirement of 80%. The errors of commission for 22 of the 29 (75.9%) mapped vegetation associations exceeded the USGS/NPS vegetation mapping protocol requirement of 80%, with eight associations attaining 100% correct. Six of the 29 associations had errors of commission below 50%. The errors of omission for 23 of the 34 (67.6%) vegetation associations observed during the accuracy assessment exceeded the USGS/NPS vegetation mapping protocol requirement of 80%, with 5 associations attaining 100%. Four of the 34 vegetation associations had errors of omission below 50%.

We used the thematic accuracy assessment data to correct and further revise the 2006 revised preliminary vegetation association map and create the 2007 final vegetation association map (i.e., we made sure that the NVC association label of the polygon matched the Accuracy Assessment Point NVC association label). Thus, our final vegetation association map (Figures 8a-c) has a much higher thematic accuracy than what is reported above for the preliminary vegetation association map. Re-assessing the thematic accuracy of the final vegetation association map, however, would require another round of intensive field sampling. The costs of a second round of sampling do not seem justified simply to quantify the level of increased accuracy in the final map.

Errors in the association map were caused by several factors. The largest source of error was the difficulty in distinguishing between types with very similar air photo signatures. For example, Northern Tall Maritime Shrubland (CEGL006379) was often misclassified as Northern Bayberry Dune Shrubland (CEGL006295) and vice versa. These two associations share many of the same species with the primary difference being shrub height (i.e., >2 m [>6.56 ft] for tall and <2 m [<6.56 ft] for short). This subtle difference in height is not detectable from air photos. Another

example is Salt Panne (Salicornia Type) (CEGL004308). None of the accuracy assessment points proved to be this type; rather, they turned out to be North Atlantic High Salt Marsh (CEGL006006), North Atlantic Upper Ocean Beach (CEGL004400), or, in one case, a cultural type, marine riprap/artificial shore. The signature for these types can be "bleached out" under high light conditions and look pure white. Lastly, the accuracy assessment ecologist recognized marine intertidal gravel/sand beach (lower tidal portion of beach) as a separate cover type from the North Atlantic Upper Ocean Beach (upper non-tidal portion of beach); thus, four polygons labeled as North Atlantic Upper Ocean Beach were found to be marine intertidal gravel/sand beaches, which lowered our accuracy, although the two types understandably look very similar on air photos. These two beach types were split on the map as follows (if photo signatures were discernable): if a wrack line was present on the beach, or the sand looked darker (wet) and the beach was directly adjacent to the water, then it was labeled as marine intertidal gravel/sand beach (Anderson Level II: 72 Beaches); if the beach was above a wrack line and/or above the marine intertidal gravel/sand beach (darker, wet sand), then it was labeled as the North Atlantic Upper Ocean Beach association (CEGL004400).

Another source of error was the discovery of seven new associations based on accuracy assessment data collection and revised plot classifications. Hardwood Plantation (CEGL006613), Mixed Forb Marsh (CEGL006446), Red Maple-Blackgum Basin Swamp (CEGL006014), and Southern New England Red Maple Seepage Swamp (CEGL006406) were identified as new via accuracy assessment. Northeastern Successional Shrubland (CEGL006451), Northern Beach Heather Dune Shrubland (CEGL006143), and Woolgrass Marsh (CEGL006349) were identified as new via revised plot classifications.

However, the few low matches were offset by several high numbers of matches including eight associations attaining 100% correct (Table 4). Examples with a high number of exact matches include North Atlantic Low Salt Marsh (CEGL004192), North Atlantic High Salt Marsh (CEGL006006), North Atlantic Upper Ocean Beach (CEGL004400), Maritime Red-cedar Woodland (CEGL006212), and Maritime Holly Forest (CEGL006376).

Lastly, we were only able to sample 331 (72%) of the 458 Accuracy Assessment (AA) Destination Points within Gateway NRA (Figures 7a-c; Table 2). While we able to sample 100% (25/25) of the AA Destination Points within the Staten Island Unit (Figure 7b) and 92% (97/105) of the AA Destination Points within the Sandy Hook Unit (Figure 7c), we were only able to sample 64% (209/328) of the AA Destination Points within the Jamaica Bay Unit (Figure 7a). Many of the AA Destination Points in Jamaica Bay Unit were only accessible by boat. Securing a boat for dedicated AA field work was difficult because of conflicting boat use schedules with other researchers, availability of the boat operator, mechanical problems with the boats, and unsafe weather conditions. As a result, there were only two days of boat surveys scheduled for the Jamaica Bay Unit accuracy assessment in 2006 (15 AA points were sampled on Sept. 22, 2006 via motorized boat, and 13 AA points and 2 reference points were sampled via non-motorized raft on Oct. 19, 2006). The associations that were missed because of inaccessibility are primarily types that are relatively easier to identify from air photos (e.g., North Atlantic Low Salt Marsh (CEGL004192) and North Atlantic Coast Estuarine Intertidal Mudflats (CEGL006614)). It is likely that many of these AA Destination Points would have proved to be correct and would have increased the overall percent accuracy of the map and for those associations.

Project Deliverables

Final products of the vegetation mapping project are shown in Table 5. All products will be delivered to the National Park Service by NY Natural Heritage with this report.

Table 5. Summary of products resulting from the vegetation classification and mapping of vegetation at Gateway National Recreation Area.

Product	FGCD-compliant spatial metadata
Aerial photos, including flight line map and photoindex	Yes
Photomosaic digital format	Yes
Vegetation plot sampling data in the PLOTS 2.0 database (NatureServe 2004)	Not applicable
GPS locations of vegetation plots	Yes
Thematic accuracy assessment data in the PLOTS 2.0 Database (NatureServe 2004)	Not applicable
GPS locations of thematic accuracy assessment sampling points	Yes
CD with digital photographs of all plots and accuracy assessment points taken	Not applicable
Final map of vegetation associations as paper copy and in digital format	Yes
Palustrine and Estuarine wetland map as paper and in digital format	Yes
Final report as paper copy and in digital format	Not applicable

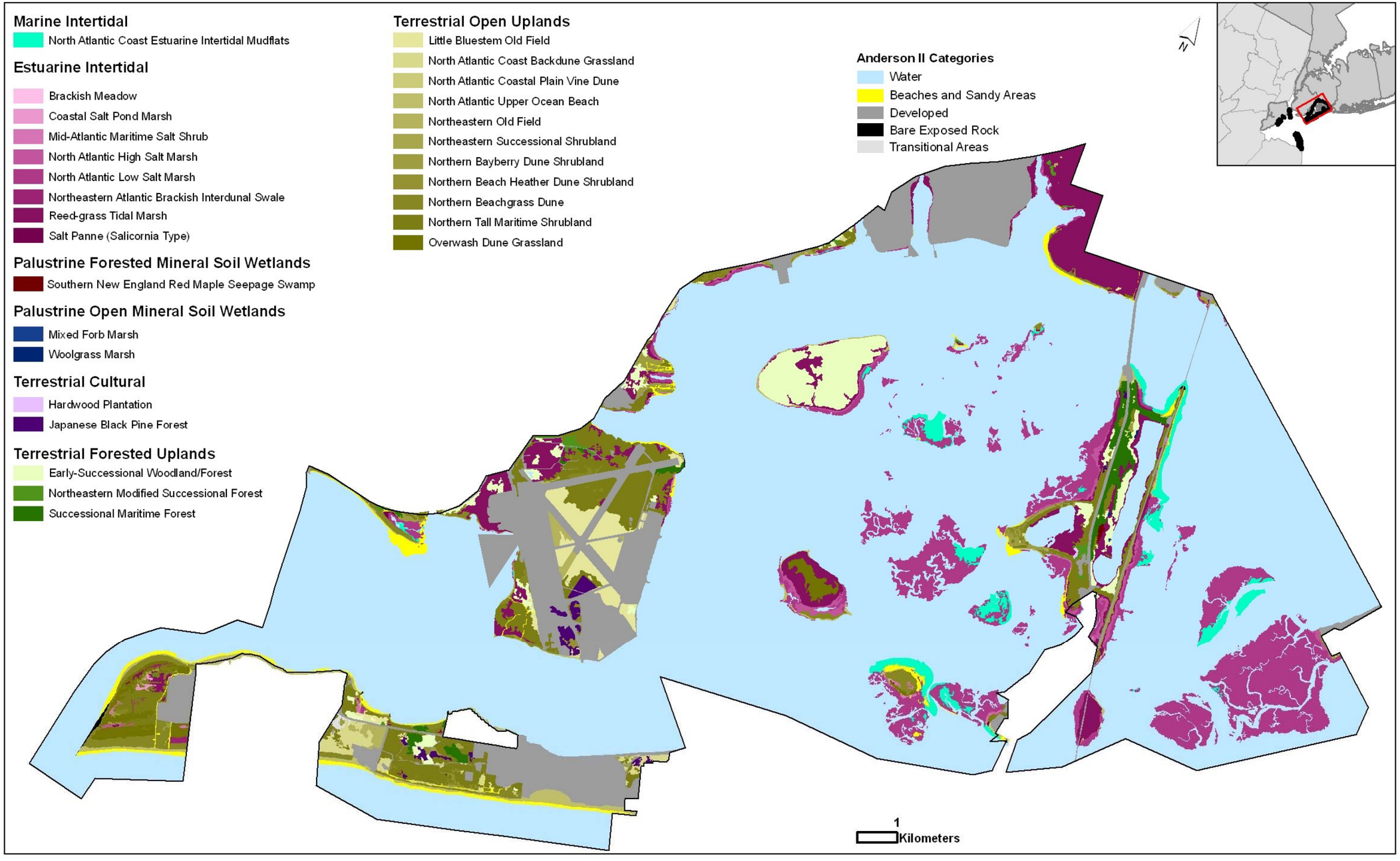


Figure 8a. Distribution of vegetation associations and Anderson Level II categories within the Jamaica Bay Unit of Gateway National Recreation Area.

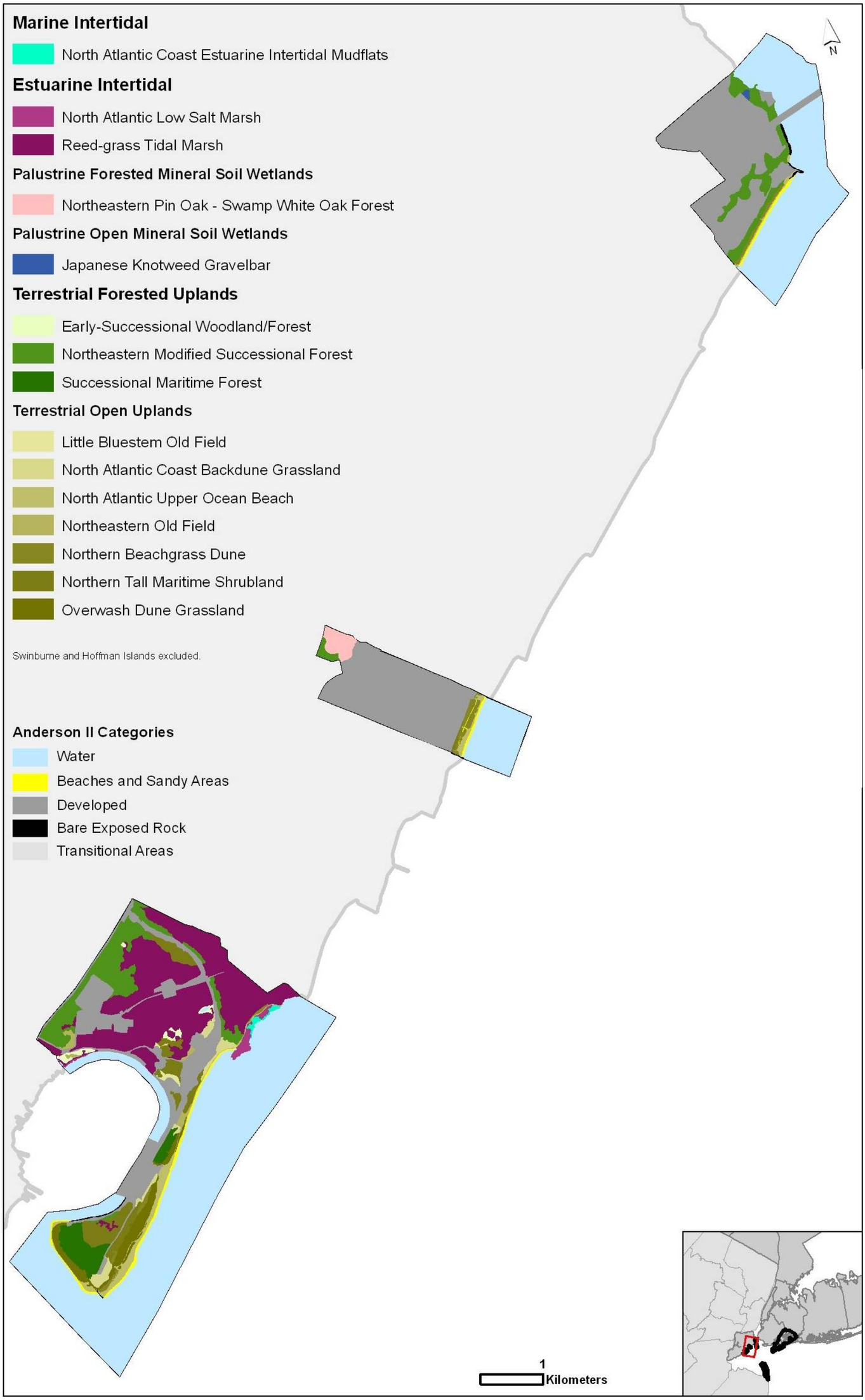


Figure 8b. Distribution of vegetation associations and Anderson Level II categories within the Staten Island Unit of Gateway National Recreation Area.

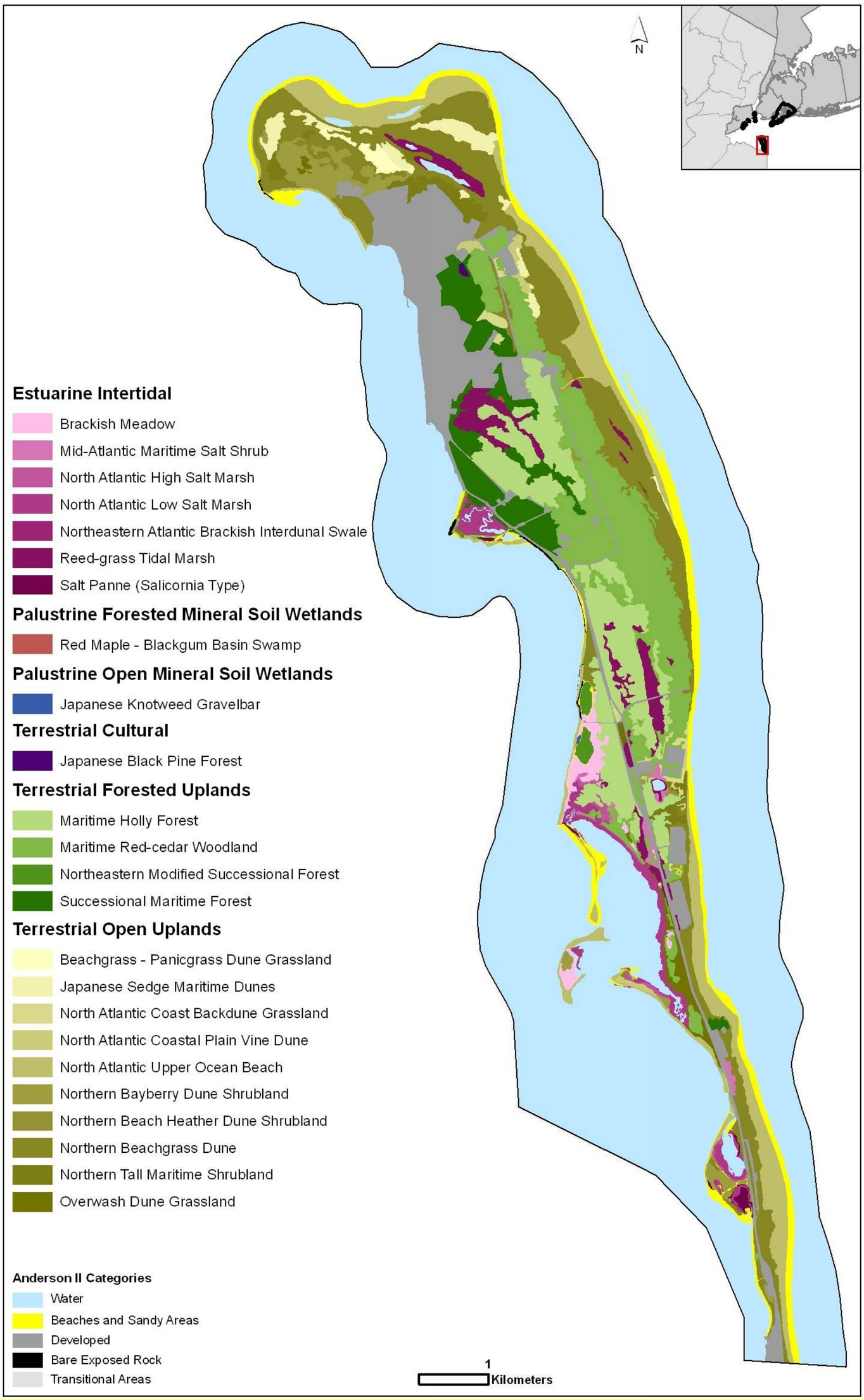


Figure 8c. Distribution of vegetation associations and Anderson Level II categories within the Sandy Hook Unit of Gateway National Recreation Area.

Table 4. Contingency matrix and calculated errors for the thematic accuracy assessment of the vegetation association map of the Gateway National Recreation Area.

	Mapped Vegetation Association																																
Accuracy Assessment Observation	3886	3921	4043	4097	4187	4192	4308	4400	6006	6012	6107	6143	6145	6150	6161	6212	6240	6274	6295	6303	6333	6342	6376	6379	6599	6614	6615	8472	STC	samp size	error of omission (% correct)	90% CI	conforms to 80% accuracy requirement?
North Atlantic Coastal Plain Vine Dune (3886)	2				1										1															4	50%	0.536	yes
Eastern Tidal Salt Shrub (3921)		8			2														1											11	73%	0.266	yes
Beachgrass - Panicgrass Dune Grassland (4043)			2																											2	100%	0.250	yes
Overwash Dune Grassland (4097)		2		10	1				1					1				2												17	59%	0.226	yes
Reed-grass Tidal Marsh (4187)					9																									9	100%	0.056	yes
North Atlantic Low Salt Marsh (4192)					1	16			2																				1	20	80%	0.172	yes
Salt Panne (Salicornia Type) (4308)																															0%		
North Atlantic Upper Ocean Beach (4400)							1	12																						13	92%	0.160	yes
North Atlantic High Salt Marsh (6006)							3		11																					14	79%	0.216	yes
Black Pine Forest (6012)										4													1							5	80%	0.394	yes
Northeastern Old Field (6107)					3						5				2			2												12	42%	0.276	
Northern Beach Heather Dune Shrubland (6143)												3			2	1														6	50%	0.419	yes
Successional Maritime Forest (6145)										1			6						1	2				6	1					17	35%	0.220	
Brackish Meadow (6150)														2				1												3	67%	0.614	yes
North Atlantic Coast Backdune Grassland (6161)		1		4											13	1		5			2									26	50%	0.181	
Maritime Red-cedar Woodland (6212)																17							1							18	94%	0.117	yes
Northeastern Pin Oak - Swamp White Oak Forest (6240)																	1													1	100%	0.500	yes
Northern Beachgrass Dune (6274)		1		4										1				9												15	60%	0.241	yes
Northern Bayberry Dune Shrubland (6295)		1														1		1	6		1						1			11	55%	0.292	yes
Early-Successional Woodland/Forest (6303)																				9	1				4					14	64%	0.246	yes
Little Bluestem Old Field (6333)					1																7									8	88%	0.255	yes
Northeastern Atlantic Brackish Interdunal Swale (6342)				1																		1								2	50%	0.832	yes
Maritime Holly Forest (6376)																1							14							15	93%	0.139	yes
Northern Tall Maritime Shrubland (6379)	3	2			1														11					16						33	48%	0.158	
Southern New England Red Maple Seepage Swamp (6406)																				1										1			
Northeastern Successional Shrubland (6451)																				1										1			
Northeastern Modified Successional Forest (6599)																			2	11	1				12					26	46%	0.180	
Hardwood Plantation (6613)																				1										1			
North Atlantic Coast Estuarine Intertidal Mudflats (6614)																										3			1	4	75%	0.481	yes
Japanese Sedge Maritime Dunes (6615)																											4			4	100%	0.125	yes
Japanese Knotweed Gravelbar (8472)																									1			1		2	50%	0.832	yes
marine intertidal gravel/sand bar (MIG/SB)								4																		1			1	6			
saltwater tidal creek (STC)																													8	8	100%	0.063	yes
paved road/path (PR/P)																					1									1			
marine riprap/artificial shore (MR/AS)							1																							1			

sample size	5	15	2	19	19	16	5	16	14	5	5	3	6	4	18	21	1	20	21	25	13	1	16	22	18	4	5	1	11	331
error of commission, percent correct	40%	53%	100%	53%	47%	100%	0%	75%	79%	80%	100%	100%	100%	50%	72%	81%	100%	45%	29%	36%	54%	100%	88%	73%	67%	75%	80%	100%	73%	
90% confidence interval (2-tailed)	0.460	0.245	0.250	0.215	0.215	0.031	0.100	0.209	0.216	0.394	0.100	0.167	0.083	0.536	0.201	0.165	0.500	0.208	0.186	0.178	0.266	0.500	0.167	0.179	0.211	0.481	0.394	0.500	0.266	
conforms to 80% accuracy requirement	yes		yes			yes		yes	yes	yes	yes	yes	yes	yes	yes	yes	yes				yes	yes	yes	yes	yes	yes	yes	yes	yes	

Percent mapped associations conforming (22 of 29)	75.86%
Percent observed associations conforming (23 of 34)	67.65%
total observations	331
total correctly classified	211
Overall accuracy	**63.75% (+-4.5%)**
Kappa index	**0.6201**

*The cells highlighted in green show the number of sampling points that were correct. Errors of commission and omission could not be calculated for the associations highlighted in orange because the association was not included in the preliminary association map. The three additional Anderson Level II categories that were observed during accuracy assessment are highlighted in blue.

Discussion

Vegetation Classification and Characterization

This study of the Gateway National Recreation Area identified and characterized 35 vegetation associations in detail (Appendix E). The diversity and distribution of vegetation associations at Gateway National Recreation Area is primarily a result of the following four factors: 1) the geologic history of the region, especially the effect of glaciation and outwash sand deposits; 2) the park's position on the northeastern U.S. coastal plain within a temperate climate; 3) its proximity to the ocean and maritime ecological processes, such as diurnal tides, storm overwash, salt spray, and high winds; and 4) its setting within an urban landscape with an intensive human land use history along with its associated problems, such as invasive species, fragmentation, habitat loss, pollution, channel dredging, land filling, etc.

A cursory comparison of the final vegetation map to the Gateway National Recreation Area soil survey map (USDA NRDC 2001) revealed that the vast majority of associations have sandy soils derived from glacial outwash and/or marine sediments. Predominant soil types for each vegetation association are reported in the Gateway National Recreation Area Environmental Description field in Appendix E.

Twenty (57%) of the 35 associations at Gateway National Recreation Area are created and/or maintained by maritime influence and oceanic derived processes and are listed below within the following three Systems: Marine, Estuarine, and Terrestrial (Cowardin et al. 1979; Edinger et al. 2002).

Marine Associations

The marine system consists of open ocean overlying the continental shelf, the associated coastline that is exposed to wind and waves, and shallow coastal bays that are saline because they lack significant freshwater inflow. Marine associations extend from mean high water seaward, beyond the limits of rooted vascular vegetation. Salinity usually exceeds 30 parts per thousand (ppt) ocean-derived salts, with little or no dilution except outside the mouths of estuaries (Cowardin et al. 1979) where salinity can range as low as 18 ppt in New York (Edinger et al. 2002).

North Atlantic Coast Estuarine Intertidal Mudflats (CEGL006614) is the only vegetation association classified as a marine community at Gateway National Recreation Area. The ocean, bays, saltwater tidal creeks, and marine intertidal gravel/sand beach are treated as Anderson Level II cover classes (Anderson et al. 1976). More field survey is needed to accurately map the marine intertidal areas at Gateway National Recreation Area.

Estuarine Associations

The estuarine system consists of deepwater tidal habitats and adjacent tidal wetlands that are usually semi-enclosed, but have open, partly obstructed, or sporadic access to open ocean or tidal fresh waters, and where ocean water is at least occasionally diluted by fresh-water runoff. Estuarine associations extend from the upstream limit of tidal influence seaward to an imaginary

line closing the mouth of a river or bay to the marine system. Salinity is usually less than 30.0 parts per thousand (ppt) ocean-derived salts, but can range from hyperhaline (>40 ppt) to oligohaline (0.5-5 ppt) (Cowardin et al. 1979; Edinger et al. 2002).

There are seven estuarine vegetation associations at Gateway National Recreation Area: Brackish Meadow (CEGL006150); Mid-Atlantic Maritime Salt Shrub (CEGL006848); North Atlantic Low Salt Marsh (CEGL004192); North Atlantic High Salt Marsh (CEGL006006); Salt Panne (Salicornia Type) (CEGL004308); Coastal Salt Pond Marsh (CEGL006398); and Northeastern Atlantic Brackish Interdunal Swale (CEGL006342).

Terrestrial Associations

Terrestrial maritime associations are generally in immediate proximity to marine communities. They are heavily influenced by coastal processes including strong salt spray, high winds and dune deposition, shifting, and overwash processes. Forests generally contain stunted "salt pruned" trees with contorted branches and wilted leaves and usually have a dense vine layer. These communities often occur as narrow bands under 50 m (164 ft) wide (Edinger et al. 2002).

There are 12 terrestrial maritime associations at Gateway National Recreation Area: North Atlantic Upper Ocean Beach (CEGL004400); Northern Beachgrass Dune (CEGL006274); Beachgrass - Panicgrass Dune Grassland (CEGL004043); Overwash Dune Grassland (CEGL004097); North Atlantic Coast Backdune Grassland (CEGL006161); Northern Beach Heather Dune Shrubland (CEGL006143); Northern Bayberry Dune Shrubland (CEGL006295); Northern Tall Maritime Shrubland (CEGL006379); North Atlantic Coastal Plain Vine Dune (CEGL003886); Maritime Red-cedar Woodland (CEGL006212); Maritime Holly Forest (CEGL006376); and Successional Maritime Forest (CEGL006145).

Human Modified Associations

There are seven associations in this classification at Gateway National Recreation Area that are there primarily as a result of human activity: Reed-grass Tidal Marsh (CEGL004187); Japanese Black Pine Forest (CEGL006012); Northeastern Old Field (CEGL006107); Early-Successional Woodland/Forest (CEGL006303); Northeastern Modified Successional Forest (CEGL006599); Hardwood Plantation (CEGL006613); Japanese Sedge Maritime Dunes (CEGL006615); and Japanese Knotweed Gravelbar (CEGL008472). All of the reed-grass (*Phragmites australis*) dominated polygons at Gateway National Recreation Area were labeled as Reed-grass Tidal Marsh (CEGL004187). It is possible that some of these polygons may actually be the non-tidal association, Reed-grass Eastern North America Temperate Semi-natural Herbaceous Vegetation (CEGL004141). These two types would likely be indistinguishable on air photos. Furthermore, several reed-grass dominated areas are technically upland community types on dredge spoil (e.g., Spring Creek) (George Frame, pers. comm.). The NVC does not currently include a reed-grass dominated upland association. Future surveys of all reed-grass dominated polygons at Gateway National Recreation Area could determine which are tidal, freshwater, and upland. Although the Japanese Knotweed Gravelbar association (CEGL008472) is described as being found in temporarily flooded habitats, such as scour bars, and disturbed habitats that flood very frequently (Appendix E), the two polygons at Gateway National Recreation Area appear to be upland examples. The remainder of the park is classified as human derived cover types labeled with

Anderson Level II land cover classes (Anderson et al. 1976), such as roads, parking lots, buildings, vacant lots, jetties, seawalls, etc.

Globally Rare and State Significant Associations

Despite the degraded landscape and developed areas in and around the park, Gateway National Recreation Area has several vegetation associations with biodiversity significance at the state and global level. The rarest association in the park is the Maritime Holly Forest (CEGL006376) at Sandy Hook. At 93.5 ha (231 ac) it is the largest one of only two known occurrences in the world, with the other, coincidentally, located on NPS land at Sunken Forest on Fire Island National Seashore. The North Atlantic Low Salt Marsh (CEGL004192) in Jamaica Bay is currently the largest (500 ha [1,237 ac]) example documented by NY Natural Heritage (includes patches not within Gateway National Recreation Area). Lastly, the Northern Beachgrass Dune (CEGL006274) and Overwash Dune Grassland (CEGL004097) at Breezy Point are of good quality and significant from a statewide perspective. All of the vegetation associations at the park provide habitat for a wide array of species and present numerous opportunities for nature study and recreation for visitors.

Vegetation Association Map Production

The final vegetation association map for Gateway National Recreation Area depicts 35 vegetation associations classified and characterized in this study (Figures 8a-c). The following three associations are widespread and occur in every section of the three park Units: North Atlantic Upper Ocean Beach (CEGL004400); Northern Beachgrass Dune (CEGL006274); and Northeastern Modified Successional Forest (CEGL006599). Northern Tall Maritime Shrubland (CEGL006379) occurs in every section of the three park units except for Fort Wadsworth. Overwash Dune Grassland (CEGL004097) occurs in every section of the three park units except for Miller Field and Fort Wadsworth. North Atlantic Low Salt Marsh (CEGL004192) occurs in all three units and has the most polygons (288) and covers the greatest area (460 ha [1,134 ac]) in the park (Table 2).

The following five associations are represented by only one polygon on the 2007 final vegetation map (Table 2) and thus restricted to one indicated park unit. Hardwood Plantation (CEGL006613), Mixed Forb Marsh (CEGL006446), Northeastern Successional Shrubland (CEGL00641), and Southern New England Red Maple Seepage Swamp (CEGL006406) are restricted to the Jamaica Bay National Wildlife Refuge (Figure 8a); Northeastern Pin Oak - Swamp White Oak Forest (CEGL006240) is restricted to Miller Field (Figure 8b); and Red Maple - Blackgum Basin Swamp (CEGL006014) is restricted to Sandy Hook (Figure 8c). In addition, the following multi-polygon associations are restricted to the Sandy Hook Unit: Beachgrass - Panicgrass Dune Grassland (CEGL004043); Japanese Sedge Maritime Dunes (CEGL006615); Maritime Red-cedar Woodland (CEGL006212); and Maritime Holly Forest (CEGL006376) (Figure 8c). Lastly, the Woolgrass Marsh (CEGL006349) multi-polygon association is restricted to the Jamaica Bay Unit (Figure 8a).

Palustrine and Estuarine Wetland Maps

As an additional task to this vegetation mapping project, the NPS requested that NY Natural Heritage produce wetland maps for Gateway National Recreation Area. All vegetation association polygons have been labeled with Systems (Cowardin et al. 1979) and Subsystems following Ecological Communities of NY State (Edinger et al. 2002). Figures 9a-c depict the palustrine, estuarine, and marine wetlands at Gateway National Recreation Area.

All of the reed-grass (*Phragmites australis*) dominated polygons at Gateway National Recreation Area were labeled as Reed-grass Tidal Marsh (CEGL004187). It is possible that some of these polygons may actually be the non-tidal association, Reed-grass Eastern North America Temperate Semi-natural Herbaceous Vegetation (CEGL004141). Furthermore, several reed-grass dominated areas are technically upland community types on dredge spoil (e.g., Spring Creek). The NVC does not currently include a reed-grass dominated upland association. Future surveys of all reed-grass dominated polygons at Gateway National Recreation Area could determine which are tidal, freshwater, and upland. These wetland maps could then be corrected based on ground-truthed field data.

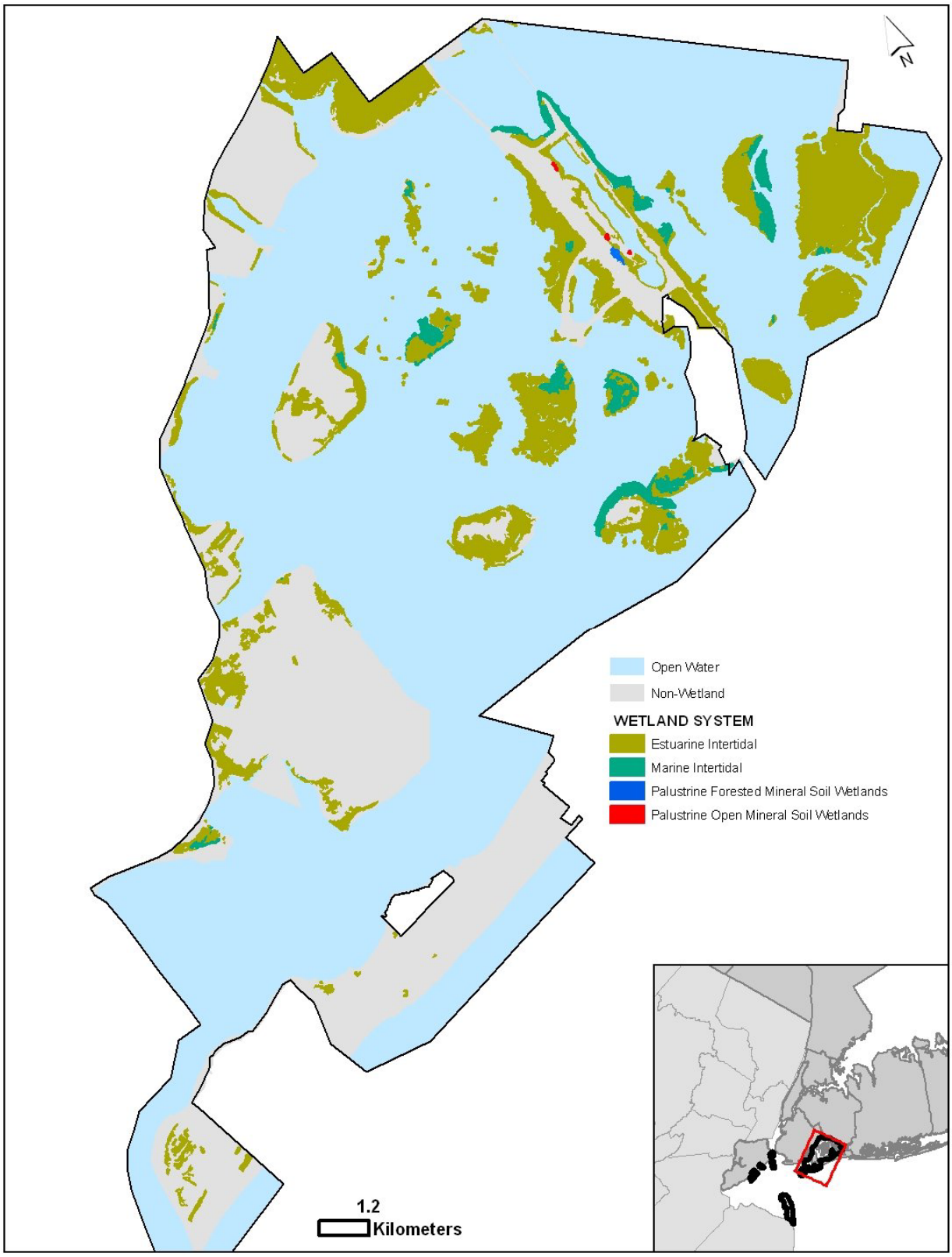


Figure 9a. Palustrine and Estuarine Wetlands within the Jamaica Bay Unit of Gateway National Recreation Area.

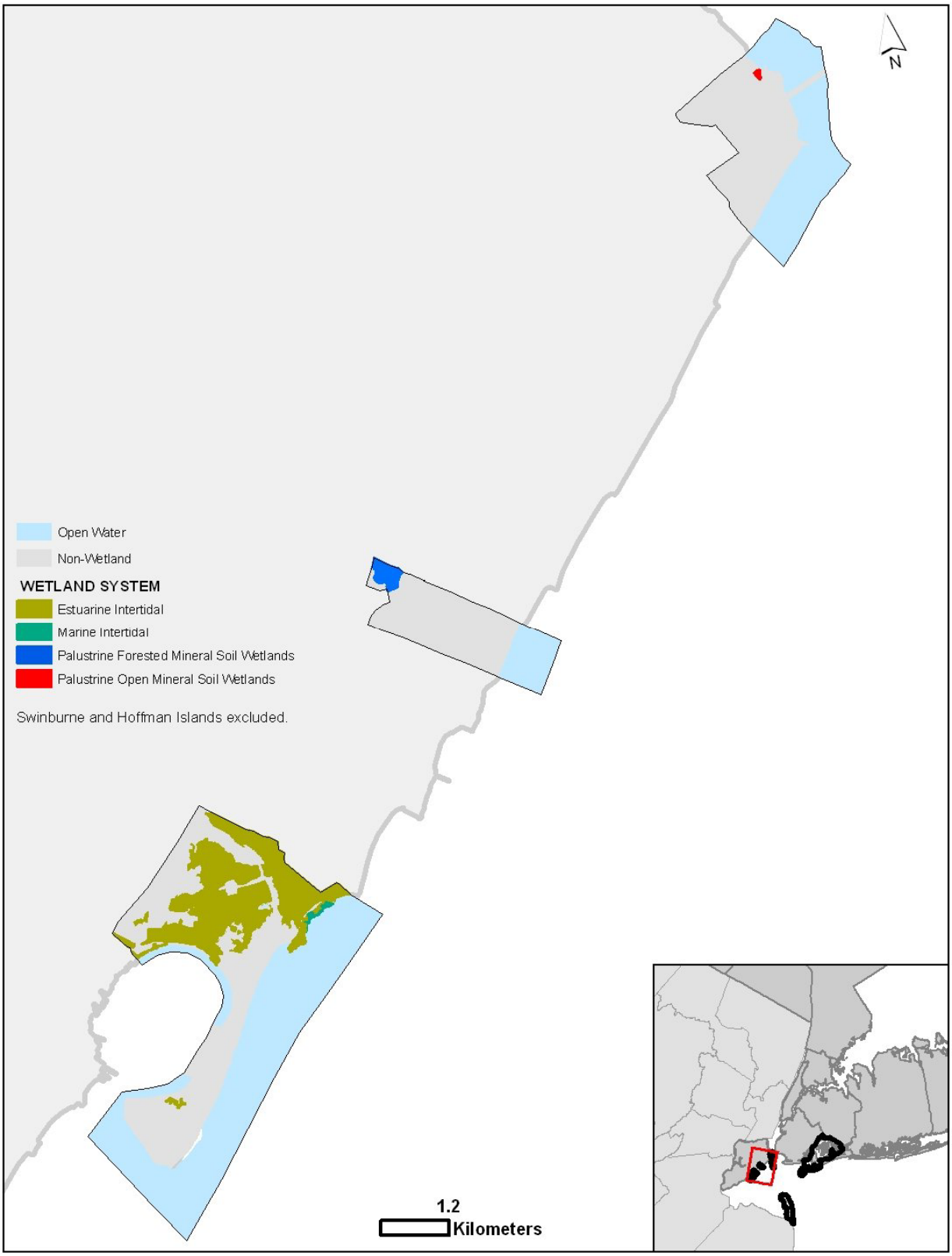


Figure 9b. Palustrine and Estuarine Wetlands within the Staten Island Unit of Gateway National Recreation Area.

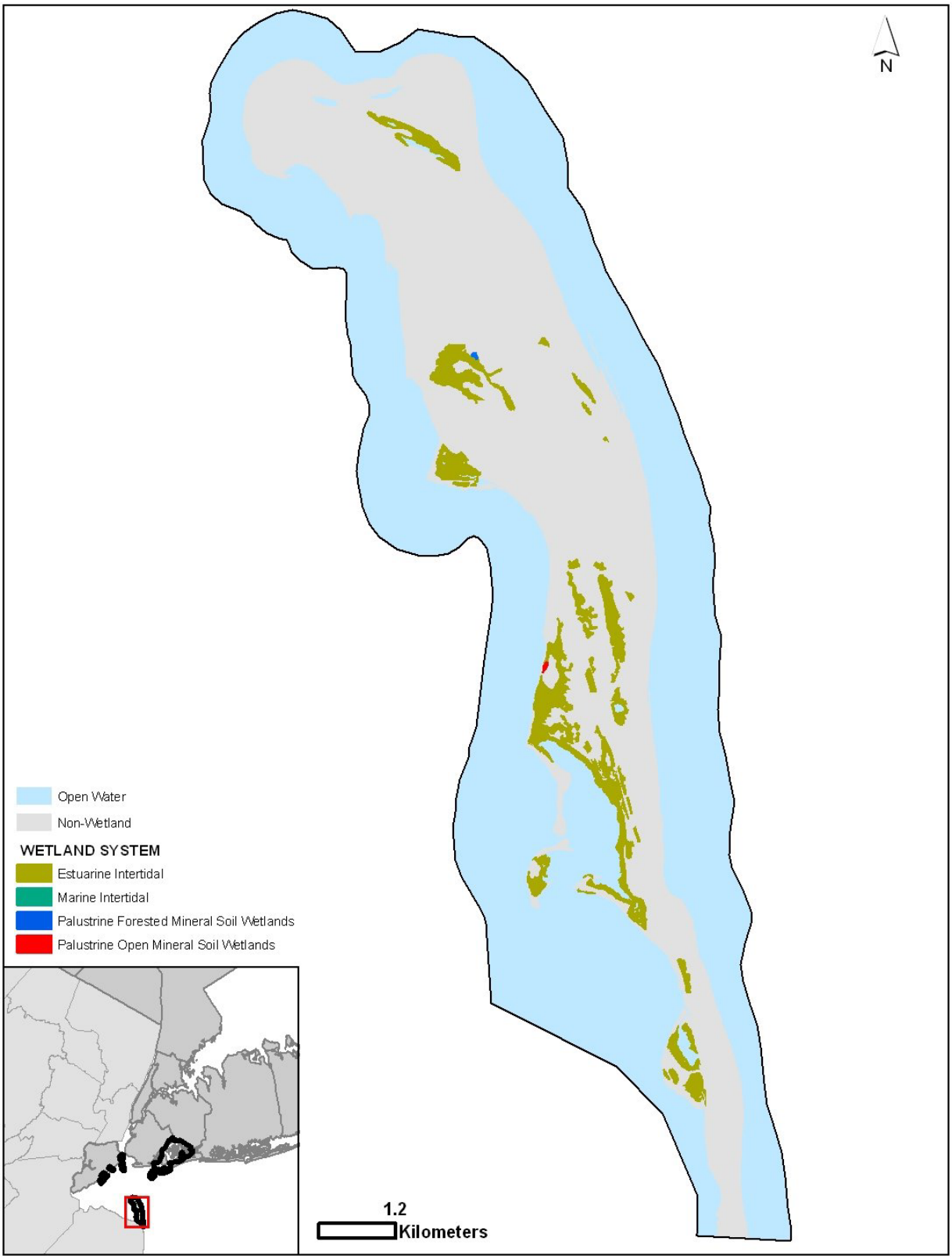


Figure 9c. Palustrine and Estuarine Wetlands within the Sandy Hook Unit of Gateway National Recreation Area.

Literature Cited

Anderson, J. R., E. E. Hardy, J. T. Roach, and R. E. Witmer. 1976. A land use and land cover classification system for use with remote sensor data. Geological Survey Professional Paper 964. United States Government Printing Office. Washington, DC. 28 pp.

Avery, T. E. 1978. Forester's Guide to Aerial Photo Interpretation. U.S. Department of Agriculture, U.S. Forest Service. Agriculture Handbook 308. 40 pp.

Bailey, R. G. 1995. Description of the ecoregions of the United States. 2nd edition revised and expanded. USDA Forest Service Miscellaneous Publication 1391. Washington, DC.

Beyer, H. L. 2006. Hawth's Analysis Tools for ArcGIS. Available at http://www.spatialecology.com/htools.

Breden, T. F., Y. R. Alger, K. S. Walz, and A. G. Windisch. 2001. Classification of vegetation communities of New Jersey: Second iteration. Association for Biodiversity Information and New Jersey Natural Heritage Program, Office of Natural Lands Management, Division of Parks and Forestry, New Jersey Department of Environmental Protection. Trenton, NJ.

Burger, M. F. and J. M. Liner. 2005. Important Bird Areas of New York. Second Edition. Audubon New York. Albany, NY.

Cadwell, D. H. 1989. Surficial Geologic Map of New York: Lower Hudson Sheet. Scale 1:250,000. Map and Chart Series No. 40. New York State Museum – Geologic Survey. The University of the State of New York, The State Education Department. Albany, NY.

Clark, J. S. 1986. Dynamism in the barrier-beach vegetation of Great South Beach, New York. Ecological Monographs 56(20):97-126.

Clarke, K. R. 1993. Non-parametric multi-variate analyses of changes in community structure. Australian Journal of Ecology 18:117-143.

Cowardin, L. M., V. Carter, F. C. Golet, and E. T. LaRoe. 1979. Classification of wetlands and deepwater habitats of the United States. U. S. Department of the Interior, Fish and Wildlife Service, Washington, DC. Jamestown, ND: Northern Prairie Wildlife Research Center Online. http://www.npwrc.usgs.gov/resource/1998/classwet/classwet.htm. (Version 04DEC98).

Drennan, S. R. 1981. Where to Find Birds in New York State. Syracuse University Press. Syracuse, NY.

Earth Resource Mapping Ltd. 2003. ER Mapper Version 6.4. San Diego, CA.

Edinger, G., D. J. Evans, A. Finton, D. Hunt, L. Lyons-Swift, and A. Olivero. 2000. Community Field Form Instructions. May 2000. New York Natural Heritage Program, New York State Department of Environmental Conservation. Latham, NY.

Edinger, G. J., D. J. Evans, S. Gebauer, T. G. Howard, D. M. Hunt, and A. M. Olivero (editors). 2002. Ecological Communities of New York State. Second Edition. A revised and expanded edition of Carol Reschke's Ecological Communities of New York State. (Draft for review). New York Natural Heritage Program, New York State Department of Environmental Conservation. Albany, NY.

Environmental Systems Research Institute, Inc., National Center for Geographic Information and Analysis, and The Nature Conservancy (ESRI et al.). 1994. NBS/NPS Vegetation Mapping Program: Accuracy Assessment Procedures. Report to the National Biological Survey and the National Park Service. Environmental Systems Research Institute, Inc., Redlands, CA. National Center for Geographic Information and Analysis, University of California, Santa Barbara, CA. The Nature Conservancy, Arlington, VA. http://biology.usgs.gov/npsveg/standards.html. Last accessed 20 June 2007.

Environmental Systems Research Institute, Inc. (ESRI). 1992-2000. ArcView 3.2. Environmental Systems Research Institute, Inc. Redlands, CA.

Environmental Systems Research Institute, Inc. (ESRI). 1999-2006. ArcMap 9.2. Environmental Systems Research Institute, Inc. Redlands, CA.

Federal Geographic Data Committee (FGDC). 1996. FGDC Vegetation classification and information standards. Federal Geographic Data Committee. Reston, VA. 31 pp.

Federal Geographic Data Committee (FGDC). 1998a. Content standard for digital geospatial metadata (FGDC-STD-001-198). Retrieved October 2001 from http://www.fgdc.gov/metadata/contstan.html.

Federal Geographic Data Committee (FGDC). 1998b. Geospatial positioning accuracy standards, Part 3: National Standard for Spatial Data Accuracy. (FGDC-STD-007.3-1998). Retrieved October 2001 from http://www.fgdc.gov/standards/status/sub1_3.html.

Fisher, D. W., Y. W. Isachsen, and L. V. Rickard. 1970. Geologic Map of New York: Lower Hudson Sheet. Scale 1:250,000. New York State Museum and Science Services, Map and Chart Series No. 15. The University of the State of New York, The State Education Department. Albany, NY.

Foody, G. M. 1992. On the compensation for chance agreement in image classification accuracy assessment. Photogrammetric Engineering and Remote Sensing. 58(10):1459-1460.

Fowle, M. T., and P. Kerlinger. 2001. The New York City Audubon Guide to Finding Birds in the Metropolitan Area. Comstock Publishing Associates, a division of Cornell University Press. Ithaca, NY

Godfrey, P. J., and M. M. Godfrey. 1976. Barrier island ecology of Cape Lookout National Seashore and vicinity, North Carolina. National Park Service Monograph Series. No. 9. National Park Service Cooperative Research Unit, University of Massachusetts. Amherst, MA.

Greller, A. M. 1984. Flora of Floyd Bennett Field and recommendations for floral management. Gateway Institute for Natural Resource Science, GATE-N-001-1. National Park Service. NY.

Grossman, D. H., D. Faber-Langendoen, A. S. Weakley, M. Anderson, P. Bourgeron, R. Crawford, K. Goodin, S. Landaal, K. Metzler, K. D. Patterson, M. Pyne, M. Reid, and L. Sneddon. 1998. International classification of ecological communities: terrestrial vegetation of the United States. Volume I. The National Vegetation Classification System: development, status and applications. The Nature Conservancy. Arlington, VA. 126 pp.

Hayden, B. P., M. C. V. Santos, G. Shao, and R. C. Koechel. 1995. Geomorphological controls on coastal vegetation at the Virginia Coast Reserve. Geomorphology 13:283-300.

Hill, M. O., and H. G. Gauch. 1979. TWINSPAN – A FORTRAN program for arranging multivariate data in an ordered two-way table by classification of the individuals and attributes. Cornell University. Ithaca, NY.

Kruskal, J. B., and M. Wish. 1978. Multidimensional Scaling. Sage Publications. Beverly Hills, CA.

Leatherman, S. P. 1979. Barrier Island Handbook. National Park Service Cooperative Research Unit. University of Massachusetts. Amherst, MA.

Leica Geosystems Geospatial Imaging. 2003. ERDAS IMAGINE Version 8.7. Norcross, GA.

LizardTech, Inc. 2000. MrSID Version 1.4. Seattle, WA.

McCune, B., and J. B. Grace. 2002. Analysis of Ecological Communities. MjM Software Design. Gleneden Beach, OR. 300pp.

McCune, B., and J. B. Mefford. 1999. PC-ORD. Multivariate Analysis of Ecological Data, Version 4. MjM Software Design. Gleneden Beach, OR.

Minnesota Governor's Council on Geographic Information and Minnesota Land Management Information Center. October 1999. Positional accuracy handbook, using the National Standard for Spatial Data Accuracy to measure and report geographic data quality. Retrieved October 2001 from: http://server.admin.state.mn.us/resource.html?Id=1852.

Mueller-Dombois, D., and H. Ellenberg. 1974. Aims and methods of vegetation ecology. New York. Wiley.

National Park Service (NPS). 2003. Resource Inventories. Last accessed 25 June 2007. http://www.nature.nps.gov/protectingrestoring/IM/resourceinventories.htm.

NatureServe. 2004. PLOTS Database System, version 2.0. A Microsoft Access database system developed for USGS-NPS Vegetation Mapping Program by NatureServe, Arlington VA. October, 2004.

Oertel, G. F. 1985. The barrier island system. *In* G. F. Oertel and S. P. Leatherman (Editors). Barrier Islands. Marine Geology 63:1-18.

Oertel, G. F., J. C. Kraft, M. S. Kearney, and H. J. Woo. 1992. Quaternary Coasts of the United States. Marine and Lacustrine Systems. SEPM Special Publication No. 48. Society for Sedimentary Geology.

Perles, S. J., G. S. Podniesinski, E. Eastman, L. A. Sneddon, and S. C. Gawler. 2006. Vegetation Classification and Mapping of Vegetation and Fire Fuel Models at Delaware Water Gap. Draft Technical Report NPS/NER/NRTR—XXXX/XXX. National Park Service. Philadelphia, PA.

Robinson, G. R., M. E. Yurlina, and S. N. Handel. 1994. A century of change in the Staten Island flora: Ecological correlates of species losses and invasions. Bulletin of the Torrey Botanical Society 121(2):119-129.

Stalter, R. 1983. The plant communities on four landfill sites, New York City, New York. Unpublished report. St. John's University, Jamaica, NY.

Stalter, R., and A. Greller. 1988. A floristic inventory of the Gateway National Recreation Area, New York – New Jersey. Rhodora 90(No. 861):21-26.

Stalter, R., and A. Munir. 2002. The vascular flora of Hoffman and Swinburne Islands, New York Harbor, New York. Journal of the Torrey Botanical Society 291(1):77-82.

Stalter, R., and E. E. Lamont. 2000. Vascular flora of Sandy Hook, New Jersey. Bartonia 60:105-116.

Stalter, R., and E. E. Lamont. 2002. Vascular flora of Jamaica Bay Wildlife Refuge, Long Island, New York. Journal of the Torrey Botanical Society 129(4):346-358.

Stalter, R., P. Cerniglia, C. Venezia, and R. Schmidt. 1982. Some botanical observations of the swamp white oak forest, Staten Island Unit, Gateway National Recreation Area. St. John's University. Jamaica, NY.

Stalter, R., R. Schmidt, S. Ambrose, and J. Walker. 1982. The plant communities of Breezy Point tip, New York. Unpublished report. St. John's University. Jamaica, NY.

Stanford, S. D. 2000. Surficial Geology of the Sandy Hook Quadrangle, Monmouth County, New Jersey. Scale 1 to 24,000, size 25x29. Open File Map 39. New Jersey Geological Survey. Trenton, NJ.

Tanacredi, J., M. Schreibman, and G. Frame. 2002. Jamaica Bay Ecosystem Research and Restoration Team (JABERRT). Final report. Division Natural Resources, Gateway National Recreation Area, National Park Service and Aquatic Research and Environmental Assessment Center, Brooklyn College, City University of New York, NY.

Tanacredi, J. T., and C. J. Badger. 1995. Gateway: A Visitor's Guide. Stackpole Books. Mechanicsburg, PA.

The Nature Conservancy and Environmental Systems Research Institute, Inc. (TNC and ESRI) 1994a. NBS/NPS Vegetation Mapping Program: Standardized National Vegetation Classification System. Report to the National Biological Survey and the National Park Service. The Nature Conservancy, Arlington VA. Environmental Systems Research Institute, Inc., Redlands, CA. http://biology.usgs.gov/npsveg/standards.html. Last accessed 20 June 2007.

The Nature Conservancy and Environmental Systems Research Institute, Inc. (TNC and ESRI). 1994b. NBS/NPS Vegetation Mapping Program: Field Methods for Vegetation Mapping. Report to the National Biological Survey and the National Park Service. The Nature Conservancy, Arlington VA. Environmental Systems Research Institute, Inc., Redlands, CA. http://biology.usgs.gov/npsveg/standards.html. Last accessed 20 June 2007.

United States Department of Agriculture, National Resources Conservation Service (USDA NRCS). 2001. Soil Survey of Gateway National Recreation Area, New York and New Jersey. U.S. Department of Agriculture, National Resources Conservation Service and U.S. Department of the Interior, National Park Service, Gateway National Recreation Area in partnership with Cornell University Agricultural Experiment Station and New York City Soil and Water Conservation District.

United States Department of Agriculture, National Resources Conservation Service (USDA NRCS). 2004. The PLANTS Database, Version 3.5 (http://plants.usda.gov). Data compiled from various sources by Mark W. Skinner. National Plant Data Center. Baton Rouge, LA.

United States Geological Survey (USGS). 2004. Tools for creation of formal metadata, a compiler for formal metadata. Retrieved June 2004 from http://geology.usgs.gov/tools/metadata/tools/doc/mp.html.

Venezia, K., and R. P. Cook. 1991. Flora of Gateway National Recreation Area. United States Department of the Interior, National Park Service, Gateway National Recreation Area, NY.

Walz, K. S. 1999. Instruction Manual on Heritage Field Methodology: Documenting Ecological Communities, Field Forms for the Description and Ranking of Terrestrial, Palustrine, and Estuarine Ecological Community Element Occurrences, Version 3.1, July 1, 1999, revisions based on Version 2.2 edited by Carol Reschke and Kathleen Strakosch with new information from BCD Community Pilot and EO Data Standards. New Jersey Natural Heritage Program. Trenton, NJ.

Walz, K. S., K. Anderson, L. Kelly, and A. Windisch. 2007. Draft New Jersey Ecological Community Crosswalk: A Tool for the Identification of Habitats Across Jurisdictional Boundaries. New Jersey Department of Environmental Protection, Division of Parks and Forestry, Office of Natural Lands Management, Natural Heritage Program. Trenton, NJ.

Wijesundara, D. S. A. 1997. Phytosociological studies of Floyd Bennett Field, Brooklyn, New York. Ph.D. Thesis. The City University of New York.

Zaremba, R. E., and S. P. Leatherman. 1984. Overwash processes and foredune ecology, Nauset Spit, Massachusetts. Department of the Army, U.S. Army Corps of Engineers. Washington, DC.

Appendix A. Key information for Gateway National Recreation Area Photomosaics

Table A1. Gateway National Recreation Area – Jamaica Bay Unit photomosaic key attributes.

Photomosaic Attributes	Photomosaic Metadata
Title of metadata record:	Jamaica Bay Unit of Gateway National Recreation Area Color Infrared Orthorectified Photomosaic; (leaf-off); (ERDAS IMAGINE 8.7 .img and MrSID 1.4 formats)
Publication date of photomosaic (from metadata):	October 7, 2004
Date aerial photography was acquired:	December 17, 2002
Vendor that provided aerial photography:	William Frament, USDA Forest Service (Northeastern Area State and Private Forestry, Durham, NH)
Scale of photography:	1:8,000
Type of photography:	Color infrared, stereo pairs
Number of air photos in photomosaic:	143
Archive location of air photos, airborne GPS/IMU files and camera calibration certificate:	North Carolina State University, Center for Earth Observation
Scanning specifications:	600 dpi
Horizontal positional accuracy of photomosaics:	2.40 meters, meets Class 2 National Map Accuracy Standards
Number of ground control points upon which estimated accuracy is based upon estimated accuracy is based:	28
Method of calculating positional accuracy:	Root mean square error
Archive location of photomosaics and metadata:	North Carolina State University, Center for Earth Observation
Format(s) of archived photomosaics:	.img (uncompressed); MrSID (20:1 compression)

Appendix A. (continued).

Table A2. Gateway National Recreation Area – Staten Island Unit photomosaic key attributes

Photomosaic Attributes	Photomosaic Metadata
Title of metadata record:	Staten Island Unit of Gateway National Recreation Area Color Infrared Orthorectified Photomosaic; (leaf-off); (ERDAS IMAGINE 8.7 .img and MrSID 1.4 formats)
Publication date of photomosaic (from metadata):	October 7, 2004
Date aerial photography was acquired:	December 17, 2002
Vendor that provided aerial photography:	William Frament, USDA Forest Service (Northeastern Area State and Private Forestry, Durham, NH)
Scale of photography:	1:8,000
Type of photography:	Color infrared, stereo pairs
Number of air photos in photomosaic:	27
Archive location of air photos, airborne GPS/IMU files and camera calibration certificate:	North Carolina State University, Center for Earth Observation
Scanning specifications:	600 dpi
Horizontal positional accuracy of photomosaics:	3.25 meters
Number of ground control points upon which estimated accuracy is based upon estimated accuracy is based:	21
Method of calculating positional accuracy:	Root mean square error
Archive location of photomosaics and metadata:	North Carolina State University, Center for Earth Observation
Format(s) of archived photomosaics:	.img (uncompressed); MrSID (20:1 compression)

Appendix A. (continued).

Table A3. Gateway National Recreation Area – Sandy Hook Unit photomosaic key attributes

Photomosaic attributes	Photomosaic Metadata
Title of metadata record:	Sandy Hook Unit of Gateway National Recreation Area Color Infrared Orthorectified Photomosaic; (leaf-off); (ERDAS IMAGINE 8.7 .img and MrSID 1.4 formats)
Publication date of photomosaic (from metadata):	October 7, 2004
Date aerial photography was acquired:	December 17, 2002
Vendor that provided aerial photography:	William Frament, USDA Forest Service (Northeastern Area State and Private Forestry, Durham, NH)
Scale of photography:	1:8,000
Type of photography:	Color infrared, stereo pairs
Number of air photos in photomosaic:	37 (22 included in photomosaic)
Archive location of air photos, airborne GPS/IMU files and camera calibration certificate:	North Carolina State University, Center for Earth Observation
Scanning specifications:	600 dpi
Horizontal positional accuracy of photomosaics:	2.08 meters, meets Class 2 National Map Accuracy Standards
Number of ground control points upon which estimated accuracy is based upon estimated accuracy is based:	36
Method of calculating positional accuracy:	Root mean square error
Archive location of photomosaics and metadata:	North Carolina State University, Center for Earth Observation
Format(s) of archived photomosaics:	.img (uncompressed); MrSID (20:1 compression)

Appendix B. NY Natural Heritage Vegetation Plot Form and Hand-Held Database (HHDB) screen shots.

COMMUNITY FORM 3: QUANTITATIVE COMMUNITY CHARACTERIZATION

revised May 10, 2001

NY Natural Heritage Program

Reviewed by NY Natural Heritage Program: Date:____ Initials: _____

A. IDENTIFIERS / LOCATION (GENERAL EOR INFORMATION)

1. Survey site name:_____

2. Quad code(s):_____

3. Quad name(s): _____

4. County name(s):_____ 5. Town:_____

6. Directions to this transect:_____

_____

_____

7. Sourcecode:_____ 8. Survey date:_____ 9. State:

10. Surveyors:_____

B. ENVIRONMENTAL DESCRIPTION

11. **Community name** _____

12. National Association_____

13. Transect/observation point #

14. Image annotation #

15. Elevation:

16. Topographic position:
___Interfluve ___Toeslope
___High slope ___Low level
___High level ___Channel wall
___Midslope ___Channel bed
___Backslope ___Basin floor
___Step in slope ___Other:
___Lowslope

17. Topographic sketch (show where plot is located within surrounding topography):

18. Slope degrees:_____

19. Slope aspect:_____

20. Parent material/bedrock:

21. Soil profile description: note depth, texture, and color of each horizon. Note significant changes such as depth to mottling, depth to water table, root penetration depth
22. Organic horizon depth:_____
23. Organic horizon type: Mor:___ Mull:___
24. Average pH of mineral soil:_____

25. Soil moisture regime:
___Extremely dry ___Very dry
___Dry ___Well drained
___Somewhat moist ___Moist
___Somewhat wet ___Wet
___Permanently inundated ___Very wet
___Periodically inundated
Soil pore salinity_____ppt. (optional)

26.Soil drainage:
___Rapidly drained
___Well drained
___Moderately well drained
___Somewhat poorly drained
___Poorly drained
___Very poorly drained

27. Hydrologic Regime of plot (adapted from Cowardin 1979):
___Semipermanently flooded ___Intermittently flooded
___Seasonally flooded ___Permanently flooded
___Saturated ___Tidally flooded
___Temporarily flooded ___Unknown
___Never Inundated

Optional fields below
pH of water_____
Flood depth_____
Tidal range_____

28. Stoniness:
_Stone free <0.1%
_Moderately stony 0.1-1%
_Stony 3-15%
_Very stony 15-50%
_Exceedingly stony 50-90%
_Stone piles >90%

29. Average mineral soil texture (Brewer 1982):
___ sand ___ loamy sand
___ loam ___ sandy loam
___ silt loam ___ sandy clay loam
___ clay loam ___ silty clay loam
___ silt ___ sandy clay
___ clay ___ silty clay

30. Average organic soil texture:
___muck
___peat

Von Post scale of peat decomposition:_____
pH of peat:_____

31.Unvegetated surface (total):_____%
___% Bedrock ___% Litter, duff
___% Large rocks (>10cm) ___% Wood >1cm
___% Small rocks (0.2-10cm) ___% Water
___% Sand (0.1-2mm) ___% Other:
___% Bare soil

32. Environmental Comments: Note homogeneity of vegetation, evidence of erosion/sedimentation, further observations of inundation, etc._____

_____

_____

_____

_____

33. Plot representativeness:_____

_____

_____

_____

_____

C. VEGETATION

Community name:_____

34. System:___Terrestrial ___Palustrine ____Estuarine 35. Plot number:_____ 36. Plot dimensions:_____

37. Leaf type:
(of dominant stratum)
___Broad-leaf
___Semi-broad-leaf
___Mixed broad-needle leaf
___Semi-needle-leaf
___Needle-leaf
___Graminoid
___Broad-leaf herbaceous
___Pteridophyte
___Non-vascular

38. Leaf phenology:
(of dominant stratum)
___Forest
___Semi-deciduous
___Mixed deciduous-evergreen
___Semi-evergreen
___Evergreen
___Perennial
___Annual

39. Physiognomic type:
___Woodland
___Sparse woodland
___Shrubland
___Sparse shrubland
___Dwarf shrubland
___Sparse dwarf shrubland
___Herbaceous
___Sparsely vegetated
___Non-vegetated

40. Strata/life forms	%cover	height
T1 Emergent tree (>5m)		
T2 Tree canopy (>5m)		
T3 Tree sub-canopy (>5m)		
S1 Tall shrub (2m - 5m)		
S2 Short shrub (< 2m)		
V Vine/liana		
H Herbaceous		
N Non-vascular		
E Epiphyte		
A1 Emergent aquatic		
A2 Floating-leaved aquatic		
A3 Submerged aquatic		

41. Species/percent cover: starting with the uppermost stratum, list all species and % cover for each in the stratum. For forests and woodlands, list the DBH of all trees over 10 cm diameter on a separate line below each tree species. Separate the measurements with a comma and note whether in cm or inches. Estimate number of fauna.

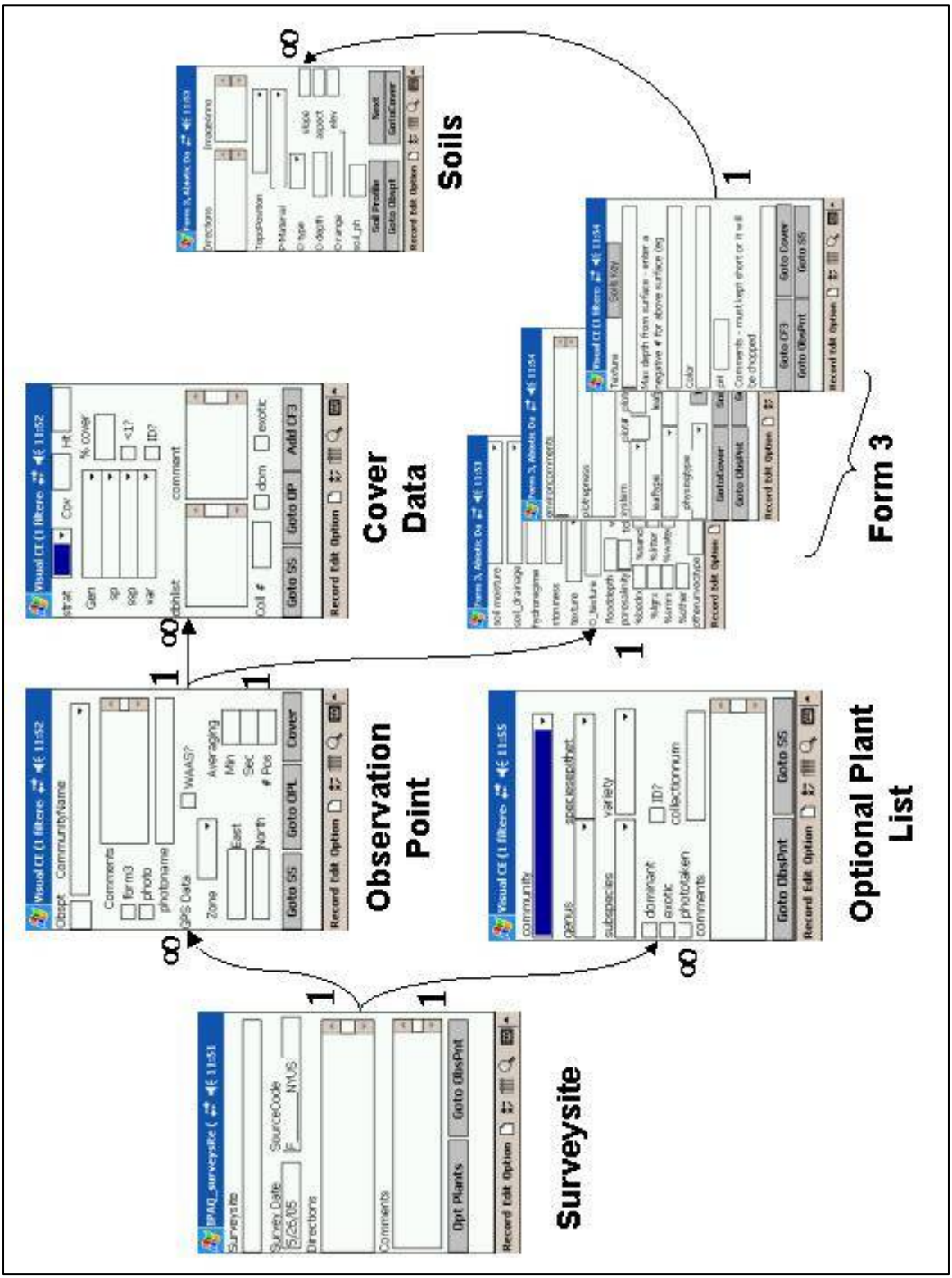
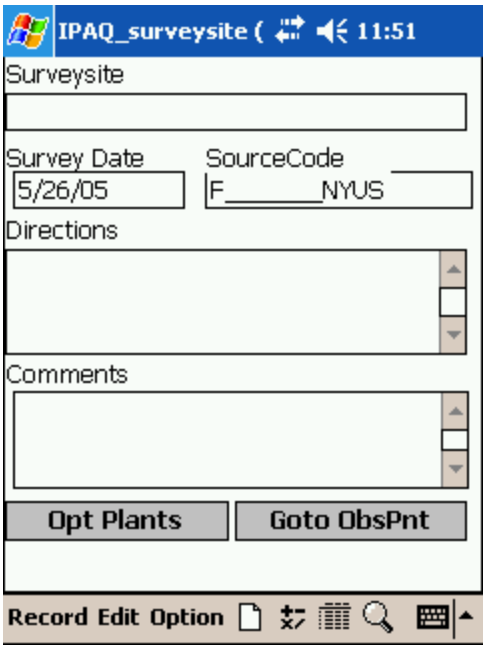
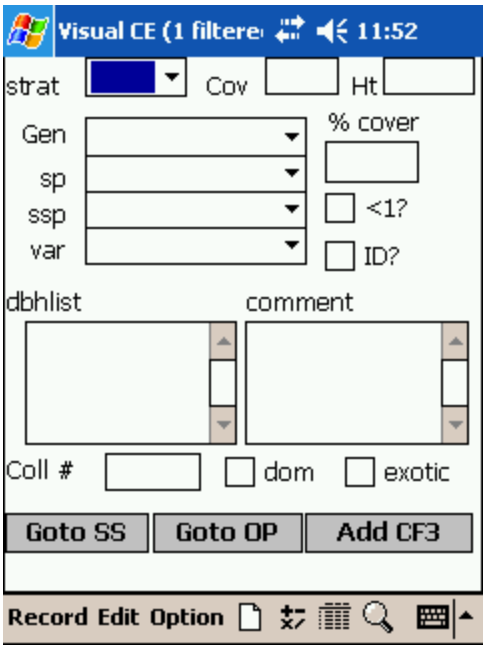


Figure B1. Screen shots of NY Natural Heritage Hand-Held DataBase (HHDB). Vegetation plot data and accuracy assessment point data were digitally collected in the field using this software.





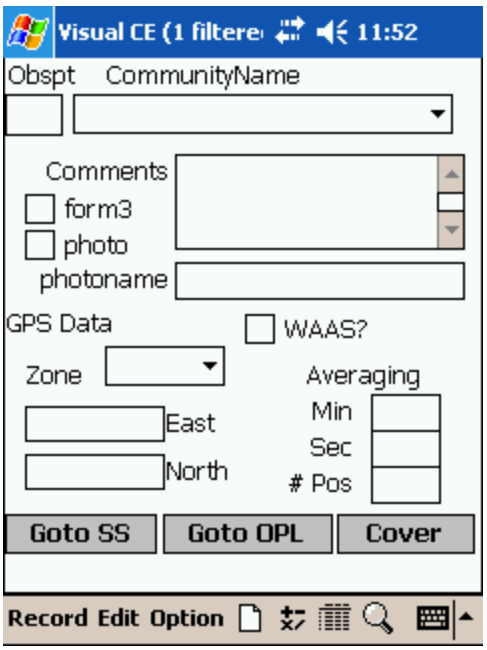


Figure B2. Screen shots of NY Natural Heritage Hand-Held DataBase (HHDB). Survey site information, plot and point spatial data, and vegetation cover data were digitally collected in the field using this software.

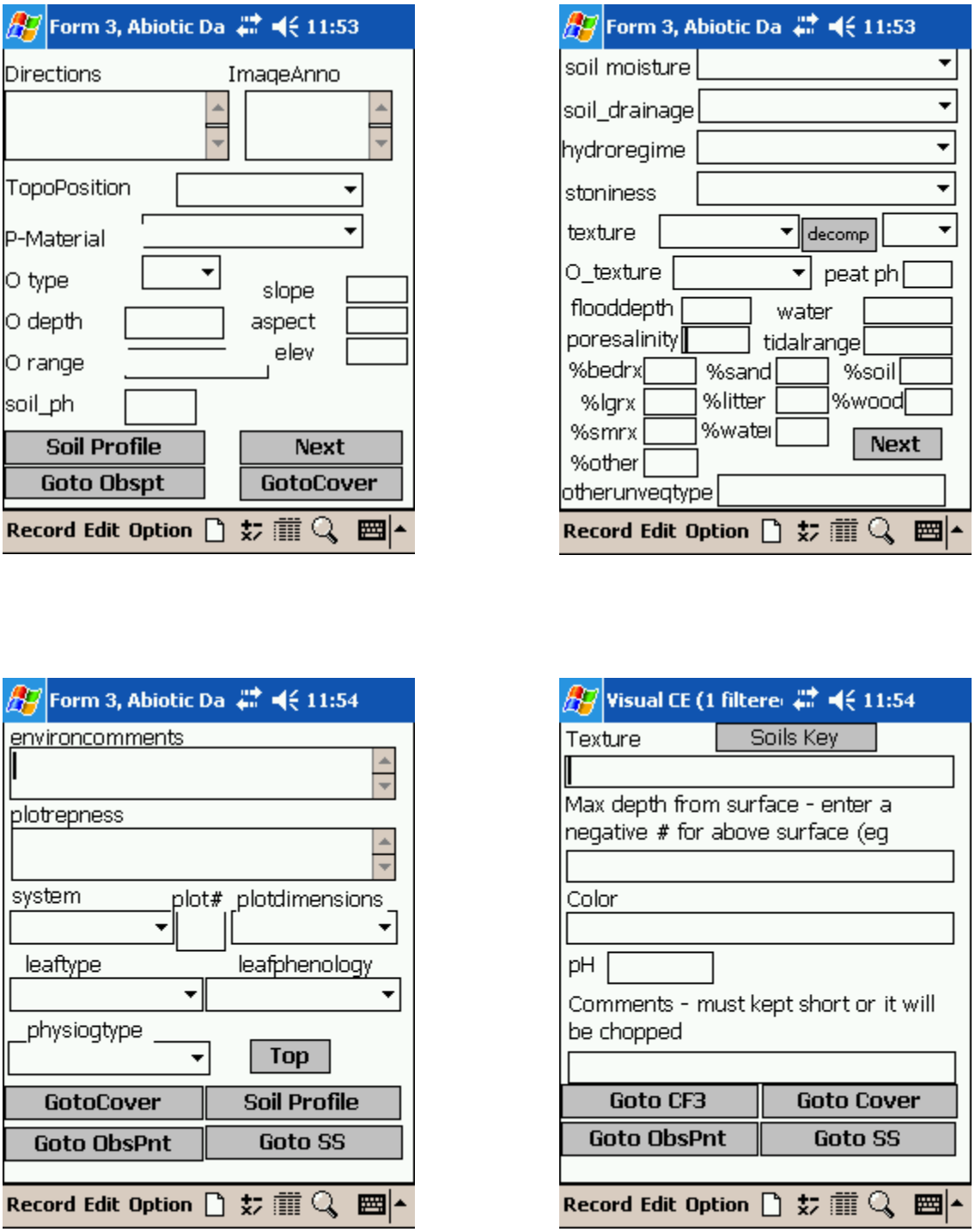


Figure B3. Screen shots of NY Natural Heritage Hand-Held DataBase (HHDB). Data on the physical characteristics and soils for plots were digitally collected in the field using this software.

Appendix C. Plants observed in Gateway National Recreation Area during vegetation plot and thematic accuracy assessment sampling

Nomenclature follows the PLANTS 3.5 Database developed by the Natural Resource Conservation Service in cooperation with the Biota of North America Program (USDA NRCS 2004). For this report, some common names listed in the PLANTS database were changed to reflect the common names typically used by ecologists and resource managers in this region. The common and scientific names of plants observed during the vegetation plot thematic accuracy assessment sampling are listed below. Species marked with an asterisk (*) were not measured in quantitative plot sampling, but noted during polygon observations or reference observation points.

Family	Scientific Name	Common Name
Aceraceae	*Acer negundo*	boxelder
	Acer platanoides	Norway maple
	Acer pseudoplatanus	sycamore maple
	Acer rubrum	red maple
	Acer saccharinum	silver maple
	Acer saccharum	sugar maple
Agavaceae	*Yucca filamentosa*	Adam's needle
Amaranthaceae	*Amaranthus pumilus*	seaside amaranth*
	Froelichia gracilis	slender snakecotton
Anacardiaceae	*Rhus copallinum*	flameleaf sumac
	Rhus glabra	smooth sumac
	Rhus typhina	staghorn sumac
	Toxicodendron radicans	eastern poison ivy
Apiaceae	*Daucus carota*	Queen Anne's lace
	Ligusticum scoticum	Scottish licorice-root
	Ptilimnium capillaceum	herbwilliam*
Apocynaceae	*Apocynum cannabinum*	Indianhemp
Aquifoliaceae	*Ilex opaca*	American holly
	Ilex verticillata	common winterberry
Araliaceae	*Aralia nudicaulis*	wild sarsaparilla
	Aralia spinosa	devil's walkingstick
Asclepiadaceae	*Asclepias incarnata*	swamp milkweed*
	Asclepias syriaca	common milkweed
	Asclepias tuberosa	butterfly milkweed
	Cynanchum vincetoxicum	white swallow-wort
Aspleniaceae	*Asplenium platyneuron*	ebony spleenwort
Asteraceae	*Achillea millefolium*	common yarrow
	Ambrosia artemisiifolia	annual ragweed
	Anaphalis margaritacea	western pearly everlasting
	Artemisia campestris ssp. *caudata*	field sagewort
	Artemisia stelleriana	oldwoman
	Artemisia vulgaris	common wormwood
	Aster spp.	aster
	Aster divaricatus	white wood aster
	Aster linariifolius	flaxleaf whitetop aster
	Baccharis halimifolia	eastern baccharis
	Bidens sp.	beggarticks
	Centaurea biebersteinii	spotted knapweed
	Conyza canadensis	Canadian horseweed
	Coreopsis lanceolata	lanceleaf tickseed
	Erechtites hieraciifolia	American burnweed

Family	Scientific Name	Common Name
Asteraceae (cont.)	*Erigeron pulchellus*	robin's plantain
	Eupatorium album	white thoroughwort
	Eupatorium aromaticum	lesser snakeroot
	Eupatorium hyssopifolium	hyssopleaf thoroughwort
	Eupatorium maculatum	spotted joepyeweed*
	Eupatorium perfoliatum	common boneset*
	Eupatorium rugosum	white snakeroot
	Euthamia graminifolia	flat-top goldentop
	Euthamia tenuifolia	slender goldentop
	Gnaphalium sp.	cudweed
	Gnaphalium obtusifolium	rabbittobacco
	Helianthus annuus	common sunflower
	Heterotheca subaxillaris	camphorweed
	Hieracium caespitosum	meadow hawkweed
	Hieracium paniculatum	Allegheny hawkweed
	Hieracium scabrum	rough hawkweed
	Iva frutescens	Jesuit's bark
	Leucanthemum vulgare	oxeye daisy
	Mikania scandens	climbing hempvine
	Pityopsis falcata	sickleleaf silkgrass
	Pluchea odorata	sweetscent
	Rudbeckia hirta	blackeyed Susan
	Solidago canadensis	Canada goldenrod
	Solidago juncea	early goldenrod
	Solidago nemoralis	gray goldenrod
	Solidago puberula	downy goldenrod
	Solidago rugosa	wrinkleleaf goldenrod
	Solidago sempervirens	seaside goldenrod
	Solidago simplex	Mt. Albert goldenrod
	Symphyotrichum lateriflorum	calico aster
	Tragopogon dubius	yellow salsify
	Tragopogon pratensis	Jack-go-to-bed-at-noon
	Xanthium strumarium	rough cockleburr
Balsaminaceae	*Impatiens capensis*	jewelweed
Berberidaceae	*Berberis thunbergii*	Japanese barberry
Betulaceae	*Alnus incana*	gray alder*
Betulaceae	*Betula populifolia*	gray birch
Bignoniaceae	*Catalpa bignonioides*	southern catalpa
	Catalpa speciosa	northern catalpa
Boraginaceae	*Echium vulgare*	common vipersbugloss
Brassicaceae	*Alliaria petiolata*	garlic mustard

Family	Scientific Name	Common Name
Brassicaceae (cont.)	*Cakile edentula*	American searocket
	Cakile maritima	European searocket
	Lepidium virginicum	Virginia pepperweed
Cactaceae	*Opuntia humifusa*	devil's-tongue
Caprifoliaceae	*Lonicera* sp.	honeysuckle
	Lonicera japonica	Japanese honeysuckle
	Lonicera tatarica	Tatarian honeysuckle
	Sambucus nigra ssp. *canadensis*	common elderberry
	Viburnum dentatum	southern arrowwood
Caryophyllaceae	*Saponaria officinalis*	bouncingbet
	Silene latifolia	bladder campion
	Spergularia salina	salt sandspurry
Celastraceae	*Celastrus orbiculatus*	Oriental bittersweet
	Euonymus atropurpurea	eastern wahoo
Chenopodiaceae	*Atriplex patula*	spear saltbush
	Atriplex prostrata	triangle orache
	Bassia hyssopifolia	fivehorn smotherweed
	Chenopodium album	lambsquarters
	Chenopodium ambrosioides	Mexican tea
	Cycloloma atriplicifolium	winged pigweed
	Salicornia bigelovii	dwarf saltwort
	Salicornia europaea	Virginia glasswort
	Salsola kali	Russian thistle
	Suaeda calceoliformis	Pursh seepweed
	Suaeda maritima	herbaceous seepweed
Cistaceae	*Helianthemum canadense*	longbranch frostweed*
	Hudsonia tomentosa	woolly beachheather
	Lechea maritima	beach pinweed
	Lechea tenuifolia	narrowleaf pinweed
Cladoniaceae	*Cladonia* sp.	cup lichen
	Cladonia chlorophaea	cup lichen
	Cladonia coniocraea	cup lichen
	Cladonia cristatella	cup lichen
	Cladonia peziziformis	cup lichen
Clusiaceae	*Hypericum boreale*	northern St. Johnswort
	Hypericum perforatum	common St. Johnswort
	Triadenum virginicum	Virginia marsh St. Johnswort*
Commelinaceae	*Commelina communis*	Asiatic dayflower
Convolvulaceae	*Calystegia sepium*	hedge false bindweed
Cornaceae	*Cornus amomum*	silky dogwood
Cupressaceae	*Juniperus virginiana*	eastern redcedar

Family	Scientific Name	Common Name
Cyperaceae	*Bulbostylis capillaris*	densetuft hairsedge
	Carex spp.	sedge
	Carex kobomugi	Japanese sedge
	Carex pensylvanica	Pennsylvania sedge
	Carex silicea	beach sedge
	Carex vulpinoidea	fox sedge*
	Cyperus esculentus	chufa flatsedge
	Cyperus filicinus	fern flatsedge
	Cyperus grayi	Gray's flatsedge
	Cyperus odoratus	fragrant flatsedge
	Cyperus polystachyos	manyspike flatsedge*
	Cyperus schweinitzii	Schweinitz's flatsedge
	Cyperus strigosus	strawcolored flatsedge
	Eleocharis parvula	dwarf spikerush
	Schoenoplectus americanus	chairmaker's bulrush
	Schoenoplectus pungens	common threesquare
	Scirpus cyperinus	woolgrass
Dicranaceae	*Dicranum* sp.	dicranum moss
Dryopteridaceae	*Onoclea sensibilis*	sensitive fern
Elaeagnaceae	*Elaeagnus angustifolia*	Russian olive
	Elaeagnus umbellata	autumn olive
Ericaceae	*Vaccinium corymbosum*	highbush blueberry
Euphorbiaceae	*Chamaesyce polygonifolia*	seaside sandmat
	Euphorbia cyparissias	cypress spurge
Fabaceae	*Chamaecrista fasciculata*	sleepingplant
	Coronilla varia	purple crownvetch
	Galactia volubilis	downy milkpea
	Gleditsia triacanthos	honeylocust
	Lathyrus japonicus	beach pea
	Lespedeza hirta	hairy lespedeza
	Lespedeza intermedia	violet lespedeza
	Melilotus alba	white sweetclover
	Mimosa sp.	sensitive plant
	Robinia pseudoacacia	black locust
	Strophostyles helvula	trailing fuzzybean
	Strophostyles umbellata	pink fuzzybean
Fabaceae	*Trifolium arvense*	rabbitfoot clover
	Trifolium dubium	suckling clover
Fagaceae	*Quercus bicolor*	swamp white oak
	Quercus coccinea	scarlet oak
	Quercus marilandica	blackjack oak

Family	Scientific Name	Common Name
Fagaceae (cont.)	*Quercus palustris*	pin oak
	Quercus phellos	willow oak
	Quercus rubra	northern red oak
	Quercus velutina	black oak
Geraniaceae	*Geranium robertianum*	Robert geranium
Hamamelidaceae	*Liquidambar styraciflua*	sweetgum
Iridaceae	*Iris versicolor*	harlequin blueflag
Juglandaceae	*Juglans nigra*	black walnut
Juncaceae	*Juncus gerardii*	saltmeadow rush
	Juncus tenuis	poverty rush
Lamiaceae	*Lycopus americanus*	American water horehound
	Lycopus uniflorus	northern bugleweed*
	Melissa officinalis	common balm
	Prunella vulgaris	common selfheal
	Scutellaria galericulata	marsh skullcap
	Teucrium canadense	Canada germander
Lauraceae	*Sassafras albidum*	sassafras
Lemnaceae	*Lemna* spp.	duckweed
	Lemna minor	common duckweed*
	Wolffia sp.	watermeal*
Liliaceae	*Allium vineale*	wild garlic
	Asparagus officinalis	garden asparagus
	Maianthemum racemosum	feathery false lily of the valley
	Maianthemum stellatum	starry false lily of the valley
Linaceae	*Linum medium*	stiff yellow flax
Lythraceae	*Lythrum salicaria*	purple loosestrife*
Magnoliaceae	*Liriodendron tulipifera*	tuliptree
Malvaceae	*Hibiscus moscheutos*	crimsoneyed rosemallow
Menispermaceae	*Menispermum canadense*	common moonseed
Molluginaceae	*Mollugo verticillata*	green carpetweed
Moraceae	*Morus alba*	white mulberry
	Morus rubra	red mulberry*
Myricaceae	*Myrica* sp.	sweetgale
	Myrica pensylvanica	northern bayberry
Nymphaeaceae	*Nymphaea odorata*	American white waterlily*
Nyssaceae	*Nyssa sylvatica*	blackgum
Oleaceae	*Fraxinus americana*	white ash
	Fraxinus pennsylvanica	green ash
	Ligustrum vulgare	European privet
Onagraceae	*Circaea lutetiana*	broadleaf enchanter's nightshade
	Epilobium hirsutum	codlins and cream

Family	Scientific Name	Common Name
Onagraceae (cont.)	*Oenothera biennis*	common evening-primrose
	Oenothera parviflora var. *oakesiana*	Oakes' evening-primrose
Osmundaceae	*Osmunda cinnamomea*	cinnamon fern
	Osmunda regalis	royal fern
Oxalidaceae	*Oxalis stricta*	common yellow oxalis
Phytolaccaceae	*Phytolacca americana*	American pokeweed
Pinaceae	*Pinus nigra*	Austrian pine
	Pinus strobus	eastern white pine
	Pinus thunbergiana	Japanese black pine
Plantaginaceae	*Plantago lanceolata*	narrowleaf plantain
	Plantago maritima	goose tongue
	Plantago psyllium	sand plantain
Platanaceae	*Platanus hybrida*	London planetree
Plumbaginaceae	*Limonium carolinianum*	Carolina sealavender
Poaceae	*Agropyron* spp.	wheatgrass
	Agrostis gigantea	redtop
	Agrostis hyemalis	winter bentgrass
	Ammophila breviligulata	American beachgrass
	Anthoxanthum odoratum	sweet vernalgrass
	Aristida dichotoma	churchmouse threeawn
	Aristida oligantha	prairie threeawn
	Aristida tuberculosa	seaside threeawn
	Bouteloua curtipendula	sideoats grama
	Bromus inermis	smooth brome
	Bromus tectorum	cheatgrass
	Calamagrostis canadensis	bluejoint
	Cenchrus tribuloides	sanddune sandbur
	Corynephorus canescens	gray clubawn grass
	Cynodon dactylon	Bermudagrass
	Dactylis glomerata	orchardgrass
	Digitaria sanguinalis	hairy crabgrass
	Distichlis spicata	inland saltgrass
	Elytrigia repens	quackgrass
	Eragrostis curvula	weeping lovegrass
	Eragrostis spectabilis	purple lovegrass
	Festuca spp.	fescue
	Leersia oryzoides	rice cutgrass
	Microstegium vimineum	Nepalese browntop
	Panicum spp.	panicgrass
	Panicum acuminatum	tapered rosette grass
	Panicum amarum	bitter panicgrass

Family	Scientific Name	Common Name
Poaceae (cont.)	*Panicum latifolium*	broadleaf rosette grass
	Panicum meridionale	matting rosette grass
	Panicum virgatum	switchgrass
	Paspalum sp.	crowngrass
	Phleum pratense	timothy
	Phragmites australis	common reed
	Poa pratensis	Kentucky bluegrass
	Poa trivialis	rough bluegrass
	Unknown	grass family
	Schizachyrium scoparium	little bluestem
	Setaria viridis	green bristlegrass
	Spartina alterniflora	smooth cordgrass
	Spartina patens	saltmeadow cordgrass
	Sporobolus cryptandrus	sand dropseed
	Triplasis purpurea	purple sandgrass
Polygonaceae	*Persicaria hydropiperoides*	swamp smartweed*
	Persicaria punctata	dotted smartweed
	Polygonella articulata	coastal jointweed
	Polygonum cuspidatum	Japanese knotweed
	Polygonum ramosissimum	bushy knotweed
	Polygonum scandens	climbing false buckwheat
	Rumex acetosella	common sheep sorrel
	Rumex crispus	curly dock
	Rumex obtusifolius	bitter dock
Polytrichaceae	*Atrichum* sp.	atrichum moss
Pottiaceae	*Pottia truncata*	truncate pottia moss
Pyrolaceae	*Chimaphila maculata*	striped prince's pine
Rhamnaceae	*Frangula alnus*	glossy buckthorn
Rosaceae	*Amelanchier arborea*	common serviceberry
	Amelanchier canadensis	Canadian serviceberry
	Amelanchier laevis	Allegheny serviceberry
	Fragaria virginiana	Virginia strawberry
	Geum sp.	avens
	Photinia sp.	chokeberry
	Potentilla recta	sulphur cinquefoil
	Prunus maritima	beach plum
	Prunus pensylvanica	pin cherry
	Prunus serotina	black cherry
	Prunus spinosa	blackthorn
	Prunus virginiana	chokecherry
	Rosa canina	dog rose

Family	Scientific Name	Common Name
Rosaceae (cont.)	*Rosa carolina*	Carolina rose
	Rosa multiflora	multiflora rose
	Rosa palustris	swamp rose
	Rosa rugosa	rugosa rose
	Rubus allegheniensis	Allegheny blackberry
	Rubus flagellaris	northern dewberry
	Rubus occidentalis	black raspberry
	Rubus pubescens	dwarf red blackberry
Rubiaceae	*Diodia teres*	poorjoe
	Galium spp.	bedstraw
	Galium aparine	stickywilly
	Galium pilosum	hairy bedstraw
	Galium tinctorium	stiff marsh bedstraw
	Mitchella repens	partridgeberry
Salicaceae	*Populus alba*	white poplar
	Populus deltoides	eastern cottonwood
	Populus grandidentata	bigtooth aspen
	Populus tremuloides	quaking aspen
	Salix alba	white willow
	Salix bebbiana	Bebb willow
	Salix nigra	black willow
Scrophulariaceae	*Linaria vulgaris*	butter and eggs
	Nuttallanthus canadensis	Canada toadflax
	Verbascum thapsus	common mullein
Simaroubaceae	*Ailanthus altissima*	tree of heaven
Smilacaceae	*Smilax glauca*	cat greenbrier
	Smilax rotundifolia	roundleaf greenbrier
Solanaceae	*Solanum carolinense*	Carolina horsenettle
	Solanum dulcamara	climbing nightshade
Sphagnaceae	*Sphagnum* sp.	sphagnum
Staphyleaceae	*Staphylea trifolia*	American bladdernut
Thelypteridaceae	*Thelypteris palustris*	eastern marsh fern
Tiliaceae	*Tilia americana*	American basswood
Trapeliaceae	*Placynthiella uliginosa*	placynthiella lichen
Typhaceae	*Typha angustifolia*	narrowleaf cattail
	Typha latifolia	broadleaf cattail
Ulmaceae	*Celtis occidentalis*	common hackberry
	Ulmus americana	American elm
	Ulmus rubra	slippery elm
Ulvaceae	*Ulva lactuca*	sea lettuce
Urticaceae	*Boehmeria cylindrica*	smallspike false nettle

Family	Scientific Name	Common Name
Verbenaceae	*Verbena hastata*	swamp verbena
Violaceae	*Viola canadensis*	Canadian white violet
Vitaceae	*Ampelopsis brevipedunculata*	Amur peppervine
	Parthenocissus spp.	creeper
	Parthenocissus quinquefolia	Virginia creeper
	Parthenocissus vitacea	woodbine
	Vitis spp.	grape
	Vitis aestivalis	summer grape
	Vitis labrusca	fox grape
	Vitis riparia	riverbank grape
	Vitis vulpina	frost grape

Appendix D. Dichotomous field key to the vegetation associations of Gateway National Recreation Area.

1. Association is dominated by herbaceous or graminoid species. Woody species cover less than 25% of the area.

HERBACEOUS GROUP

A. Upland associations: associations that are well-drained and never regularly flooded; or in soils that are usually well-drained and not hydric, lack predominantly hydrophytic vegetation, but may be regularly flooded for a short time each year.

HERBACEOUS TERRESTRIAL SUBGROUP

A. Wetland associations: communities that are in water all year, or have wet soils all year; or are regularly flooded every day (such as flooded by tidal waters); or are regularly flooded at one or more seasons of the year (such as flooded in spring) and have predominantly hydrophytic vegetation and hydric soils.

B. Tidal wetland associations with some direct hydrological connection to the open ocean, and with regular, daily water level fluctuations caused by ocean tides, including saline and brackish tidal wetlands.

HERBACEOUS TIDAL SUBGROUP

B. Non-tidal wetland associations that are not directly connected to the open ocean, including freshwater wetlands that are permanently saturated by seepage, permanently flooded wetlands, and wetlands that are seasonally or intermittently flooded (these may be seasonably dry) if the vegetative cover is predominately hydrophytic and soils are hydric.

HERBACEOUS PALUSTRINE SUBGROUP

1. Woody species (shrubs or trees) cover at least 25% of the area.

2. Shrubs (woody species 5 meters tall or less) cover at least 25% of the area. Trees (woody species greater than 5 meters tall) cover less than 25% of the area.

SHRUB GROUP

2. Trees (woody species greater than 5 meters tall) cover at least 25% of the area.

3. Trees (woody species greater than 5 meters tall) cover 25-60% of the area.

WOODLAND GROUP

3. Trees (woody species greater than 5 meters tall) cover greater than 60% of the area.

FOREST GROUP

FOREST GROUP

1. Palustrine forests that contain saturated soil for at least part of the growing season.

    2. Swamp is strongly dominated by blackgum (*Nyssa sylvatica)* in the canopy and subcanopy layers and occurs in the Sandy Hook Unit of Gateway National Recreation Area.

        Acer rubrum - *Nyssa sylvatica* - *Betula alleghaniensis/Sphagum* spp. Forest **(CEGL006014)**
        Red Maple-Blackgum Basin Swamp

    2. Swamp is not strongly dominated by blackgum (*Nyssa sylvatica).* If it is present, it is in association with other hardwood dominants.

        3. Small basin swamp co-dominated by red maple (*Acer rubrum*) and gray birch (*Betula populifolia*) with wet to saturated soils throughout the season located in the Jamaica Bay NWR section of the Jamaica Bay Unit of Gateway National Recreation Area.

            Acer rubrum - *Fraxinus* (*pennsylvanica, americana*) / *Lindera benzoin* / *Symplocarpus foetidus* Forest **(CEGL006406)**
            Southern New England Red Maple Seepage Swamp

        3. Moist to well-drained forest dominated by pin oak (*Quercus palustris)* with associated red maple (*Acer rubrum),* blackgum *(Nyssa sylvatica),* swamp white oak *(Quercus bicolor),* and scarlet oak *(Quercus coccinea).* Soils are essentially dry at the surface by late summer in most years. This community is located in the Miller Field section of the Staten Island Unit of Gateway National Recreation Area.

            Quercus palustris - (*Quercus bicolor*) - *Acer rubrum* / *Osmunda cinnamomea* Forest (**CEGL006240)**
            Northeastern Pin Oak-Swamp White Oak Forest

1. Terrestrial forests that do not regularly experience saturated soils during the growing season.

    4. Evergreen forests; deciduous trees < 20-25% of the total canopy cover.

5. Forest occurring on sandy coastal soils in the Sandy Hook Unit of Gateway National Recreation Area dominated by American holly (*Ilex opaca*) (generally >50% cover in the canopy and sub-canopy combined); co-dominants include black cherry (*Prunus serotina*), eastern redcedar (*Juniperis virginiana),* and common hackberry (*Celtis occidentalis*). American holly is also dominant in the shrub layers. Vines, such as roundleaf greenbrier (*Smilax rotundifolia*), eastern poison ivy (*Toxicodendron radicans*), and Virginia creeper (*Parthenocissus quinquefolia*), are common. Characteristic herbs include Robert geranium (*Geranium robertianum*), starry false lily of the valley (*Maianthemum stellatum*), and devil's-tongue (*Opuntia humifusa*).

Ilex opaca / *Morella pensylvanica* Forest **(CEGL006376)**
Maritime Holly Forest

5. Forest canopy and subcanopy is dominated by needle-leaved species; American holly (*Ilex opaca*) absent or present at very low percent cover.

    6. Forest is dominated by Japanese black pine (*Pinus thunbergiana*); understory usually dominated by nonnative grasses and forbs (includes plantations and sites with naturalized Japanese black pine).

Pinus thunbergiana Forest **(CEGL006012)**
Japanese Black Pine Forest

    6. Forest is dominated by eastern redcedar (*Juniperus virginiana*); structure variable from dense to closed, 2 m to 10 m in height. This community occurs on sand dunes and back dunes and is influenced by salt spray and wind; black cherry (*Prunus serotina*) is often co-dominant in the tree and shrub layers. Characteristic shrubs also include northern bayberry (*Myrica pensylvanica*) and flameleaf sumac (*Rhus copallinum*). Vines, such as eastern poison ivy (*Toxicodendron radicans*) and Virginia creeper (*Parthenocissus quinquefolia*) are common. Characteristic sparse herbs include devil's-tongue (*Opuntia humifusa*), seaside goldenrod (*Solidago sempervirens*), starry false lily of the valley (*Maianthemum stellatum*), and little bluestem (*Schizachyrium scoparium*). This community is restricted to the Sandy Hook Unit of Gateway National Recreation Area.

Juniperus virginiana / *Morella pensylvanica* Woodland **(CEGL006212)**
Maritime Red-cedar Woodland

4. Deciduous or mixed forests; deciduous trees > 25% of the total canopy cover.

    7. Canopy dominated by aspen, poplar (*Populus* spp.) and/or birch (*Betula* spp.).

        Populus (*tremuloides, grandidentata*) - *Betula* (*populifolia, papyrifera*) Woodland **(CEGL006303)**
        Early-Successional Woodland/Forest

    7. Canopy not as above.
        8. Canopy dominated by planted, even-aged willow oak (*Quercus phellos*) and/or London planetree (*Platanus hybrida*).

            Quercus phellos - Platanus hybrida Plantation **(CEGL006613)**
            Hardwood Plantation

        8. Canopy not as above.

            9. Forest characterized by black cherry (*Prunus serotina*) with a pronounced tall shrub (2-5 m) component dominated by northern bayberry (*Myrica pensylvanica*) with flameleaf sumac (*Rhus copallinum*) and eastern redcedar (*Juniperus virginiana*). Black cherry (*Prunus serotina*) is the most frequently-encountered canopy species. Vines are commonly draped in and over the shrubs; Oriental bittersweet (*Celastrus orbiculatus*), Virginia creeper (*Parthenocissus quinquefolia*), and eastern poison ivy *(Toxicodendron radicans)* are the most abundant species. The vegetation often occurs in somewhat sheltered settings and forms dense tall maritime shrubland to short forest or woodland

                Amelanchier canadensis - Viburnum spp. - *Morella pensylvanica* Shrubland **(CEGL006379)**
                Northern Tall Maritime Shrubland

            9. Forest without a pronounced tall shrub component.

                10. This successional maritime forest is strongly dominated by black cherry (*Prunus serotina)* with common hackberry (*Celtis occidentalis)*. The vegetation is sheltered from direct maritime influences and occurs on stabilized backdunes or in protected hollows

                Prunus serotina - Sassafras albidum - Amelanchier canadensis / *Smilax rotundifolia* Shrubland **(CEGL006145)**
                Successional Maritime Forest

10. This forest is dominated by early successional, weedy species, such as tree of heaven (*Ailanthus altissima*), black locust (*Robinia pseudoacacia*), white mulberry (*Morus alba*), and black cherry (*Prunus serotina*). Invasive shrubs such as multiflora rose (*Rosa multiflora*), glossy buckthorn (*Frangula alnus*), and Tatarian honeysuckle (*Lonicera tatarica*) are characteristic and can be abundant. Occurs on lands that have been cleared by human activity

Prunus serotina - Liriodendron tulipifera - Acer rubrum - Fraxinus americana Forest **(CEGL006599)**
Northeastern Modified Successional Forest

WOODLAND GROUP

1. Woodland with evergreen species dominant

    2. Woodland dominated by broad-leaved evergreen species. This community, which occurs on sandy coastal soils in the Sandy Hook Unit of Gateway National Recreation Area, is dominated by American holly (*Ilex opaca*) (generally >50% cover in the canopy and sub-canopy combined); co-dominants include black cherry (*Prunus serotina*), eastern redcedar (*Juniperis virginiana),* and common hackberry (*Celtis occidentalis*). American holly is also dominant in the shrub layers. Vines, such as roundleaf greenbrier (*Smilax rotundifolia*), eastern poison ivy (*Toxicodendron radicans*), and Virginia creeper (*Parthenocissus quinquefolia*), are common. Characteristic herbs include Robert geranium (*Geranium robertianum*), starry false lily of the valley (*Maianthemum stellatum*), and devil's-tongue (*Opuntia humifusa*).

        Ilex opaca / *Morella pensylvanica* Forest **(CEGL006376)**
        Maritime Holly Forest

    2. Woodland dominated by needle-leaved species

        3. Woodland is dominated by Japanese black pine (*Pinus thunbergiana*); understory usually dominated by nonnative grasses and forbs (includes plantations and sites with naturalized Japanese black pine)

            Pinus thunbergiana Forest **(CEGL006012)**
            Japanese Black Pine Forest

        3. Woodland is dominated by eastern redcedar (*Juniperus virginiana*). This community occurs on sand dunes and back dunes and is influenced by salt spray and wind; black cherry (*Prunus serotina*) is often co-dominant in the tree and shrub layers. Characteristic shrubs also include northern bayberry (*Myrica pensylvanica*) and flameleaf sumac (*Rhus copallinum*). Vines, such as eastern poison ivy (*Toxicodendron radicans*) and Virginia creeper (*Parthenocissus quinquefolia*) are common. Characteristic sparse herbs include devil's-tongue (*Opuntia humifusa*), seaside goldenrod (*Solidago sempervirens*), starry false lily of the valley (*Maianthemum stellatum*), and little bluestem (*Schizachyrium scoparium*)

            Juniperus virginiana / *Morella pensylvanica* Woodland **(CEGL006212)**
            Maritime Red-cedar Woodland

1. Woodland with deciduous species dominant

    4. Canopy dominated by aspen, poplar (*Populus* spp.) and/or birch (*Betula* spp.)

        Populus (*tremuloides, grandidentata*) - *Betula* (*populifolia, papyrifera*) Woodland **(CEGL006303)**
        Early-Successional Woodland/Forest

    4. Canopy with a pronounced tall shrub (2-5 m) component dominated by northern bayberry (*Myrica pensylvanica*) with flameleaf sumac (*Rhus copallinum*) and eastern redcedar (*Juniperus virginiana*). Vines are commonly draped in and over the shrubs; Oriental bittersweet (*Celastrus orbiculatus*), Virginia creeper (*Parthenocissus quinquefolia*), and eastern poison ivy *(Toxicodendron radicans)* are the most abundant species. The vegetation often occurs in somewhat sheltered settings and forms dense tall maritime shrubland to short forest or woodland

        Amelanchier canadensis - *Viburnum* spp. - *Morella pensylvanica* Shrubland **(CEGL006379)**
        Northern Tall Maritime Shrubland

SHRUB GROUP

1. Shrubland dominated by dwarf-shrubs or low-growing vine species

    2. Association dominated by dwarf-shrubs (<0.25 m). Vegetation is characterized by woolly beachheather (*Hudsonia tomentosa)* occurring with other low-growing shrubs, including eastern redcedar (*Juniperus virginiana),* beach plum *(Prunus maritima),* flameleaf sumac *(Rhus copallinum),* Japanese black pine *(Pinus thunbergiana),* northern bayberry *(Myrica pensylvanica),* and black cherry (*Prunus serotina*)

        Hudsonia tomentosa - Arctostaphylos uva-ursi Dwarf-shrubland **(CEGL006143)**
        Northern Beach Heather Dune Shrubland

    2. Association dominated by vine species, such as eastern poison ivy (*Toxicodendron radicans*), growing in shrub-like form, usually on exposed maritime foredunes

        Smilax glauca - Toxicodendron radicans Vine-Shrubland **(CEGL003886)**
        North Atlantic Coastal Plain Vine Dune

1. Shrubland not dominated by dwarf-shrubs or low-growing vine species

    3. Shrubland dominated by the needle-leaved evergreen species eastern redcedar (*Juniperus virginiana*) and occurs in the Sandy Hook Unit of Gateway National Recreation Area. This community occurs on sand dunes and back dunes and is influenced by salt spray and wind; black cherry (*Prunus serotina*) is often co-dominant in the tree and shrub layers. Characteristic shrubs also include northern bayberry (*Myrica pensylvanica*) and flameleaf sumac (*Rhus copallinum*). Vines, such as eastern poison ivy (*Toxicodendron radicans*) and Virginia creeper (*Parthenocissus quinquefolia*) are common. Characteristic sparse herbs include devil's-tongue (*Opuntia humifusa*), seaside goldenrod (*Solidago sempervirens*), starry false lily of the valley (*Maianthemum stellatum*), and little bluestem (*Schizachyrium scoparium*)

        Juniperus virginiana / *Morella pensylvanica* Woodland **(CEGL006212)**
        Maritime Red-cedar Woodland

    3. Shrubland dominated by deciduous species

        4. Shrubland with a strong northern bayberry (*Myrica pensylvanica*) component

5. Shrub vegetation is dense and low (to 2 m tall), primarily dominated by clumps of northern bayberry (*Myrica pensylvanica)* with flameleaf sumac (*Rhus copallinum).* Scattered tall shrubs and trees (mainly black cherry (*Prunus serotina*)) can be present at low abundance

Morella pensylvanica - *Prunus maritima* Shrubland **(CEGL006295)**
Northern Bayberry Dune Shrubland

5. Shrub vegetation with a pronounced tall shrub (2-5 m) component dominated by northern bayberry (*Myrica pensylvanica*) with flameleaf sumac (*Rhus copallinum*) and eastern redcedar (*Juniperus virginiana*). Vines are commonly draped in and over the shrubs; Oriental bittersweet (*Celastrus orbiculatus*), Virginia creeper (*Parthenocissus quinquefolia*), and eastern poison ivy *(Toxicodendron radicans)* are the most abundant species. The vegetation often develops in somewhat sheltered settings and forms dense tall maritime shrubland to short forest

Amelanchier canadensis - *Viburnum* spp. - *Morella pensylvanica* Shrubland **(CEGL006379)**
Northern Tall Maritime Shrubland

4. Shrubland without a strong northern bayberry (*Myrica pensylvanica*) component. Northern bayberry may be present but in low abundance

6. Vegetation dominated by Jesuit's bark (*Iva frutescens)* and eastern baccharis (*Baccharis halimifolia)* shrubs with common reed (*Phragmites australis),* saltmeadow cordgrass (*Spartina patens*), and saltmeadow rush (*Juncus gerardii)* occurring in the ecotonal area between salt marsh and uplands

Iva frutescens / *Spartina patens* Shrubland **(CEGL006848)**
Mid-Atlantic Maritime Salt Shrub

6. Vegetation not dominated by Jesuit's bark (*Iva frutescens)* and eastern baccharis (*Baccharis halimifolia*) shrubs

7. A successional shrubland characterized by a mix of native and nonnative tall shrubs draped by a dense cover of vines that extends into the sparse, short tree canopy. The shrub layer is dominated by multiflora rose (*Rosa multiflora)* with associated species that include southern arrowwood (*Viburnum dentatum),* autumn olive *(Elaeagnus umbellata),* black cherry *(Prunus serotina),* Allegheny blackberry *(Rubus allegheniensis),* and northern bayberry *(Myrica pensylvanica)*. The thick vine layer (with >85% cover) is co-dominated by Japanese honeysuckle (*Lonicera japonica),* Oriental bittersweet *(Celastrus orbiculatus),* and Virginia creeper *(Parthenocissus quinquefolia)* with eastern poison ivy (*Toxicodendron radicans)* present at lower abundance

Elaeagnus umbellata - Cornus racemosa - Rosa multiflora - Juniperus virginiana Shrubland **(CEGL006451)**
Northeastern Successional Shrubland

7. A sparse shrubland whose vegetation is dominated by graminoid species. This community occurs on level stabilized areas of interdunes or in disturbed settings on sandy dredge spoil. It is dominated by gray clubawn grass (*Corynephorus canescens)* in more disturbed settings and by little bluestem (*Schizachyrium scoparium)* in more natural habitats. Maritime dune species, such as camphorweed (*Heterotheca subaxillaris),* American beachgrass *(Ammophila breviligulata),* seaside goldenrod (*Solidago sempervirens),* beach pinweed (*Lechea maritima),* and devil's-tongue (*Opuntia humifusa)* can be present. Shrubs and stunted trees may be scattered throughout and include flameleaf sumac (*Rhus copallinum),* woolly beachheather *(Hudsonia tomentosa),* beach plum *(Prunus maritima),* northern bayberry (*Myrica pensylvanica),* and black cherry *(Prunus serotina)* (*Morella pensylvanica*) - *Schizachyrium littorale - Aristida tuberculosa* Shrub Herbaceous Vegetation **(CEGL006161)**
North Atlantic Coast Backdune Grassland

HERBACEOUS GROUP

Herbaceous Terrestrial Subgroup

1. Vegetation of beaches and foredunes, fully exposed to oceanic influences; dominated by annuals, perennial grasses and forbs, or sparsely vegetated

    2. Sparsely vegetated beach community occurring above the wrack line on well-drained sands but flooded irregularly by storm tides, dominated by annuals such as American searocket (*Cakile edentula*)

    Cakile edentula ssp. *edentula* - *Chamaesyce polygonifolia* Sparse Vegetation **(CEGL004400)**
    North Atlantic Upper Ocean Beach

    2. Vegetation of foredunes or breached dunes, perennial grasses and forbs predominant; may be very sparse

        3. Vegetation of breached foredunes, back dunes, or upland interdunal swales, characterized by past or recent ocean storm overwash. Saltmeadow cordgrass (*Spartina patens*) is dominant and characteristic, with lesser amounts of seaside goldenrod *(Solidago sempervirens)* and American beachgrass (*Ammophila breviligulata*)

        Spartina patens - Schoenoplectus pungens - Solidago sempervirens Herbaceous Vegetation **(CEGL004097)**
        Overwash Dune Grassland

        3. Vegetation of foredunes; American beachgrass (*Ammophila breviligulata*) commonly present

            4. Foredune vegetation dominated by Japanese sedge (*Carex kobomugi*) in association with (and outcompeting) typical maritime dune species. This community is restricted to the Sandy Hook Unit of Gateway National Recreation Area

            Carex kobomugi Herbaceous Vegetation **(CEGL006615)**
            Japanese Sedge Maritime Dunes

            4. Foredune vegetation not dominated by Japanese sedge (*Carex kobomugi*)

5. Foredune vegetation dominated by bitter panicgrass (*Panicum amarum*) with lesser amounts of American beachgrass (*Ammophila breviligulata).* This community is restricted to the Sandy Hook Unit of Gateway National Recreation Area

Ammophila breviligulata - *Panicum amarum* var. *amarum* Herbaceous Vegetation **(CEGL004043)**
Beachgrass-Panicgrass Dune Grassland

5. Foredune vegetation dominated by American beachgrass (*Ammophila breviligulata*) with seaside goldenrod (*Solidago sempervirens*) often present; bitter panicgrass (*Panicum amarum*) and Japanese sedge (*Carex kobomugi*) absent or present at low abundance

Ammophila breviligulata - *Lathyrus japonicus* Herbaceous Vegetation **(CEGL006274)**
Northern Beachgrass Dune

1. Vegetation on the lee side of dunes and inland; marginally protected or largely isolated from oceanic influences (low areas of dunes, backdunes, interdunal swales, and inland communities); vegetation consists of forbs and/or grasses potentially mixed with sparse low or tall shrubs

    6. Vegetation of backdunes or interdunal swales and coastal salt pond shores

        7. Vegetation of backdunes

            8. Association dominated by dwarf-shrubs (<0.25 m). Vegetation is characterized by woolly beachheather (*Hudsonia tomentosa)* occurring with other low-growing shrubs, including eastern redcedar (*Juniperus virginiana),* beach plum *(Prunus maritima),* flameleaf sumac *(Rhus copallinum),* Japanese black pine *(Pinus thunbergiana),* northern bayberry *(Myrica pensylvanica),* and black cherry (*Prunus serotina*)

Hudsonia tomentosa - *Arctostaphylos uva-ursi* Dwarf-shrubland **(CEGL006143)**
Northern Beach Heather Dune Shrubland

8. Association dominated by gray clubawn grass (*Corynephorus canescens)* in more disturbed settings and by little bluestem (*Schizachyrium scoparium)* in more natural habitats. Maritime dune species, such as camphorweed (*Heterotheca subaxillaris),* American beachgrass *(Ammophila breviligulata),* seaside goldenrod (*Solidago sempervirens),* beach pinweed (*Lechea maritima),* and devil's-tongue (*Opuntia humifusa)* can be present. Shrubs and stunted trees may be scattered throughout and include flameleaf sumac (*Rhus copallinum),* woolly beachheather *(Hudsonia tomentosa),* beach plum *(Prunus maritima),* northern bayberry (*Myrica pensylvanica),* and black cherry *(Prunus serotina).* Vegetation occurs on level stabilized areas of interdunes or in disturbed settings on sandy dredge spoil.

(*Morella pensylvanica*) - *Schizachyrium littorale* - *Aristida tuberculosa* Shrub Herbaceous Vegetation **(CEGL006161)**
North Atlantic Coast Backdune Grassland

7. Vegetation of interdunal swales and coastal salt pond shores. Association is dominated by grasses, sedges, and rushes; wetland plants present (but substrate may be dry, particularly in late season)

    9. Vegetation of mudflats surrounding coastal salt ponds (ponds of variable salinity with shores closed to regular tidal flooding but periodically breached by storm surges). The vegetation of this association is most abundant on mudflats that are exposed when water levels draw down. Dwarf spikerush (*Eleocharis parvula)* and chairmaker's bulrush (*Schoenoplectus americanus)* are characteristic

Schoenoplectus pungens - *Eleocharis parvula* Herbaceous Vegetation **(CEGL006398)**
Coastal Salt Pond Marsh

    9. Vegetation not of mudflats surrounding coastal salt ponds

        10. Vegetation of interdunal swales and ponds dominated by dense stands of common reed (*Phragmites australis)*

Phragmites australis Tidal Herbaceous Vegetation **(CEGL004187)**
Reed-grass Tidal Marsh

10. Vegetation of interdunal swales that are more diverse, primarily dominated by saltmeadow cordgrass (*Spartina patens)* with chairmaker's bulrush and common three-square (*Schoenoplectus americanus, Schoenoplectus pungens)* occurring as sub-dominants with a variety of associated herbs

Spartina patens - *Eleocharis parvula* Herbaceous Vegetation **(CEGL006342)**
Northeastern Atlantic Brackish Interdunal Swale

6. Vegetation of inlands, largely isolated from oceanic influences

11. Vegetation consists primarily of a monospecific stand of Japanese knotweed (*Polygonum cuspidatum*)

Polygonum cuspidatum Temporarily Flooded Herbaceous Vegetation **(CEGL008472)**
Japanese Knotweed Gravelbar

11. Vegetation of successional old fields, dominated by graminoids and forbs

12. Successional old field vegetation dominated and characterized by little blue stem (*Schizachyrium scoparium)*

Schizachyrium scoparium - *Solidago* spp. Herbaceous Vegetation **(CEGL006333)**
Little Bluestem Old Field

12. Successional old field vegetation often dominated by common wormwood (*Artemisia vulgaris)* with varied associates that can include orchardgrass (*Dactylis glomerata),* butter and eggs *(Linaria vulgaris),* flat-top goldentop *(Euthamia graminifolia),* cheatgrass *(Bromus tectorum),* early goldenrod *(Solidago juncea*), and white sweetclover *(Melilotus alba*)

Dactylis glomerata - Phleum pratense - Festuca spp. - *Solidago* spp. Herbaceous Vegetation **(CEGL006107)**
Northeastern Old Field

Herbaceous Tidal Subgroup

1. Vegetation of low, regularly flooded salt marshes and flats

    2. Vegetated associations

        3. Smooth cordgrass (*Spartina alterniflora)* strongly dominant, often forming a monoculture

            Spartina alterniflora / (*Ascophyllum nodosum*) Acadian/Virginian Zone Herbaceous Vegetation **(CEGL004192)**
            North Atlantic Low Salt Marsh

        3. Saltworts (*Salicornia* spp.) dominant; short-form smooth cordgrass (*Spartina alterniflora)* may be present

            Salicornia (*virginica, bigelovii, maritima*) - *Spartina alterniflora* Herbaceous Vegetation **(CEGL004308)**
            Salt Panne (Salicornia Type)

    2. Nearly unvegetated saline, silty mudflat. Sea-lettuce (*Ulva lactuca)* can form extensive mats

        Intertidal Mudflats Sparse Vegetation **(CEGL006614)**
        North Atlantic Coast Estuarine Intertidal Mudflats

1. Vegetation of high salt marshes and the ecotone between high and low marsh; irregularly flooded by tides

    4. Vegetation of high salt marshes; low species diversity

        5. Graminoids dominant. This association is characterized by co-dominance of saltmeadow cordgrass (*Spartina patens)* and inland saltgrass (*Distichlis spicata),* which can form extensive meadows or linear features at the upper edge of the low salt marsh.

            Spartina patens - Distichlis spicata - (*Juncus gerardii*) Herbaceous Vegetation **(CEGL006006)**
            North Atlantic High Salt Marsh

        5. Saltworts (*Salicornia* spp.) dominant. This association consists of shallow, hypersaline depressions often within low salt marsh or at its upper margin in high salt marsh. Short-form smooth cordgrass (*Spartina alterniflora)* may be present

            Salicornia (*virginica, bigelovii, maritima*) - *Spartina alterniflora* Herbaceous Vegetation **(CEGL004308)**
            Salt Panne (Salicornia Type)

    4. Vegetation of ecotone (transition area between high and low marsh or high marsh and upland)

6. Vegetation dominated by Jesuit's bark (*Iva frutescens)* and eastern baccharis (*Baccharis halimifolia)* shrubs with common reed (*Phragmites australis),* saltmeadow cordgrass (*Spartina patens*), and saltmeadow rush (*Juncus gerardii)* occurring in the ecotonal area between salt marsh and uplands

Iva frutescens / *Spartina patens* Shrubland **(CEGL006848)**
Mid-Atlantic Maritime Salt Shrub

6. Vegetation herbaceous (tall brackish grassland)

    7. Vegetation dominated by switchgrass (*Panicum virgatum)* with saltmeadow cordgrass (*Spartina patens),* little bluestem (*Schizachyrium scoparium),* and seaside goldenrod (*Solidago sempervirens)* as common associates

Panicum virgatum - *Spartina patens* Herbaceous Vegetation **(CEGL006150)**
Brackish Meadow

    7. Vegetation dominated by dense stands of common reed (*Phragmites australis)*

Phragmites australis Tidal Herbaceous Vegetation **(CEGL004187)**
Reed-grass Tidal Marsh

Herbaceous Palustrine Subgroup

1. Association dominated by either Japanese knotweed (*Polygonum cuspidatum*) or common reed (*Phragmites australis)*

    2. Vegetation consists primarily of a monospecific stand of Japanese knotweed (*Polygonum cuspidatum*)

Polygonum cuspidatum
Temporarily Flooded Herbaceous Vegetation **(CEGL008472)**
Japanese Knotweed Gravelbar

    2. Vegetation dominated by dense stands of common reed (*Phragmites australis)*

Phragmites australis
Tidal Herbaceous Vegetation **(CEGL004187)**
Reed-grass Tidal Marsh

1. Association dominated by a diverse mix of graminoids, ferns, and forbs

    3. Association dominated by eastern marsh fern (*Thelypteris palustris)* with common reed (*Phragmites australis)* and woolgrass (*Scirpus cyperinus*)

Scirpus cyperinus Seasonally Flooded Herbaceous Vegetation **(CEGL006349)**
Woolgrass Marsh

    3. Association dominated by spotted joepyeweed (*Eupatorium maculatum)* with a mix of herbs including chairmaker's bulrush (*Schoenoplectus americanus)*, fox sedge *(Carex vulpinoidea)*, and common boneset *(Eupatorium perfoliatum)*

Bidens cernua - Verbena hastata - Polygonum spp.
Herbaceous Vegetation [Provisional] **(CEGL006446)**
Mixed Forb Marsh

Appendix E. Local and global descriptions of vegetation associations.

Vascular plant species nomenclature within the local and global descriptions follows the nationally standardized list of Kartesz (1999), with very few exceptions. This nomenclature differs from PLANTS 3.5 (USDA NRCS 2004) in only a very few cases, and when this difference occurs, synonymy is indicated parenthetically in the local description information. Nomenclature for nonvascular plants follows Anderson (1990) and Anderson et al. (1990) for mosses, Egan (1987, 1989, 1990, 1991) and Esslinger and Egan (1995) for lichens, and Stotler and Crandall-Stotler (1977) for liverworts/ hornworts. English names for associations and alliances use NatureServe Central Ecology-accepted names and may differ slightly from the PLANTS 3.5 (USDA NRCS 2004) common names that are used within the local description information and throughout the rest of the report.

Table of Contents

Common Name (Park-specific): Maritime Holly Forest 103
Common Name (Park-specific): Japanese Black Pine Forest 107
Common Name (Park-specific): Northern Tall Maritime Shrubland 111
Common Name (Park-specific): Northeastern Modified Successional Forest 115
Common Name (Park-specific): Successional Maritime Forest 121
Common Name (Park-specific): Northeastern Pin Oak - Swamp White Oak Forest 127
Common Name (Park-specific): Southern New England Red Maple Seepage Swamp 133
Common Name (Park-specific): Red Maple - Blackgum Basin Swamp 139
Common Name (Park-specific): Maritime Red-cedar Woodland 145
Common Name (Park-specific): Early-Successional Woodland/Forest 151
Common Name (Park-specific): Northeastern Successional Shrubland 157
Common Name (Park-specific): Northern Bayberry Dune Shrubland 163
Common Name (Park-specific): North Atlantic Coastal Plain Vine Dune 169
Common Name (Park-specific): Mid-Atlantic Maritime Salt Shrub 173
Common Name (Park-specific): Northern Beach Heather Dune Shrubland 179
Common Name (Park-specific): Northern Beachgrass Dune 185
Common Name (Park-specific): Beachgrass - Panicgrass Dune Grassland 191
Common Name (Park-specific): Little Bluestem Old Field 197
Common Name (Park-specific): Northeastern Old Field 201
Common Name (Park-specific): Overwash Dune Grassland 207
Common Name (Park-specific): Woolgrass Marsh 213
Common Name (Park-specific): Northeastern Atlantic Brackish Interdunal Swale 217
Common Name (Park-specific): Brackish Meadow 221
Common Name (Park-specific): Reed-grass Tidal Marsh 225
Common Name (Park-specific): Coastal Salt Pond Marsh 229
Common Name (Park-specific): North Atlantic Low Salt Marsh 235

Common Name (Park-specific): North Atlantic High Salt Marsh 241
Common Name (Park-specific): North Atlantic Coast Backdune Grassland 245
Common Name (Park-specific): Japanese Knotweed Gravelbar 251
Common Name (Park-specific): Mixed Forb Marsh 255
Common Name (Park-specific): Salt Panne (Salicornia Type) 259
Common Name (Park-specific): North Atlantic Upper Ocean Beach 265
Common Name (Park-specific): North Atlantic Coast Estuarine Intertidal Mudflats 271
Common Name (Park-specific): Japanese Sedge Maritime Dunes 275
Common Name (Park-specific): Hardwood Plantation 279

COMMON NAME (PARK-SPECIFIC): MARITIME HOLLY FOREST

SYNONYMS
NVC English Name: **American Holly / Northern Bayberry Forest**
NVC Scientific Name: ***Ilex opaca* / *Morella pensylvanica* Forest**
NVC Identifier: **CEGL006376**

LOCAL INFORMATION

Environmental Description: This association occurs on old, inactive dunes with undulating topography. Some patches show evidence of past fire in charred stumps and multi-trunked *Ilex opaca* (American holly). Substrate is a variable mix of loamy/organic sand and medium sand with a covering of litter and duff. Soils within this community are in the very-deep-to-bedrock and excessively drained Hooksan series formed in eolian sands or sandy marine sediments. Coarse fragments range from 0 to 5% throughout the profile, consisting mostly of shell fragments (NRCS 2001b).

Vegetation Description: At Gateway, this association is strongly dominated by *Ilex opaca* (American holly) in the canopy and subcanopy. Associated trees are *Prunus serotina* (black cherry), *Juniperus virginiana* (eastern redcedar), *Celtis occidentalis* (common hackberry), *Acer rubrum* (red maple), and *Amelanchier arborea* (common serviceberry). *Sassafras albidum* (sassafras), *Amelanchier laevis* (Allegheny serviceberry), *Nyssa sylvatica* (blackgum), *Rhus typhina* (staghorn sumac), *Robinia pseudoacacia* (black locust), and *Ailanthus altissima* (tree of heaven) may also be present. *Ilex opaca* (American holly) is also dominant in the tall- and short-shrub layers. Common shrub-layer associates are *Vaccinium corymbosum* (highbush blueberry), *Prunus serotina* (black cherry), *Rhus copallinum* (flameleaf sumac), and *Morella pensylvanica (*northern bayberry*)*, with *Celtis occidentalis* (common hackberry), *Juniperus virginiana* (eastern redcedar), *Euonymus atropurpureus* (eastern wahoo), *Prunus maritima* (beach plum), *Viburnum dentatum* (southern arrowwood), *Rubus occidentalis* (black raspberry), and *Rubus flagellaris* (northern dewberry) occurring occasionally. Vines can be common (over 30% cover) and robust in this community, covering the trunks of trees and extending into the canopy; *Smilax rotundifolia* (roundleaf greenbrier), *Toxicodendron radicans* (eastern poison ivy), and *Parthenocissus quinquefolia* (Virginia creeper) are the most abundant species. *Lonicera japonica* (Japanese honeysuckle), *Vitis aestivalis* (summer grape), *Vitis vulpina* (frost grape), and *Smilax glauca* (cat greenbrier) can also be present. Herbaceous species are sparse (less than 2.5% cover) and include *Geranium robertianum* (Robert geranium), *Maianthemum stellatum* (starry false lily of the valley), *Opuntia humifusa* (devil's-tongue), *Aralia nudicaulis* (wild sarsaparilla), and *Galium pilosum* (hairy bedstraw).

Most Abundant Species:

Stratum	Lifeform	Species
Tree (canopy & subcanopy)	Broad-leaved evergreen tree	*Ilex opaca* (American holly)
Shrub/sapling (tall & short)	Broad-leaved evergreen shrub	*Ilex opaca* (American holly)
Herb (field)	Vine/Liana	*Parthenocissus quinquefolia* (Virginia creeper), *Smilax rotundifolia* (roundleaf greenbrier), *Toxicodendron radicans* (eastern poison ivy)
Herb (field)	Forb	*Geranium robertianum* (Robert geranium)

Characteristic Species: *Ilex opaca* (American holly), *Parthenocissus quinquefolia* (Virginia creeper), *Prunus serotina* (black cherry), *Smilax rotundifolia* (roundleaf greenbrier), *Toxicodendron radicans* (eastern poison ivy), *Vaccinium corymbosum* (highbush blueberry).

Other Noteworthy Species: Information not available.
Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
NY	S1	=	1	Maritime holly forest	Edinger et al. 2002
NJ	S1	=	1	*Ilex opaca* / *Morella pensylvanica* Forest	Breden et al. 2001

Local Range: This association is only found on the west shore of the Sandy Hook Unit, New Jersey, and is inland from low salt marsh.
Classification Comments: None.
Other Comments: None.
Local Description Authors: G. J. Edinger and A. L. Feldmann.
Plots: 1al, 1an, 1s, 1t, 2al, 2t, 4al, 4t, 5t, 10an, 10t, 16XX, 17YY, 18YY, 19XX, 20XX, 21XX, 22YY, 34, 35, 47YY, 48YY, 52, 64XX, 74, 83.
Gateway National Recreation Area Inventory Notes: Information not available.

GLOBAL INFORMATION

NVC CLASSIFICATION

Physiognomic Class	Forest (I)
Physiognomic Subclass	Evergreen forest (I.A.)
Physiognomic Group	Temperate broad-leaved seasonal evergreen forest (I.A.4.)
Physiognomic Subgroup	Natural/Semi-natural temperate broad-leaved seasonal evergreen forest (I.A.4.N.)
Formation	Lowland temperate seasonal evergreen forest (I.A.4.N.a.)
Alliance	*Ilex opaca* Forest Alliance (A.3002)
Alliance (English name)	American Holly Forest Alliance
Association	*Ilex opaca / Morella pensylvanica* Forest
Association (English name)	American Holly / Northern Bayberry Forest
Ecological System(s):	Northern Atlantic Coastal Plain Maritime Forest (CES203.302).

GLOBAL DESCRIPTION

Concept Summary: This type represents maritime holly forest of the lee sides of backdunes in New Jersey and Long Island, New York. It occurs in low areas behind backdunes where it is protected from overwash and salt spray. Substrate is sandy loam over coarse sand. The dominant tree is *Ilex opaca* (American holly). Other canopy associates can include *Amelanchier canadensis* (Canadian serviceberry), *Amelanchier laevis* (Allegheny serviceberry), *Acer rubrum* (red maple), *Celtis occidentalis* (common hackberry), *Sassafras albidum* (sassafras), *Quercus stellata* (post oak), *Quercus velutina* (black oak), and *Prunus serotina* (black cherry). Characteristic shrubs include *Morella pensylvanica* (northern bayberry), *Gaylussacia baccata* (black huckleberry), *Rhus copallinum* (flameleaf sumac), *Vaccinium corymbosum* (highbush blueberry). *Sambucus canadensis* (common elderberry), *Viburnum dentatum* (southern arrowwood), and *Toxicodendron vernix* (poison sumac) can occur infrequently. Vines are particularly abundant, and include *Toxicodendron radicans* (eastern poison ivy), *Smilax rotundifolia* (roundleaf greenbrier), *Parthenocissus quinquefolia* (Virginia creeper), and *Vitis* (grape) spp. The herbaceous layer is sparsely to moderately developed and includes *Aralia nudicaulis* (wild sarsaparilla), *Maianthemum stellatum* (starry false lily of the valley), *Maianthemum canadense* (Canada mayflower), *Maianthemum racemosum* (feathery false lily of the valley), *Carex pensylvanica* (Pennsylvania sedge), and *Cypripedium acaule* (moccasin flower). In locally wetter, boggy areas within the forest *Nyssa sylvatica* (blackgum),

Rhododendron viscosum (swamp azalea), *Vaccinium corymbosum* (highbush blueberry), *Photinia melanocarpa* (black chokeberry), *Osmunda cinnamomea* (cinnamon fern), *Osmunda regalis* (royal fern), and *Thelypteris palustris* (eastern marsh fern) occur abundantly.
Environmental Description: This sunken forest occurs in hollows leeward of maritime backdunes where they are protected from tidal overwash and salt spray except during severe storms and hurricanes. Substrate is generally sandy loam over coarse sand with local pockets of peat.
Vegetation Description: The dominant tree is *Ilex opaca* (American holly); stems can be 300 years old. Other canopy associates can include *Amelanchier canadensis* (Canadian serviceberry), *Amelanchier laevis* (Allegheny serviceberry), *Acer rubrum* (red maple), *Celtis occidentalis* (common hackberry), *Sassafras albidum* (sassafras), *Quercus stellata* (post oak), *Quercus velutina* (black oak) and *Prunus serotina* (black cherry). Characteristic shrubs include *Morella pensylvanica* (northern bayberry), *Gaylussacia baccata* (black huckleberry), *Rhus copallinum* (flameleaf sumac), and *Vaccinium corymbosum* (highbush blueberry). *Sambucus canadensis* (common elderberry), *Viburnum dentatum* (southern arrowwood), and *Toxicodendron vernix* (poison sumac) can occur infrequently. Vines are particularly abundant and include *Toxicodendron radicans* (eastern poison ivy), *Smilax rotundifolia* (roundleaf greenbrier), *Parthenocissus quinquefolia* (Virginia creeper), and *Vitis* (grape) spp. The herbaceous layer is sparsely to moderately developed and includes *Aralia nudicaulis* (wild sarsaparilla), *Maianthemum stellatum* (starry false lily of the valley), *Maianthemum racemosum* (feathery false lily of the valley), and *Maianthemum canadense* (Canada mayflower). In locally wetter, boggy areas within the forest *Nyssa sylvatica* (blackgum), *Rhododendron viscosum* (swamp azalea), *Vaccinium corymbosum* (highbush blueberry), *Photinia melanocarpa* (black chokeberry), *Osmunda cinnamomea* (cinnamon fern), *Osmunda regalis* (royal fern), and *Thelypteris palustris* (eastern marsh fern) occur abundantly.
Most Abundant Species:

Stratum	Lifeform	Species
Tree (canopy & subcanopy)	Broad-leaved evergreen tree	*Ilex opaca* (American holly)
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Morella pensylvanica* (northern bayberry)
Shrub/sapling (tall & short)	Vine/Liana	*Toxicodendron radicans* (eastern poison ivy)

Characteristic Species: *Gaylussacia baccata* (black huckleberry), *Ilex opaca* (American holly), *Morella pensylvanica* (northern bayberry), *Rhus copallinum* (flameleaf sumac), *Smilax rotundifolia* (roundleaf greenbrier), *Toxicodendron radicans* (eastern poison ivy).
Other Noteworthy Species: Information not available.
USFWS Wetland System: Not applicable.

DISTRIBUTION
Range: Currently only known from New Jersey and Long Island, New York.
States/Provinces: NJ:S1, NY:S1.
Federal Lands: NPS (Fire Island, Gateway).

CONSERVATION STATUS
Rank: G1 (1-Mar-2002).
Reasons: Information not available.

CLASSIFICATION INFORMATION
Status: Standard.
Confidence: 2 - Moderate.
Comments: Occurrences in New York and New Jersey are on the order of 50+ acres in size.

Similar Associations: Information not available.

Related Concepts:

Maple-holly forest (Chrysler 1930) ?
Sunken Forest (Stalter 1979) ?
Sunken Forest (Art 1976) ?
Sunken Forest (Greller 1977) ?

SOURCES

Description Authors: S.L. Neid, mod. E. Largay.

References: Art 1976, Art 1987, Art 1992, Breden et al. 2001, Chrysler 1930, Dowhan and Rozsa 1989, Eastern Ecology Working Group n.d., Edinger et al. 2002, Greller 1977, NRCS 2001b, Reschke 1990, Sirkin 1972, Sneddon and Lundgren 2001, Stalter 1979.



Figure E1. Maritime Holly Forest in Gateway National Recreation Area, Sandy Hook Unit (Accuracy Assessment Point 83, image no. 1193). 9/28/2006. NAD 1983 / UTM easting 585548, northing 4477098.

COMMON NAME (PARK-SPECIFIC): JAPANESE BLACK PINE FOREST

SYNONYMS
NVC English Name: **Japanese Black Pine - (Austrian Pine) Forest**
NVC Scientific Name: ***Pinus thunbergiana* - (*Pinus nigra*) Forest**
NVC Identifier: **CEGL006012**

LOCAL INFORMATION

Environmental Description: This association occurs on old, inactive, undulating dune deposits; some patches may be natural and others were probably intentionally planted. Substrate is well-drained sand, which can be moist below 10-15 cm, covered by a layer of pine needles, duff, and loamy sand. Soils within this community are in the Hooksan, Bigapple, Breeze, and Fortress series. The Hooksan series consists of very deep, excessively drained soils formed in eolian sands or sandy marine sediments. Coarse fragments range from 0 to 5% throughout the profile, consisting mostly of shell fragments. The Bigapple, Breeze, and Fortress series all consist of very deep, primarily sandy, well-drained fill deposits (NRCS 2001b).
Vegetation Description: *Pinus thunbergiana* (Japanese black pine) is the dominant canopy and subcanopy tree of this association; *Prunus serotina* (black cherry) is the only documented associated tree species at Gateway. Shrub cover is sparse and commonly under 1 m in height. *Prunus serotina* (black cherry), *Morella pensylvanica (*northern bayberry*)*, and *Viburnum dentatum* (southern arrowwood) are the most consistent shrub species. Vine cover is just over 10% and species can include *Toxicodendron radicans* (eastern poison ivy), *Celastrus orbiculata* (Asian bittersweet), and *Parthenocissus quinquefolia* (Virginia creeper). The herbaceous layer is quite sparse and variable; documented species are *Chimaphila maculata* (striped prince's pine), *Asplenium platyneuron* (ebony spleenwort), *Apocynum cannabinum* (Indianhemp), *Hypericum boreale* (northern St. Johnswort), and *Artemisia vulgaris* (common wormwood).
Most Abundant Species:

Stratum	Lifeform	Species
Tree (canopy & subcanopy)	Needle-leaved tree	*Pinus thunbergiana* (Japanese black pine)
Short shrub/sapling	Broad-leaved deciduous shrub	*Prunus serotina* (black cherry)
Herb (field)	Vine/Liana	*Toxicodendron radicans* (eastern poison ivy)

Characteristic Species: *Morella pensylvanica* (northern bayberry), *Pinus thunbergiana* (Japanese black pine), *Prunus serotina* (black cherry).
Other Noteworthy Species: Information not available.
Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
NY	SNA	B	1	Pine plantation	Edinger et al. 2002
NJ	.	=	1	*Pinus thunbergiana* – (*Pinus nigra*) Forest	Walz et al. 2007

Local Range: This association occurs in the Sandy Hook Unit and in the Fort Tilden, Floyd Bennett Field, and Jamaica Bay Wildlife Refuge sections of the Jamaica Bay Unit.
Classification Comments: None.
Other Comments: None.
Local Description Authors: G. J. Edinger and A. L. Feldmann.
Plots: 1q, 2n, 3ac, 46XX, 107YY, 108XX, 111XX, 114XX.
Gateway National Recreation Area Inventory Notes: Information not available.

GLOBAL INFORMATION

NVC CLASSIFICATION

Physiognomic Class	Forest (I)
Physiognomic Subclass	Evergreen forest (I.A.)
Physiognomic Group	Temperate or subpolar needle-leaved evergreen forest (I.A.8.)
Physiognomic Subgroup	Natural/Semi-natural temperate or subpolar needle-leaved evergreen forest (I.A.8.N.)
Formation	Rounded-crowned temperate or subpolar needle-leaved evergreen forest (I.A.8.N.b.)
Alliance	*Pinus thunbergiana* Forest Alliance (A.3016)
Alliance (English name)	Japanese Black Pine Forest Alliance
Association	*Pinus thunbergiana - (Pinus nigra)* Forest
Association (English name)	Japanese Black Pine - (Austrian Pine) Forest
Ecological System(s):	Northern Atlantic Coastal Plain Maritime Forest (CES203.302).

GLOBAL DESCRIPTION

Concept Summary: This nonnative Japanese black pine forest of the northeastern coastal region occurs on well-drained to xeric sandy soils, usually on sand dunes or near-coastal glacial tills. Stands are of variable canopy height and closure and dominated by *Pinus thunbergiana* (Japanese black pine) or *Pinus nigra* (Austrian pine). A frequent canopy associate can be *Pinus rigida* (pitch pine). The shrub layer is not well-developed, and the herbaceous layer is of variable composition, sometimes containing *Panicum virgatum* (switchgrass) and other herbaceous associates. *Toxicodendron radicans* (eastern poison ivy) is common in all strata of this community.

Environmental Description: This nonnative Japanese black pine forest of the northeastern coastal region occurs on well-drained to xeric sandy soils, usually on sand dunes or near-coastal glacial tills.

Vegetation Description: These planted stands are of variable canopy height and closure and dominated by *Pinus thunbergiana* (Japanese black pine) or less commonly by *Pinus nigra* (Austrian pine). A frequent canopy associate is *Pinus rigida* (pitch pine). The shrub layer is not well-developed, however, it may contain *Prunus serotina* (black cherry) and *Morella pensylvanica* (northern bayberry). The herbaceous layer is of variable composition, sometimes containing *Panicum virgatum* (switchgrass), *Solidago rugosa* (wrinkleleaf goldenrod), *Hieracium canadense* (Canadian hawkweed), and other herbaceous associates. Vines, including *Toxicodendron radicans* (eastern poison ivy), *Parthenocissus quinquefolia* (Virginia creeper), *Celastrus orbiculata* (Asian bittersweet), *Smilax rotundifolia* (roundleaf greenbrier), and *Lonicera japonica* (Japanese honeysuckle), can be common in this community.

Most Abundant Species:

Stratum	Lifeform	Species
Tree (canopy & subcanopy)	Needle-leaved tree	*Pinus nigra* (Austrian pine), *Pinus thunbergiana* (Japanese black pine)
Tall shrub/sapling	Broad-leaved deciduous shrub	*Prunus serotina* (black cherry)
Tall shrub/sapling	Vine/Liana	*Toxicodendron radicans* (eastern poison ivy)

Characteristic Species: *Pinus nigra* (Austrian pine), *Pinus thunbergiana* (Japanese black pine).

Other Noteworthy Species: Information not available.

USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: These plantations occur on Cape Cod National Seashore and Boston Harbor Islands National Recreation Area, Massachusetts; Block Island, Rhode Island; and Fire Island National Seashore and Gateway National Recreation Area, New York.
States/Provinces: DE, MA, NJ, NY, RI.
Federal Lands: NPS (Boston Harbor Islands, Fire Island, Gateway); USFWS (Parker River?).

CONSERVATION STATUS

Rank: GNA (modified/managed) (10-Oct-2001).
Reasons: This planted nonnative community is not a conservation priority and therefore does not receive a conservation rank.

CLASSIFICATION INFORMATION

Status: Standard.
Confidence: 2 - Moderate.
Comments: This community was originally described from Fire Island National Seashore. The description was expanded from data from National Park Service vegetation mapping projects completed for Cape Cod National Seashore, Block Island, Rhode Island, Gateway National Recreation Area, New York, and Boston Harbor Islands National Recreation Area, Massachusetts.
Similar Associations: Information not available.
Related Concepts: Information not available.

SOURCES

Description Authors: L. A. Sneddon, mod. E. Largay.
References: Dowhan and Rozsa 1989, Eastern Ecology Working Group n.d., NRCS 2001b, Sneddon and Lundgren 2001, TNC unpubl. data 1995d.



Figure E2. Japanese Black Pine Forest in Gateway National Recreation Area, Sandy Hook Unit (Accuracy Assessment Point 46XX, image no. 1203). 8/23/2006. NAD 1983 / UTM easting 584598, northing 4479931.

COMMON NAME (PARK-SPECIFIC): NORTHERN TALL MARITIME SHRUBLAND

SYNONYMS

NVC English Name: **Canada Serviceberry - Viburnum species - Northern Bayberry Scrub Forest**

NVC Scientific Name: ***Amelanchier canadensis* - *Viburnum* spp. - *Morella pensylvanica* Scrub Forest**

NVC Identifier: **CEGL006379**

LOCAL INFORMATION

Environmental Description: This tall maritime shrubland community is usually very dense and often occurs inland of Northern Bayberry Dune Shrubland (CEGL006295) in sheltered settings. Substrate is most commonly coarse to fine sand originating from marine sediments, eolian deposition, or dredge fill in the Barren, Bigapple, Fortress, Hooksan, and Jamaica series (NRCS 2001b).

Vegetation Description: This dense, tall maritime shrubland is dominated by *Morella pensylvanica* (northern bayberry) in combination with *Rhus copallinum* (flameleaf sumac) and *Prunus serotina* (black cherry) and a variable suite of associates, including *Elaeagnus umbellata* (autumn olive), *Frangula alnus* (glossy buckthorn), *Populus alba* (white poplar), *Rosa multiflora* (multiflora rose), *Baccharis halimifolia* (eastern baccharis), *Lonicera tatarica* (Tatarian honeysuckle), *Viburnum dentatum* (southern arrowwood), *Iva frutescens* (Jesuit's bark), *Morus alba* (white mulberry), *Rosa rugosa* (rugosa rose), and *Rhus glabra* (smooth sumac). Vines are commonly draped in and over the shrubs; *Celastrus orbiculata* (Asian bittersweet), *Parthenocissus quinquefolia* (Virginia creeper), and *Toxicodendron radicans* (eastern poison ivy) are the most abundant species. A sparse tree canopy and subcanopy containing a variable mix of successional or exotic species can overtop the shrubs. *Prunus serotina* (black cherry) is commonly dominant and can be found in combination with any of the following species in low abundance: *Populus alba* (white poplar), *Rhus copallinum* (flameleaf sumac), *Juniperus virginiana* (eastern redcedar), *Populus tremuloides* (quaking aspen), *Populus deltoides* (eastern cottonwood), *Ailanthus altissima* (tree of heaven), *Betula populifolia* (gray birch), *Elaeagnus umbellata* (autumn olive), and *Prunus pensylvanica* (pin cherry). The herbaceous layer is generally sparse, non-diagnostic, and patchy, occurring primarily where there is a break in the shrub cover. Species vary quite a bit depending on the surrounding communities, past land use, and landscape setting. *Phragmites australis* (common reed) can be dominant with *Artemisia vulgaris* (common wormwood), *Euthamia graminifolia* (flat-top goldentop), *Ageratina aromatica* (lesser snakeroot), *Panicum amarum* (bitter panicgrass), *Schizachyrium scoparium* (little bluestem), *Solidago sempervirens* (seaside goldenrod), and many others.

Most Abundant Species:

Stratum	Lifeform	Species
Tree (canopy & subcanopy)	Broad-leaved deciduous tree	*Prunus serotina* (black cherry)
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Morella pensylvanica* (northern bayberry)
Herb (field)	Vine/Liana	*Celastrus orbiculatus* (Asian bittersweet), *Parthenocissus quinquefolia* (Virginia creeper), *Toxicodendron radicans* (eastern poison ivy)
Herb (field)	Graminoid	*Phragmites australis* (common reed)

Characteristic Species: *Celastrus orbiculata* (Asian bittersweet), *Morella pensylvanica* (northern bayberry), *Parthenocissus quinquefolia* (Virginia creeper), *Populus alba* (white poplar), *Prunus serotina* (black cherry), *Rhus copallinum* (flameleaf sumac), *Toxicodendron radicans* (eastern poison ivy).
Other Noteworthy Species: Information not available.
Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
NY	S4*	B	2	Maritime shrubland	Edinger et al. 2002
NJ	.	=	1	*Amelanchier canadensis-Viburnum* spp.-*Morella pensylvanica* Shrubland	Breden et al. 2001

Local Range: This association occurs in the Sandy Hook Unit; the Great Kills and Miller Field sections of the Staten Island Unit; and in all sections of the Jamaica Bay Unit.
Classification Comments: None.
Other Comments: None.
Local Description Authors: G. J. Edinger and A. L. Feldmann.
Plots: 1aj, 1r, 1ac, 1af, 1n, 1ah, 2r, 2v, 2z, 3ad, 3y, 3j, 3z, 3ah, 4ai, 5aj, 5w, 5XX, 6ac, 7v, 7, 9ac, 9n, 11ag, 11XX, 21YY, 22XX, 24YY, 26, 69YY, 101XX, 103YY, 109XX, 151, 154, 155YY, 156XX, 158, 159XX, 160, 162YY, 167, 171, 174, 176, 183, 185, 213, 214, 234, 242, 243, 261, 263, 265, ref1, ref2.
Gateway National Recreation Area Inventory Notes: Information not available.

GLOBAL INFORMATION

NVC CLASSIFICATION

Physiognomic Class	Forest (I)
Physiognomic Subclass	Deciduous forest (I.B.)
Physiognomic Group	Cold-deciduous forest (I.B.2.)
Physiognomic Subgroup	Natural/Semi-natural cold-deciduous forest (I.B.2.N.)
Formation	Lowland or submontane cold-deciduous forest (I.B.2.N.a.)
Alliance	*Prunus serotina - Acer rubrum - Amelanchier canadensis - Quercus* spp. Forest Alliance (A.237)
Alliance (English name)	Black Cherry - Red Maple - Canada Serviceberry - Oak species Forest Alliance
Association	*Amelanchier canadensis - Viburnum* spp. - *Morella pensylvanica* Scrub Forest
Association (English name)	Canada Serviceberry - Viburnum species - Northern Bayberry Scrub Forest
Ecological System(s):	Northern Atlantic Coastal Plain Maritime Forest (CES203.302).

GLOBAL DESCRIPTION

Concept Summary: This tall maritime shrubland or scrub forest community characteristically replaces maritime forests that have been cleared. The community is variable in composition and generally includes *Amelanchier canadensis* (Canadian serviceberry), *Prunus serotina* (black cherry), *Sassafras albidum* (sassafras), *Nyssa sylvatica* (blackgum), *Acer rubrum* (red maple), *Juniperus virginiana* (eastern redcedar) in the canopy. The oaks *Quercus velutina* (black oak), *Quercus stellata* (post oak), *Quercus alba* (white oak) may or may not be present. The shrubs *Morella pensylvanica* (northern bayberry), *Photinia* (chokeberry) spp., *Viburnum* (viburnum)

spp. may form an understory or contribute substantial cover to the canopy. Vines are often prevalent, including *Smilax* (greenbrier) spp., *Vitis* (grape) spp., *Toxicodendron radicans* (eastern poison ivy), *Parthenocissus quinquefolia* (Virginia creeper). The herbaceous layer is generally sparse. These shrublands are usually very dense, and often maintained in their current state by constant winds and salt spray.

Environmental Description: This tall maritime shrubland or scrub forest community characteristically replaces maritime forests that have been cleared. It occurs at former agricultural sites on sandy loam soils. These shrublands are usually very dense and often maintained in their current state by constant winds and salt spray.

Vegetation Description: This tall shrubland community is variable in composition and generally includes *Amelanchier canadensis* (Canadian serviceberry), *Prunus serotina* (black cherry), *Sassafras albidum* (sassafras), *Nyssa sylvatica* (blackgum), *Acer rubrum* (red maple), and *Juniperus virginiana* (eastern redcedar) in the canopy. The oaks *Quercus velutina* (black oak), *Quercus stellata* (post oak), and *Quercus alba* (white oak) may or may not be present. The shrubs *Morella pensylvanica* (northern bayberry), *Photinia* (chokeberry) spp., *Viburnum* (viburnum) spp., and *Gaylussacia baccata* (black huckleberry) may form an understory or contribute substantial cover to the canopy. Vines are often prevalent, including *Smilax* (greenbrier) spp., *Vitis* (grape) spp., *Toxicodendron radicans* (eastern poison ivy), and *Parthenocissus quinquefolia* (Virginia creeper). The herbaceous layer is generally sparse.

Most Abundant Species:

Stratum	Lifeform	Species
Tall shrub/sapling	Broad-leaved deciduous shrub	*Amelanchier canadensis* (Canadian serviceberry), *Prunus serotina* (black cherry)
Short shrub/sapling	Broad-leaved deciduous shrub	*Viburnum recognitum* (southern arrowwood)
Short shrub/sapling	Broad-leaved evergreen shrub	*Morella pensylvanica* (northern bayberry)
Short shrub/sapling	Vine/Liana	*Smilax rotundifolia* (roundleaf greenbrier), *Toxicodendron radicans* (eastern poison ivy)

Characteristic Species: *Amelanchier canadensis* (Canadian serviceberry), *Morella pensylvanica* (northern bayberry), *Prunus serotina* (black cherry).

Other Noteworthy Species: Information not available.

USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: Information not available.

States/Provinces: CT, MA, NH, NJ, NY, RI.

Federal Lands: NPS (Cape Cod, Gateway); USFWS (Nomans Land Island?).

CONSERVATION STATUS

Rank: GNR (1-Dec-1997).

Reasons: Information not available.

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 2 - Moderate.

Comments: Information not available.

Similar Associations:

Prunus serotina - Sassafras albidum - Amelanchier canadensis - Quercus velutina / Smilax rotundifolia Forest (CEGL006145).

Related Concepts:
Coastal dune shrubland (Breden 1989) ?
Coastal dune woodland (Breden 1989) ?
SNE coastal rocky headland community (Rawinski 1984) ?

SOURCES
Description Authors: L. A. Sneddon.
References: Breden 1989, Breden et al. 2001, Eastern Ecology Working Group n.d., Edinger et al. 2002, Metzler and Barrett 2001, NRCS 2001b, Rawinski 1984, Reschke 1990, Swain and Kearsley 2001.



Figure E3. Northern Tall Maritime Shrubland in Gateway National Recreation Area, Jamaica Bay Unit (Accuracy Assessment Point Ref2, photo no. 1132). 8/15/2006. NAD 1983 / UTM easting 597091, northing 4500698.

COMMON NAME (PARK-SPECIFIC): NORTHEASTERN MODIFIED SUCCESSIONAL FOREST

SYNONYMS
NVC English Name: **Black Cherry - Tuliptree - Red Maple - White Ash Forest**
NVC Scientific Name: ***Prunus serotina - Liriodendron tulipifera - Acer rubrum - Fraxinus americana* Forest**
NVC Identifier: **CEGL006599**

LOCAL INFORMATION

Environmental Description: This association generally occurs on sites that have been heavily modified in the past, and their environmental characteristics are extremely variable. Substrates can range from coarse sand derived from sandy dredge fill to loam that developed over either glacial till or loamy fill material. Soils are in the Bigapple, Cheshire, and Greenbelt series (NRCS 2001b).

Vegetation Description: This association is characterized by dominance of successional and/or invasive species in all layers. The tree canopy and subcanopy are composed of a mix of species, including *Ailanthus altissima* (tree of heaven), *Robinia pseudoacacia* (black locust), *Morus alba* (white mulberry), and *Prunus serotina* (black cherry). Associated trees can include *Ulmus americana* (American elm), *Acer saccharinum* (silver maple), *Populus alba* (white poplar), *Populus deltoides* (eastern cottonwood), *Aralia spinosa* (devil's walkingstick), *Frangula alnus* (glossy buckthorn), *Elaeagnus umbellata* (autumn olive), *Celtis occidentalis* (common hackberry), *Juniperus virginiana* (eastern redcedar), *Acer rubrum* (red maple), *Acer platanoides* (Norway maple), *Pinus thunbergiana* (Japanese black pine), and many others. Many of these canopy and subcanopy species also appear in the shrub layers in combination with associates that can vary by landscape setting and land-use history. Additional shrub species can include *Rosa multiflora* (multiflora rose), *Lonicera tatarica* (Tatarian honeysuckle), *Ligustrum vulgare* (European privet), *Rhus copallinum* (flameleaf sumac), *Rubus allegheniensis* (Allegheny blackberry), and *Morella pensylvanica* (northen bayberry). Woody vines are important in this association and are commonly draped over the shrub layer, sometimes creeping up into the canopy. *Celastrus orbiculata* (Asian bittersweet) and *Lonicera japonica* (Japanese honeysuckle) are the most abundant species; *Toxicodendron radicans* (eastern poison ivy), *Parthenocissus quinquefolia* (Virginia creeper), and *Ampelopsis brevipedunculata* (Amur peppervine) are fairly regular associates. As in other layers, herbaceous cover is also dominated by species that are invasive and/or exotic. Composition differs among sites; potential species are *Artemisia vulgaris* (common wormwood), *Phragmites australis* (common reed), *Alliaria petiolata* (garlic mustard), *Polygonum cuspidatum* (Japanese knotweed), *Phytolacca americana* (American pokeweed), and *Saponaria officinalis* (bouncingbet), among others.

Most Abundant Species:

Stratum	Lifeform	Species
Tree (canopy & subcanopy)	Broad-leaved deciduous tree	*Ailanthus altissima* (tree of heaven), *Morus alba* (white mulberry), *Prunus serotina* (black cherry), *Robinia pseudoacacia* (black locust)
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Lonicera tatarica* (Tatarian honeysuckle), *Rosa multiflora* (multiflora rose)
Herb (field)	Vine/Liana	*Celastrus orbiculata* (Asian bittersweet), *Lonicera japonica* (Japanese honeysuckle)
Herb (field)	Forb	*Alliaria petiolata* (garlic mustard), *Artemisia vulgaris* (common wormwood)
Herb (field)	Graminoid	*Phragmites australis* (common reed)

Characteristic Species: *Ailanthus altissima* (tree of heaven), *Alliaria petiolata* (garlic mustard), *Artemisia vulgaris* (common wormwood), *Celastrus orbiculata* (Asian bittersweet), *Lonicera japonica* (Japanese honeysuckle), *Lonicera tatarica* (Tatarian honeysuckle), *Morus alba* (white mulberry), *Prunus serotina* (black cherry), *Robinia pseudoacacia* (black locust), *Rosa multiflora* (multiflora rose).

Other Noteworthy Species: Information not available.

Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
NY	S5*	B	1	Successional southern hardwoods	Edinger et al. 2002
NJ	.	=	1	*Prunus serotina-Liriodendron tulipifera - Acer rubrum - Fraxinus americana* Forest	Walz et al. 2007

Local Range: This association occurs in all sections of all units; it can be found in the Sandy Hook Unit, the Staten Island Unit, and the Jamaica Bay Unit.

Classification Comments: None.

Other Comments: None.

Local Description Authors: G. J. Edinger and A. L. Feldmann.

Plots: 1ak, 1ae, 1k, 3c, 5v, 5y, 6y, 9ag, 12t, 13t, 25, 33XX, 36YY, 37, 44XX, 55YY, 61XX, 62XX, 62YY, 71, 72XX, 78, 80, 103XX, 107XX, 108YY, 172, 198, 216, 217, 218, 229, 240, 248XX, 281, 282, ref1.

Gateway National Recreation Area Inventory Notes: Information not available.

GLOBAL INFORMATION

NVC CLASSIFICATION

Physiognomic Class	Forest (I)
Physiognomic Subclass	Deciduous forest (I.B.)
Physiognomic Group	Cold-deciduous forest (I.B.2.)
Physiognomic Subgroup	Natural/Semi-natural cold-deciduous forest (I.B.2.N.)
Formation	Lowland or submontane cold-deciduous forest (I.B.2.N.a.)
Alliance	*Prunus serotina - Acer rubrum - Amelanchier canadensis - Quercus* spp. Forest Alliance (A.237)
Alliance (English name)	Black Cherry - Red Maple - Canada Serviceberry - Oak species Forest Alliance
Association	*Prunus serotina - Liriodendron tulipifera - Acer rubrum - Fraxinus americana* Forest
Association (English name)	Black Cherry - Tuliptree - Red Maple - White Ash Forest

Ecological System(s): Central Appalachian Dry Oak-Pine Forest (CES202.591).
Northeastern Interior Dry-Mesic Oak Forest (CES202.592).

GLOBAL DESCRIPTION

Concept Summary: This early-successional woody vegetation of the northeastern United States occurs on sites that are becoming reforested after having been cleared for agriculture. Environmental setting varies, but generally sites are dry-mesic to mesic, with small seepage inclusions in some examples. Physiognomy of this vegetation is highly variable, ranging from closed forest, open forest, tall dense shrubland, to more open tall shrubland. Early-successional woody species dominate the canopy in a widely variable mix, depending on geographic location. Tree species often include some combination of *Prunus serotina* (black cherry), *Liriodendron tulipifera* (tuliptree), *Fraxinus americana* (white ash), *Robinia pseudoacacia* (black locust), and *Acer rubrum* (red maple). Other associates can include *Juglans nigra* (black walnut), *Sassafras albidum* (sassafras), *Betula populifolia* (gray birch), *Juniperus virginiana* (eastern redcedar), *Acer negundo* (boxelder), *Acer saccharinum* (silver maple), *Ailanthus altissima* (tree of heaven), *Ulmus americana* (American elm), *Quercus* (oak) spp., *Betula lenta* (sweet birch), *Amelanchier* (serviceberry) spp., *Pinus strobus* (eastern white pine), and *Populus grandidentata* (bigtooth aspen). Other woody species may contribute to the canopy or form a tall-shrub layer, including *Lindera benzoin* (northern spicebush) and *Carpinus caroliniana* (American hornbeam). The low-shrub layer, if present, is usually characterized by the presence of *Rubus* (blackberry) spp. such as *Rubus flagellaris* (northern dewberry), *Rubus allegheniensis* (Allegheny blackberry), *Rubus phoenicolasius* (wine raspberry), or *Rubus hispidus* (bristly dewberry). This layer is often dominated by exotic species such as *Lonicera tatarica* (Tatarian honeysuckle), *Lonicera morrowii* (Morrow's honeysuckle), *Rhamnus cathartica* (common buckthorn), *Crataegus* (hawthorn) spp., *Rosa multiflora* (multiflora rose), and *Berberis thunbergii* (Japanese barberry). The herbaceous layer is variable, often containing grasses and forbs of both native and exotic origin. Common species include *Ageratina altissima var. altissima* (white snakeroot), *Polygonum persicaria* (spotted ladysthumb), *Impatiens capensis* (jewelweed), *Glechoma hederacea* (ground ivy), *Polystichum acrostichoides* (Christmas fern), *Calystegia sepium* ssp. *sepium* (hedge false bindweed), *Galium aparine* (stickywilly), *Oxalis stricta* (common yellow oxalis), *Polygonum virginianum* (jumpseed), *Dennstaedtia punctilobula* (eastern hayscented fern), *Arisaema triphyllum* (Jack in the pulpit), *Allium vineale* (wild garlic), and *Veronica officinalis* (common gypsyweed), among many others. The invasive species *Alliaria petiolata* (garlic mustard), *Microstegium vimineum* (Nepalese browntop), and *Polygonum caespitosum* (oriental ladysthumb) can be abundant in this disturbed forest type. Vines can be absent or abundant. In stands with high vine cover, the vegetation structure can be altered by the weight of the vines pulling down trees and shrubs. Common vines include *Parthenocissus quinquefolia* (Virginia creeper), *Toxicodendron radicans* (eastern poison ivy), *Vitis labrusca* (fox grape), and the invasive vines *Celastrus orbiculata* (Asian bittersweet) and *Lonicera japonica* (Japanese honeysuckle). These forests are often young and resulted from the colonization of old agricultural fields by woody species. Recent disturbance or abundant invasive species give these forest stands a weedy character. It is unlikely that these stands will succeed to a natural plant community dominated by native species.

Environmental Description: This vegetation occurs on sites that have been cleared for agriculture or otherwise heavily modified in the past. Generally sites are dry-mesic and may have small seepage inclusions in some examples. Occasionally this type may occur in formerly agricultural bottomlands, in which case the soils may be temporarily flooded or saturated.

Vegetation Description: Early-successional woody species dominate the canopy in a widely variable mix, depending on geographic location. Tree species often include some combination of *Prunus serotina* (black cherry), *Liriodendron tulipifera* (tuliptree), *Fraxinus americana* (white ash), *Robinia pseudoacacia* (black locust), and *Acer rubrum* (red maple). Other associates can include *Juglans nigra* (black walnut), *Sassafras albidum* (sassafras), *Betula populifolia* (gray birch), *Juniperus virginiana* (eastern redcedar), *Acer negundo* (boxelder), *Acer saccharinum* (silver maple), *Ailanthus altissima* (tree of heaven), *Ulmus americana* (American elm), *Quercus* (oak) spp., *Betula lenta* (sweet birch), *Amelanchier* (serviceberry) spp., *Pinus strobus* (eastern white pine), and *Populus grandidentata* (bigtooth aspen). Other woody species may contribute to the canopy or form a tall-shrub layer, including *Lindera benzoin* (northern spicebush) and *Carpinus caroliniana* (American hornbeam). The low-shrub layer, if present, is usually characterized by the presence of *Rubus* (blackberry) spp. such as *Rubus flagellaris* (northern dewberry), *Rubus allegheniensis* (Allegheny blackberry), *Rubus phoenicolasius* (wine raspberry), or *Rubus hispidus* (bristly dewberry). This layer is often dominated by exotic species such as *Lonicera tatarica* (Tatarian honeysuckle), *Lonicera morrowii* (Morrow's honeysuckle), *Rhamnus cathartica* (common buckthorn), *Crataegus* (hawthorn) spp., *Rosa multiflora* (multiflora rose), and *Berberis thunbergii* (Japanese barberry). The herbaceous layer is variable, often containing grasses and forbs of both native and exotic origin. Common species include *Ageratina altissima var. altissima* (white snakeroot), *Polygonum persicaria* (spotted ladysthumb), *Impatiens capensis* (jewelweed), *Glechoma hederacea* (ground ivy), *Polystichum acrostichoides* (Christmas fern), *Calystegia sepium* ssp. *sepium* (hedge false bindweed), *Galium aparine* (stickywilly), *Oxalis stricta* (common yellow oxalis), *Polygonum virginianum* (jumpseed), *Dennstaedtia punctilobula* (eastern hayscented fern), *Arisaema triphyllum* (Jack in the pulpit), *Allium vineale* (wild garlic), and *Veronica officinalis* (common gypsyweed), among many others. The invasive species *Alliaria petiolata* (garlic mustard), *Microstegium vimineum* (Nepalese browntop), and *Polygonum caespitosum* (oriental ladysthumb) can be abundant in this disturbed forest type. Vines can be absent or abundant. In stands with high vine cover, the vegetation structure can be altered by the weight of the vines pulling down trees and shrubs. Common vines include *Parthenocissus quinquefolia* (Virginia creeper), *Toxicodendron radicans* (eastern poison ivy), *Vitis labrusca* (fox grape), and the invasive vines *Celastrus orbiculata* (Asian bittersweet) and *Lonicera japonica* (Japanese honeysuckle).

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Acer rubrum* (red maple), *Fraxinus americana* (white ash), *Liriodendron tulipifera* (tuliptree), *Prunus serotina* (black cherry), *Robinia pseudoacacia* (black locust)
Tree subcanopy	Broad-leaved deciduous tree	*Acer rubrum* (red maple)
Tall shrub/sapling	Broad-leaved deciduous tree	*Carpinus caroliniana* (American hornbeam)
Tall shrub/sapling	Broad-leaved deciduous shrub	*Lindera benzoin* (northern spicebush), *Rosa multiflora* (multiflora rose)
Herb (field)	Forb	*Alliaria petiolata* (garlic mustard), *Polygonum persicaria* (spotted ladysthumb)
Herb (field)	Graminoid	*Microstegium vimineum* (Nepalese browntop)

Characteristic Species: *Acer rubrum* (red maple), *Alliaria petiolata* (garlic mustard), *Berberis thunbergii* (Japanese barberry), *Elaeagnus umbellata* (autumn olive), *Fraxinus americana* (white ash), *Juglans nigra* (black walnut), *Liriodendron tulipifera* (tuliptree), *Microstegium vimineum* (Nepalese browntop), *Polygonum persicaria* (spotted ladysthumb), *Prunus serotina* (black

cherry), *Robinia pseudoacacia* (black locust), *Rosa multiflora* (multiflora rose), *Rubus allegheniensis* (Allegheny blackberry).
Other Noteworthy Species: Information not available.
USFWS Wetland System: Not applicable.

DISTRIBUTION
Range: This vegetation is currently described from Pennsylvania, New York, and New Jersey but is of broader distribution in the northeastern U.S.
States/Provinces: CT, DE, MA, NJ, NY, PA.
Federal Lands: NPS (Allegheny Portage Railroad, Boston Harbor Islands, Delaware Water Gap, Fort Necessity, Friendship Hill, Gateway, Gettysburg, Johnstown Flood, Morristown, Sagamore Hill, Saratoga, Saugus Iron Works, Upper Delaware, Valley Forge, Weir Farm); USFWS (Erie, Great Meadows?, Prime Hook).

CONSERVATION STATUS
Rank: GNA (ruderal) (29-Nov-2004).
Reasons: This vegetation is modified by human activity and not of conservation concern.

CLASSIFICATION INFORMATION
Status: Standard.
Confidence: 2 - Moderate.
Comments: This vegetation is broadly defined and varies widely in composition across its range, presenting a classification challenge at the alliance level.
Similar Associations:
Juglans nigra / Verbesina alternifolia Forest (CEGL007879).
Liriodendron tulipifera - Quercus spp. Forest (CEGL007221)--is more strongly dominated by *Liriodendron* and is generally in a later successional state as evidenced by taller trees and more closed canopy.
Prunus serotina - Sassafras albidum - (Fraxinus americana) / Juniperus virginiana Forest (CEGL004133).
Robinia pseudoacacia Forest (CEGL007279).
Related Concepts: Information not available.

SOURCES
Description Authors: L. A. Sneddon, mod. S. C. Gawler and E. Largay.
References: Eastern Ecology Working Group n.d., Ehrenfeld 1977, Fike 1999, NRCS 2001b, NRCS 2004, Perles et al. 2006c, Podniesinski et al. 2006, Soil Conservation Service 1987.



Figure E4. Northeastern Modified Successional Forest in Gateway National Recreation Area, Jamaica Bay Unit (Accuracy Assessment Point Ref1, photo no. 1130). 8/15/2006. NAD 1983 / UTM easting 597021, northing 4500655.

COMMON NAME (PARK-SPECIFIC): SUCCESSIONAL MARITIME FOREST

SYNONYMS

NVC English Name: **Black Cherry - Sassafras - Canada Serviceberry - Black Oak / Roundleaf Greenbrier Forest**

NVC Scientific Name: ***Prunus serotina - Sassafras albidum - Amelanchier canadensis – Quercus velutina / Smilax rotundifolia*** **Forest**

NVC Identifier: **CEGL006145**

LOCAL INFORMATION

Environmental Description: This maritime forest community occurs most often on stabilized backdunes, generally leeward of secondary maritime dunes or in protected hollows. It can also be found farther inland in association with tall maritime shrubland. Substrates are somewhat poorly drained to excessively drained coarse to fine sands originating from marine- or eolian-derived sand or sandy dredge fill. Soils are in the Hooksan, Bigapple, Barren and Jamaica series (NRCS 2001b).

Vegetation Description: The somewhat open tree canopy (to 15 m tall) of this successional maritime forest is strongly dominated by *Prunus serotina* (black cherry) with *Celtis occidentalis* (common hackberry). Associated canopy species include *Acer rubrum* (red maple), *Ilex opaca* (American holly), *Populus alba* (white poplar), and *Robinia pseudoacacia* (black locust) with lesser amounts of *Juniperus virginiana* (eastern redcedar), *Pinus thunbergiana* (Japanese black pine), *Populus deltoides* (eastern cottonwood), and *Rhus typhina* (staghorn sumac). *Celtis occidentalis* (common hackberry), *Ailanthus altissima* (tree of heaven), *Rhus typhina* (staghorn sumac), *Prunus serotina* (black cherry), and *Populus tremuloides* (quaking aspen) contribute to the sparse subcanopy. Tall-shrub cover can be almost 35%. *Morella pensylvanica* (northern bayberry) and *Prunus serotina* (black cherry) are co-dominant with a mix of early-successional species that are also important in the short-shrub layer, including *Rhus copallinum* (flameleaf sumac), *Elaeagnus umbellata* (autumn olive), *Celtis occidentalis* (common hackberry), *Rosa multiflora* (multiflora rose), *Frangula alnus* (glossy buckthorn), *Viburnum dentatum* (southern arrowwood), *Euonymus atropurpureus* (eastern wahoo), *Lonicera tatarica* (Tatarian honeysuckle), and *Populus alba* (white poplar), among others. Vines and lianas are common and extend into at least the tall-shrub layer. *Toxicodendron radicans* (eastern poison ivy), *Celastrus orbiculata* (Asian bittersweet), and *Lonicera japonica* (Japanese honeysuckle) are the most abundant species, but *Parthenocissus quinquefolia* (Virginia creeper) and *Smilax rotundifolia* (roundleaf greenbrier) are also common. The sparse herbaceous layer can include *Artemisia vulgaris* (common wormwood), *Geranium robertianum* (Robert geranium), *Maianthemum stellatum* (starry false lily of the valley), *Panicum virgatum* (switchgrass), *Schizachyrium scoparium* (little bluestem), and/or *Phragmites australis* (common reed).

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Prunus serotina* (black cherry)
Tree subcanopy	Broad-leaved deciduous tree	*Celtis occidentalis* (common hackberry)
Tall shrub/sapling	Broad-leaved deciduous shrub	*Morella pensylvanica* (northern bayberry), *Prunus serotina* (black cherry)
Short shrub/sapling	Broad-leaved deciduous shrub	*Morella pensylvanica* (northern bayberry)
Herb (field)	Vine/Liana	*Celastrus orbiculata* (Asian bittersweet), *Lonicera japonica* (Japanese honeysuckle), *Toxicodendron radicans* (eastern poison ivy)
Herb (field)	Forb	*Artemisia vulgaris* (common wormwood)

Characteristic Species: *Artemisia vulgaris* (common wormwood), *Celastrus orbiculata* (Asian bittersweet), *Lonicera japonica* (Japanese honeysuckle), *Morella pensylvanica* (northern bayberry), *Prunus serotina* (black cherry), *Toxicodendron radicans* (eastern poison ivy).
Other Noteworthy Species: Information not available.
Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
NY	SNR	=	1	Successional maritime forest	Edinger et al. 2002
NJ	S1S2	=	1	*Prunus serotina-Sassafras albidum - Amelanchier canadensis/Smilax rotundifolia* Shrubland	Breden et al. 2001

Local Range: This association occurs in the Sandy Hook Unit; in the Great Kills section of the Staten Island Unit; and in the Fort Tilden, Floyd Bennett Field, Canarsie Pier, and Jamaica Bay Wildlife Refuge sections of the Jamaica Bay Unit.
Classification Comments: None.
Other Comments: None.
Local Description Authors: G. J. Edinger and A. L. Feldmann.
Plots: 1l, 1o, 1z, 3al, 8an, 77, 90YY, 106XX, 117XX, 120YY, 121YY, 122YY, 132YY, 153YY, 163, 168XX, 215, 233, 241, 260, 270, 284.
Gateway National Recreation Area Inventory Notes: Information not available.

GLOBAL INFORMATION

NVC CLASSIFICATION

Physiognomic Class	Forest (I)
Physiognomic Subclass	Deciduous forest (I.B.)
Physiognomic Group	Cold-deciduous forest (I.B.2.)
Physiognomic Subgroup	Natural/Semi-natural cold-deciduous forest (I.B.2.N.)
Formation	Lowland or submontane cold-deciduous forest (I.B.2.N.a.)
Alliance	*Prunus serotina - Acer rubrum - Amelanchier canadensis - Quercus* spp. Forest Alliance (A.237)
Alliance (English name)	Black Cherry - Red Maple - Canada Serviceberry - Oak species Forest Alliance
Association	*Prunus serotina - Sassafras albidum - Amelanchier canadensis - Quercus velutina / Smilax rotundifolia* Forest
Association (English name)	Black Cherry - Sassafras - Canada Serviceberry - Black Oak / Roundleaf Greenbrier Forest
Ecological System(s):	Northern Atlantic Coastal Plain Maritime Forest (CES203.302).

GLOBAL DESCRIPTION

Concept Summary: This maritime forest community of the North Atlantic Coast Ecoregion occurs on sheltered backdunes, bluffs, or more interior coastal areas not directly influenced by overwash but affected by salt spray and wind-pruning. Vegetation in these sheltered areas is sometimes referred to as "sunken forest." This name refers to the topographic position of these examples, which are found in large depressions, lower in elevation (by 1-3 m) than the interdunes. These examples are shielded from strong prevailing winds and salt spray, which permits lush growth of broadleaf shrub and vine species. Soils are coarse, well-drained sand subject to considerable shifting during coastal storms, or till and sand deposits of terminal moraines. Physiognomy is variable and ranges from closed-canopy forest to open woodland to dense tall shrubland, and may be more accurately called scrub. Trees found in this community are usually stunted and flat-topped; the canopy may be only 3-7 m tall. Dominant trees vary locally and include *Prunus serotina* (black cherry), *Sassafras albidum* (sassafras), and *Amelanchier canadensis* (Canadian serviceberry), with admixtures of *Celtis occidentalis* (common hackberry), *Quercus velutina* (black oak), *Pinus rigida* (pitch pine), *Juniperus virginiana* (eastern redcedar), *Acer rubrum* (red maple), *Amelanchier stolonifera* (running serviceberry), and in southern occurrences *Quercus coccinea* (scarlet oak), *Quercus falcata* (southern red oak), *Liquidambar styraciflua* (sweetgum), and *Ilex opaca* (American holly). Additional shrub species may also contribute substantially to the canopy and include *Vaccinium corymbosum* (highbush blueberry), *Morella pensylvanica* (northern bayberry), *Gaylussacia baccata* (black huckleberry), *Viburnum recognitum* (southern arrowwood), *Viburnum dentatum* (southern arrowwood), and *Rosa virginiana* (Virginia rose). A true shrub layer is generally not present. Lianas are common and can be dense in the canopy or the ground layer; species include *Parthenocissus quinquefolia* (Virginia creeper), *Toxicodendron radicans* (eastern poison ivy), *Smilax rotundifolia* (roundleaf greenbrier), and *Smilax glauca* (cat greenbrier). The understory is generally sparse with tree or vine seedlings plus herbaceous species, including *Aralia nudicaulis* (wild sarsaparilla), *Moehringia lateriflora* (bluntleaf sandwort), *Maianthemum stellatum* (starry false lily of the valley), and *Maianthemum canadense* (Canada mayflower). Several invasive species can be prevalent in this association, including *Lonicera morrowii* (Morrow's honeysuckle), *Lonicera japonica* (Japanese honeysuckle), *Ligustrum vulgare* (European privet), *Berberis vulgaris* (common barberry), and *Celastrus orbiculata* (Asian bittersweet).

Environmental Description: This association occurs most often on stabilized backdunes, generally leeward of secondary dunes or in protected hollows. It also occurs on bluffs or in more interior coastal areas. It is subject to varying degrees of wind and salt spray. Soils are coarse, well-drained sand subject to considerable shifting during coastal storms, or till and sand deposits of terminal moraines.

Vegetation Description: This association is generally a maritime forest or scrub forest, although physiognomy can vary considerably. Trees found in this community are usually stunted and flat-topped; the canopy may be only 3-7 m tall. Dominant trees vary locally but often include *Prunus serotina* (black cherry), *Sassafras albidum* (sassafras), and *Amelanchier canadensis* (Canadian serviceberry), with admixtures of *Celtis occidentalis* (common hackberry), *Quercus velutina* (black oak), *Pinus rigida* (pitch pine), *Juniperus virginiana* (eastern redcedar), *Acer rubrum* (red maple), *Amelanchier stolonifera* (running serviceberry), and in southern occurrences *Quercus coccinea* (scarlet oak), *Quercus falcata* (southern red oak), *Liquidambar styraciflua* (sweetgum), and/or *Ilex opaca* (American holly). Additional shrub species may also contribute substantially to the canopy and include *Vaccinium corymbosum* (highbush blueberry), *Morella*

pensylvanica (northern bayberry), *Gaylussacia baccata* (black huckleberry), *Prunus maritima* (beach plum), *Viburnum recognitum* (southern arrowwood), *Viburnum dentatum* (southern arrowwood), and *Rosa virginiana* (Virginia rose). A true shrub layer is generally not present. Lianas are common and can be dense in the canopy or in the ground layer; species include *Parthenocissus quinquefolia* (Virginia creeper), *Toxicodendron radicans* (eastern poison ivy), *Smilax rotundifolia* (roundleaf greenbrier), and *Smilax glauca* (cat greenbrier). The understory is generally sparse with tree or vine seedlings plus herbaceous species, including *Aralia nudicaulis* (wild sarsaparilla), *Moehringia lateriflora* (bluntleaf sandwort), *Maianthemum stellatum* (starry false lily of the valley) and *Maianthemum canadense* (Canada mayflower). Several invasive species can be prevalent in this association, including *Lonicera morrowii* (Morrow's honeysuckle), *Lonicera japonica* (Japanese honeysuckle), *Ligustrum vulgare* (European privet), *Berberis vulgaris* (common barberry), and *Celastrus orbiculata* (Asian bittersweet).

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Amelanchier canadensis* (Canadian serviceberry), *Prunus serotina* (black cherry), *Quercus velutina* (black oak), *Sassafras albidum* (sassafras)
Shrub/sapling (tall & short)	Vine/Liana	*Parthenocissus quinquefolia* (Virginia creeper), *Smilax rotundifolia* (roundleaf greenbrier), *Toxicodendron radicans* (eastern poison ivy)

Characteristic Species: *Amelanchier canadensis* (Canadian serviceberry), *Ilex opaca* (American holly), *Parthenocissus quinquefolia* (Virginia creeper), *Prunus serotina* (black cherry), *Quercus velutina* (black oak), *Sassafras albidum* (sassafras), *Smilax rotundifolia* (roundleaf greenbrier), *Toxicodendron radicans* (eastern poison ivy).

Other Noteworthy Species: Information not available.

USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: The range of this community (estimated at 400 square km) is from southern New Hampshire to Delaware but is restricted to the coast.

States/Provinces: CT, DE, MA, NH, NJ:S1S2, NY, RI.

Federal Lands: NPS (Boston Harbor Islands, Cape Cod, Fire Island, Gateway); USFWS (Parker River, Prime Hook).

CONSERVATION STATUS

Rank: G2G3 (31-Jan-2007).

Reasons: This maritime forest community is restricted in range to the coastal areas of seven northeastern states. Average occurrence size is estimated to be 20-100 acres, but many are substantially below this in size. The potential habitat of this community is naturally restricted to areas directly affected by maritime processes, e.g., salt spray and winds. Northeastern coastal areas in general are under significant threat from housing development.

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 2 - Moderate.

Comments: *Prunus serotina / Morella cerifera / Smilax rotundifolia* Scrub Forest (CEGL006319) is the southern analog of this association and is differentiated by having species of more southern affinity such as *Morella cerifera* (wax myrtle) and *Pinus taeda* (loblolly pine). This association is floristically similar to *Amelanchier canadensis* - *Viburnum* spp. - *Morella pensylvanica* (northern bayberry) Scrub Forest (CEGL006379), which is a successional type.

Similar Associations:

Amelanchier canadensis - *Viburnum* spp. - *Morella pensylvanica* Scrub Forest (CEGL006379).
Prunus serotina / Morella cerifera / Smilax rotundifolia Scrub Forest (CEGL006319).

Related Concepts:

Dune woodland/dune shrubland (Breden 1989) ?
High dune thicket (Martin 1959b) F
High mesic thicket (Martin 1959b) I
High xeric thicket (Martin 1959b) F
Maritime Forest, Dune Subtype, Deciduous Forest (Rawinski 1984) ?
Oak-Mixed Shrub-Herb Forest (Greller 1977) I
SNE Maritime Forest on Dunes/Maritime Juniper Forest (Rawinski 1984) ?
SNE Maritime Forest on Uplands/Maritime Oak Forest (Rawinski 1984) ?
SNE coastal rocky headland community (Rawinski 1984) ?
Scrub Forest (McDonnell 1979) ?
Southern New England forest on dunes (Rawinski 1984) ?
Tall thicket (Dunlop and Crow 1985) ?

SOURCES

Description Authors: S. L. Neid and L. A. Sneddon, mod. E. Largay.

References: Art 1987, Bellis 1992, Breden 1989, Breden et al. 2001, Burk 1968, Dowhan and Rozsa 1989, Dunlop and Crow 1985, Eastern Ecology Working Group n.d., Edinger et al. 2002, Greller 1977, Martin 1959b, McDonnell 1979, Metzler and Barrett 2001, NRCS 2001b, Rawinski 1984, Reschke 1990, Sperduto 1997b, Stalter 1979, Svenson 1970, Swain and Kearsley 2001.



Figure E5. Successional Maritime Forest in Gateway National Recreation Area, Jamaica Bay Unit (Accuracy Assessment Point 90YY, photo no. 1106). 8/3/2006. NAD 1983 / UTM easting 594658, northing 4498739.

COMMON NAME (PARK-SPECIFIC): NORTHEASTERN PIN OAK - SWAMP WHITE OAK FOREST

SYNONYMS

NVC English Name: **Pin Oak - (Swamp White Oak) - Red Maple / Highbush Blueberry / Cinnamon Fern Forest**

NVC Scientific Name: ***Quercus palustris - (Quercus bicolor) - Acer rubrum / Vaccinium corymbosum / Osmunda cinnamomea* Forest**

NVC Identifier: **CEGL006240**

LOCAL INFORMATION

Environmental Description: This association occurs in a small patch that is surrounded by high-density urban development and mowed playing fields. The forest is at least seasonally flooded and may contain vernal pools. Soils are very deep, acidic, moderately well-drained to well-drained loams in the Pompton and Branford series formed from glacial outwash (NRCS 2001b).

Vegetation Description: The nearly closed tree canopy of this seasonally wet forest is strongly dominated by *Quercus palustris* (pin oak) with associated *Acer rubrum* (red maple), *Nyssa sylvatica* (blackgum), *Quercus bicolor* (swamp white oak), and *Quercus coccinea* (scarlet oak). *Nyssa sylvatica* (blackgum) is dominant in the subcanopy with *Acer rubrum* (red maple), *Quercus palustris* (pin oak), and *Acer negundo* (boxelder) present in lower abundance. Both tall- and short-shrub layers are moderately well-developed and are also dominated by *Nyssa sylvatica* (blackgum). Associated shrubs and saplings can include *Rosa multiflora* (multiflora rose), *Acer negundo* (boxelder), *Viburnum dentatum* (southern arrowwood), *Ulmus americana* (American elm), *Prunus serotina* (black cherry), *Juglans nigra* (black walnut), *Quercus palustris* (pin oak), and *Liquidambar styraciflua* (sweetgum). Vines and lianas extend into the subcanopy and are strongly dominated by *Toxicodendron radicans* (eastern poison ivy) with *Smilax rotundifolia* (roundleaf greenbrier), *Parthenocissus quinquefolia* (Virginia creeper), *Smilax glauca* (cat greenbrier), and *Lonicera japonica* (Japanese honeysuckle). Herbaceous species are very sparse and do not exhibit dominance by any one species. Herbs can include scattered *Viola canadensis* (Canadian white violet), *Circaea lutetiana* (broadleaf enchanter's nightshade), *Polygonum cuspidatum* (Japanese knotweed), *Iris versicolor* (harlequin blueflag), *Impatiens capensis* (jewelweed), and *Boehmeria cylindrica* (smallspike false nettle).

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Acer rubrum* (red maple), *Quercus palustris* (pin oak)
Tree subcanopy	Broad-leaved deciduous tree	*Nyssa sylvatica* (blackgum)
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Nyssa sylvatica* (blackgum)
Herb (field)	Vine/Liana	*Toxicodendron radicans* (eastern poison ivy)
Herb (field)	Forb	*Circaea lutetiana* (broadleaf enchanter's nightshade), *Viola canadensis* (Canadian white violet)

Characteristic Species: *Acer rubrum* (red maple), *Nyssa sylvatica* (blackgum), *Quercus palustris* (pin oak), *Toxicodendron radicans* (eastern poison ivy).

Other Noteworthy Species: Information not available.

Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
NY	S4S5*	B	.	Red maple-hardwood swamp	Edinger et al. 2002
NJ	.	=	1	*Quercus (palustris, bicolor)-Acer rubrum/ Osmunda cinnamomea* Forest	Breden et al. 2001

Local Range: This association is only known from one small patch in the Miller Field section of the Staten Island Unit, New York.
Classification Comments: None.
Other Comments: None.
Local Description Authors: G. J. Edinger and A. L. Feldmann.
Plots: 1i, 145XX.
Gateway National Recreation Area Inventory Notes: Information not available.

GLOBAL INFORMATION

NVC CLASSIFICATION

Physiognomic Class	Forest (I)
Physiognomic Subclass	Deciduous forest (I.B.)
Physiognomic Group	Cold-deciduous forest (I.B.2.)
Physiognomic Subgroup	Natural/Semi-natural cold-deciduous forest (I.B.2.N.)
Formation	Seasonally flooded cold-deciduous forest (I.B.2.N.e.)
Alliance	*Quercus palustris - (Quercus bicolor)* Seasonally Flooded Forest Alliance (A.329)
Alliance (English name)	Pin Oak - (Swamp White Oak) Seasonally Flooded Forest Alliance
Association	*Quercus palustris - (Quercus bicolor) - Acer rubrum / Vaccinium corymbosum / Osmunda cinnamomea* Forest
Association (English name)	Pin Oak - (Swamp White Oak) - Red Maple / Highbush Blueberry / Cinnamon Fern Forest
Ecological System(s):	North-Central Interior Wet Flatwoods (CES202.700). Northern Atlantic Coastal Plain Basin Swamp and Wet Hardwood Forest (CES203.520).

GLOBAL DESCRIPTION

Concept Summary: This association comprises a perched hardwood swamp occurring in the northeastern United States from New Hampshire to Virginia. These are closed to partially open, deciduous, seasonally flooded forests. They occur in basin areas that are seasonally wet (winter and early spring) with a shallow, perched water table, but tend to be dry in late summer and early fall. There is usually pronounced hummock-and-hollow microtopography. They are found on sandy loams or clayey soils of glacial lakeplains, or on soils with impermeable subsoils in unglaciated regions. There is generally some layer that impedes drainage. The canopy is codominated by *Quercus palustris* (pin oak) and/or *Quercus bicolor* (swamp white oak) and *Acer rubrum* (red maple). Common associates include *Nyssa sylvatica* (blackgum) and occasionally *Tsuga canadensis* (eastern hemlock) or *Carya* (hickory) spp. The shrub layer may be sparse or dense and contains *Ilex verticillata* (common winterberry), *Vaccinium corymbosum* (highbush blueberry), *Viburnum dentatum* (southern arrowwood), *Cephalanthus occidentalis* (common buttonbush), and *Kalmia angustifolia* (sheep laurel). The sparse herb layer may include *Osmunda cinnamomea* (cinnamon fern), *Scirpus cyperinus* (woolgrass), *Thelypteris palustris*

(eastern marsh fern), *Thelypteris simulata* (bog fern), *Carex frankii* (Frank's sedge), *Glyceria striata* (fowl mannagrass), *Isoetes* (quillwort) spp., *Carex crinita* (fringed sedge), *Onoclea sensibilis* (sensitive fern), and *Osmunda regalis* (royal fern).

Environmental Description: This vegetation is found in basin areas that are seasonally wet (winter and early spring) with a shallow, perched water table, but which tend to be dry in late summer and early fall. There is usually pronounced hummock-and-hollow microtopography. They are found on sandy loams or clayey soils of glacial lakeplains, or on soils with impermeable subsoils in unglaciated regions. Although substrates are variable, all generally have some layer that impedes drainage and may receive groundwater seepage. Soils collected from Maryland and Virginia plots have very low pH and base cation levels.

Vegetation Description: This seasonally flooded pin oak community occurs in the northeastern United States. These are closed to partially open, deciduous, seasonally flooded forests codominated by *Quercus palustris* (pin oak) and *Acer rubrum* (red maple). Common associates include *Quercus bicolor* (swamp white oak), *Nyssa sylvatica* (blackgum), and occasionally *Tsuga canadensis* (eastern hemlock) or *Carya* (hickory) spp. The shrub layer may be sparse or dense and contains *Ilex verticillata* (common winterberry), *Vaccinium corymbosum* (highbush blueberry), and *Viburnum dentatum* (southern arrowwood). The sparse herb layer may include *Osmunda cinnamomea* (cinnamon fern), *Scirpus cyperinus* (woolgrass), *Thelypteris palustris* (eastern marsh fern), *Thelypteris simulata* (bog fern), *Carex frankii* (Frank's sedge), *Glyceria striata* (fowl mannagrass), *Isoetes* (quillwort) spp., *Carex crinita* (fringed sedge), *Onoclea sensibilis* (sensitive fern), and *Osmunda regalis* (royal fern). Occurrences at the southern end of the range in Maryland and northern Virginia are generally very species-poor, with an overstory dominated by *Quercus palustris* (pin oak) (rarely *Quercus bicolor* (swamp white oak)), *Acer rubrum* (red maple), and *Liquidambar styraciflua* (sweetgum). Species of highbush blueberries (*Vaccinium corymbosum* (highbush blueberry), *Vaccinium fuscatum* (black highbush blueberry), and *Vaccinium formosum* (southern blueberry)) are the most characteristic shrubs. Herbs are very sparse.

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Acer rubrum* (red maple), *Quercus bicolor* (swamp white oak), *Quercus palustris* (pin oak)
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Ilex verticillata* (common winterberry)
Herb (field)	Fern or fern ally	*Osmunda cinnamomea* (cinnamon fern)

Characteristic Species: *Acer rubrum* (red maple), *Osmunda cinnamomea* (cinnamon fern), *Quercus bicolor* (swamp white oak).

Other Noteworthy Species: Information not available.

USFWS Wetland System: Palustrine.

DISTRIBUTION

Range: This vegetation occurs in southern New England south to Maryland and northern Virginia.

States/Provinces: CT, MA:S2, MD, NH, NJ, NY, PA, VA.

Federal Lands: DOD (Fort Belvoir); NPS (C&O Canal, Gateway, George Washington Parkway, National Capital-East, Prince William); USFWS (Great Swamp).

CONSERVATION STATUS

Rank: GNR (1-Dec-1997).

Reasons: Information not available.

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 2 - Moderate.

Comments: Vegetation tentatively assigned to this association was classified through analysis of a regional dataset assembled for the NCR vegetation mapping project. The type was represented by nine Maryland and Virginia plots. Composition of this southern variant differs somewhat from the existing description but is conceptually similar. Although six states to the north of Maryland and Virginia have recognized this type, substantial data from across this range are lacking (L. Sneddon pers. comm.). Therefore, at present, this association represents a broad concept that may have to be split once variation over its range is more fully understood.

Similar Associations:

Liquidambar styraciflua - Acer rubrum - Quercus phellos / Leucothoe racemosa Forest (CEGL006110)--similar to occurrences at the southern end of the range; occurs in Coastal Plain depressions of the Chesapeake Bay region.

Quercus palustris - (Fraxinus nigra) / Lindera benzoin / Carex bromoides Forest (CEGL007399).

Quercus palustris - Acer rubrum / Carex grayi - Geum canadense Forest (CEGL006185).

Quercus palustris - Quercus bicolor / Carex tribuloides - Carex radiata - (Carex squarrosa) Forest (CEGL006497).

Quercus palustris - Quercus bicolor / Viburnum prunifolium / Leersia virginica - Impatiens capensis Forest (CEGL004643).

Related Concepts: Information not available.

SOURCES

Description Authors: S. L. Neid, mod. G. P. Fleming.

References: Breden et al. 2001, Eastern Ecology Working Group n.d., Edinger et al. 2002, Fike 1999, Golet et al. 1993, Metzler and Barrett 2001, NRCS 2001b, Sperduto 2000a, Sperduto 2000b, Swain and Kearsley 2000, Swain and Kearsley 2001.



Figure E6. Northeastern Pin Oak - Swamp White Oak Forest in Gateway National Recreation Area, Staten Island Unit (plot GATE.23, NYNHP plot 1i). 7/18/2003. NAD 1983 / UTM easting 575873, northing 4491715.

COMMON NAME (PARK-SPECIFIC): SOUTHERN NEW ENGLAND RED MAPLE SEEPAGE SWAMP

SYNONYMS

NVC English Name: **Red Maple - (Green Ash, White Ash) / Northern Spicebush / Skunk-cabbage Forest**

NVC Scientific Name: ***Acer rubrum - Fraxinus (pennsylvanica, americana) / Lindera benzoin / Symplocarpus foetidus*** **Forest**

NVC Identifier: **CEGL006406**

LOCAL INFORMATION

Environmental Description: This deciduous seepage swamp occurs in the Jamaica Bay Wildlife Refuge in saturated soils at the edge of East Pond, whose water levels are artificially controlled. It is underlain by Barren series sand, which is very deep, somewhat poorly drained soil formed from sandy dredge fill that was transported and modified by human activity (NRCS 2001b). The swamp is not particularly species-rich, and it is surrounded by successional communities; on one side, it is bordered by reedgrass marsh and on the other by successional maritime forest.

Vegetation Description: The tree canopy of this seepage swamp is slightly open (over 80% cover) and canopy species are limited to *Acer rubrum* (red maple) and *Betula populifolia* (gray birch), which share dominance. The tall- and short-shrub layers each have about 30% cover and are dominated by *Frangula alnus* (glossy buckthorn) and *Viburnum dentatum* (southern arrowwood) with lesser amounts of *Acer rubrum* (red maple). With nearly 25% cover, *Toxicodendron radicans* (eastern poison ivy) is the dominant vine; it stays close to the ground and does not form lianas into the canopy. The herbaceous layer is similarly depauperate; it is codominated by *Thelypteris palustris* (eastern marsh fern) and *Phragmites australis* (common reed) with scattered *Calamagrostis canadensis* (bluejoint), *Osmunda cinnamomea* (cinnamon fern), and *Onoclea sensibilis* (sensitive fern). *Sphagnum* sp. (sphagnum) moss occurs in scattered patches.

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Acer rubrum* (red maple), *Betula populifolia* (gray birch)
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Frangula alnus* (glossy buckthorn)
Short shrub/sapling	Broad-leaved deciduous shrub	*Viburnum dentatum* (southern arrowwood)
Herb (field)	Vine/Liana	*Toxicodendron radicans* (eastern poison ivy)
Herb (field)	Graminoid	*Phragmites australis* (common reed)
Herb (field)	Fern or fern ally	*Thelypteris palustris* (eastern marsh fern)

Characteristic Species: *Acer rubrum* (red maple), *Phragmites australis* (common reed), *Thelypteris palustris* (eastern marsh fern), *Toxicodendron radicans* (eastern poison ivy), *Viburnum dentatum* (southern arrowwood).

Other Noteworthy Species: Information not available.

Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
NY	S4S5*	B	1	Red maple-hardwood swamp	Edinger et al. 2002
NJ	S3S5	=	1	*Acer rubrum-Fraxinus (pennsylvanica, americana)/Lindera benzoin/Symplocarpus foetidus* Forest	Breden et al. 2001

Local Range: This association is known from one location in New York on the east side of East Pond in the Jamaica Bay Wildlife Refuge, Jamaica Bay Unit.
Classification Comments: The expression of this association at Gateway represents a Coastal Plain variant of the type.
Other Comments: None.
Local Description Authors: G. J. Edinger and A. L. Feldmann.
Plots: 236.
Gateway National Recreation Area Inventory Notes: Information not available.

GLOBAL INFORMATION

NVC CLASSIFICATION

Physiognomic Class	Forest (I)
Physiognomic Subclass	Deciduous forest (I.B.)
Physiognomic Group	Cold-deciduous forest (I.B.2.)
Physiognomic Subgroup	Natural/Semi-natural cold-deciduous forest (I.B.2.N.)
Formation	Saturated cold-deciduous forest (I.B.2.N.g.)
Alliance	*Acer rubrum - Fraxinus pennsylvanica* Saturated Forest Alliance (A.3035)
Alliance (English name)	Red Maple - Green Ash Saturated Forest Alliance
Association	*Acer rubrum - Fraxinus (pennsylvanica, americana) / Lindera benzoin / Symplocarpus foetidus* Forest
Association (English name)	Red Maple - (Green Ash, White Ash) / Northern Spicebush / Skunk-cabbage Forest
Ecological System(s):	North-Central Appalachian Acidic Swamp (CES202.604). Central Appalachian Stream and Riparian (CES202.609).

GLOBAL DESCRIPTION

Concept Summary: This association is a seepage swamp dominated by *Acer rubrum* (red maple) and ranging from southern New England to Virginia. It generally occurs in saturated situations on slightly sloping hillsides, along small streams, or in basins that receive overland flooding in addition to groundwater influence. In general, these swamps are moderately acidic to moderately basic and have some seepage indicators but are not particularly species-rich. Soils are shallow to moderately deep mucks over mineral soils. *Acer rubrum* (red maple) dominates the canopy; *Fraxinus pennsylvanica* (green ash) or *Fraxinus americana* (white ash) are usually also found in the canopy. *Fraxinus nigra* (black ash) is not generally associated with this type and, if present, occurs only as scattered individuals. Other canopy or subcanopy associates may include *Liriodendron tulipifera* (tuliptree), *Quercus bicolor* (swamp white oak), *Quercus palustris* (pin oak), *Prunus serotina* (black cherry), *Fagus grandifolia* (American beech), *Betula lenta* (sweet birch), *Ulmus americana* (American elm), and *Ulmus rubra* (slippery elm). Conifers such as *Tsuga canadensis* (eastern hemlock) or *Pinus strobus* (eastern white pine) are generally absent or

occur in very low abundance. The shrub layer may be fairly open to quite dense, depending on the amount of canopy closure. Shrub species commonly include *Ilex verticillata* (common winterberry), *Rhododendron viscosum* (swamp azalea), *Clethra alnifolia* (coastal sweetpepperbush), *Lindera benzoin* (northern spicebush), *Cornus amomum* (silky dogwood), *Alnus serrulata* (hazel alder), and less commonly *Vaccinium corymbosum* (highbush blueberry), *Lyonia ligustrina* (maleberry), *Ilex montana* (mountain holly), *Toxicodendron vernix* (poison sumac), *Viburnum dentatum* (southern arrowwood), and *Viburnum nudum var. cassinoides* (withe-rod). The herbaceous layer is variable in cover; *Symplocarpus foetidus* (skunk cabbage) and *Osmunda cinnamomea* (cinnamon fern) are nearly always present. In some areas, tall ferns (*Osmunda cinnamomea* (cinnamon fern), *Onoclea sensibilis* (sensitive fern), *Osmunda regalis* (royal fern), *Thelypteris palustris* (eastern marsh fern), *Thelypteris noveboracensis* (New York fern)) form an herbaceous canopy within which other species are scattered. Microtopography is generally pronounced, resulting from tip-ups. Tree seedlings and *Sphagnum* (sphagnum) mosses are common on hummocks but do not in general form extensive carpets. Additional nonvascular species can include *Plagiomnium cuspidatum* (toothed plagiomnium moss) and *Calliergon* (calliergon moss) spp. Invasive shrubs and herbs, including *Berberis thunbergii* (Japanese barberry), *Rosa multiflora* (multiflora rose), *Lonicera morrowii* (Morrow's honeysuckle), *Alliaria petiolata* (garlic mustard), and *Microstegium vimineum* (Nepalese browntop), may be abundant.

Environmental Description: This association is a seepage swamp dominated by *Acer rubrum* (red maple) and ranging from southern New England to Virginia. It generally occurs in saturated soils on slightly sloping hillsides, along small headwater streams, or in depressions at the edges of floodplains that receive overland flooding in addition to groundwater inputs. In general, these swamps are moderately acidic to moderately basic and have some seepage indicators but are not particularly species-rich. Soils are shallow to moderately deep mucks over mineral soils. Microtopography is generally pronounced, resulting from tip-ups and the braided character of the drainage. Soil samples collected from 18 Maryland and Virginia plot samples are "intermediate" in chemistry, i.e., mean pH = 5.2, mean Ca = 1071 ppm, mean Mg = 195 ppm, mean total base saturation = 57%, but are more "basic" than "acidic" in their calcium and magnesium content.

Vegetation Description: *Acer rubrum* (red maple) dominates the canopy; *Fraxinus pennsylvanica* (green ash) or *Fraxinus americana* (white ash) are usually also found in the canopy. *Fraxinus nigra* (black ash) is not generally associated with this type and, if present, occurs only as scattered individuals. Other canopy or subcanopy associates may include *Liriodendron tulipifera* (tuliptree), *Quercus bicolor* (swamp white oak), *Quercus palustris* (pin oak), *Prunus serotina* (black cherry), *Fagus grandifolia* (American beech), *Betula lenta* (sweet birch), *Ulmus americana* (American elm), and *Ulmus rubra* (slippery elm). Conifers such as *Tsuga canadensis* (eastern hemlock) or *Pinus strobus* (eastern white pine) are generally absent or occur in very low abundance. The shrub layer may be fairly open to quite dense, depending on the amount of canopy closure. Shrub species commonly include *Ilex verticillata* (common winterberry), *Rhododendron viscosum* (swamp azalea), *Clethra alnifolia* (coastal sweetpepperbush), *Lindera benzoin* (northern spicebush), *Cornus amomum* (silky dogwood), *Alnus serrulata* (hazel alder), *Carpinus caroliniana* (American hornbeam), and less commonly *Vaccinium corymbosum* (highbush blueberry), *Lyonia ligustrina* (maleberry), *Ilex montana* (mountain holly), *Toxicodendron vernix* (poison sumac), *Viburnum dentatum* (southern arrowwood), and *Viburnum nudum var. cassinoides* (withe-rod). The herbaceous layer is variable in cover; *Symplocarpus foetidus* (skunk cabbage) and *Osmunda cinnamomea* (cinnamon fern)

are nearly always present. In some areas, tall ferns (*Osmunda cinnamomea* (cinnamon fern), *Onoclea sensibilis* (sensitive fern), *Osmunda regalis* (royal fern), *Thelypteris palustris* (eastern marsh fern), *Thelypteris noveboracensis* (New York fern)) form an herbaceous canopy within which other species are scattered. These other herbaceous species include *Impatiens capensis* (jewelweed), *Galium aparine* (stickywilly), *Geum canadense* (white avens), *Arisaema triphyllum* (Jack in the pulpit), *Carex stricta* (upright sedge), *Carex gracillima* (graceful sedge), *Carex intumescens* (greater bladder sedge), *Carex radiata* (eastern star sedge), *Carex laevivaginata* (smoothsheath sedge), *Veratrum viride* (green false hellebore), *Boehmeria cylindrica* (smallspike false nettle), *Chelone glabra* (white turtlehead), *Cardamine pensylvanica* (Pennsylvania bittercress), *Pilea pumila* (Canadian clearweed), and *Glyceria* (mannagrass) spp. At the southern end of the range in Maryland and Virginia, *Symplocarpus foetidus* (skunk cabbage) is usually greatly dominant (>50% cover) early in the growing season, with *Saururus cernuus* (lizard's tail) frequently assuming patch-dominance during the summer. Tree seedlings and *Sphagnum* (sphagnum) mosses are common on hummocks but do not in general form extensive carpets. Additional nonvascular species can include *Plagiomnium cuspidatum* (toothed plagiomnium moss) and *Calliergon* (calliergon moss) spp. Invasive shrubs and herbs, including *Berberis thunbergii* (Japanese barberry), *Rosa multiflora* (multiflora rose), *Lonicera morrowii* (Morrow's honeysuckle), *Alliaria petiolata* (garlic mustard), and *Microstegium vimineum* (Nepalese browntop), may be abundant.

Most Abundant Species:

Stratum	Lifeform	Species
Tree (canopy & subcanopy)	Broad-leaved deciduous tree	*Acer rubrum* (red maple)
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Ilex verticillata* (common winterberry), *Lindera benzoin* (northern spicebush)
Herb (field)	Forb	*Symplocarpus foetidus* (skunk cabbage)
Herb (field)	Fern or fern ally	*Osmunda cinnamomea* (cinnamon fern)

Characteristic Species: *Acer rubrum* (red maple), *Clethra alnifolia* (coastal sweetpepperbush), *Fraxinus americana* (white ash), *Fraxinus pennsylvanica* (green ash), *Lindera benzoin* (northern spicebush), *Osmunda cinnamomea* (cinnamon fern), *Rhododendron viscosum* (swamp azalea), *Symplocarpus foetidus* (skunk cabbage).

Other Noteworthy Species: Information not available.

USFWS Wetland System: Palustrine.

DISTRIBUTION

Range: This vegetation occurs in southern New England south through the mid-Atlantic states to Virginia.

States/Provinces: CT, DE?, MA, MD, NH, NJ:S3S5, NY, PA, RI, VA, VT.

Federal Lands: NPS (Appomattox Court House, C&O Canal, Delaware Water Gap, Fort Necessity, Gateway, George Washington Parkway, Minute Man, Morristown, Prince William, Rock Creek, Upper Delaware, Weir Farm, Wolf Trap); USFWS (Great Meadows?).

CONSERVATION STATUS

Rank: G4G5 (30-Jan-2007).

Reasons: Although this is a small-patch community, its environmental requirements are quite general, and it occurs where acidic groundwater seepage emerges on the headwaters of stream drainages. The range extent crosses several ecoregions and 10 states. The major threat to this community is housing development, with disruption of groundwater source a lesser threat.

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 1 - Strong.

Comments: Classification of this type at the southern end of the range is supported by analysis of a 1250-plot regional dataset compiled for the NCR and Mid-Atlantic national parks vegetation mapping project. In that analysis, this association was represented a group of 18 Maryland and Virginia plots.

Similar Associations:

Acer rubrum - Betula alleghaniensis / Lindera benzoin Forest (CEGL006936).
Acer rubrum - Fraxinus nigra - (Tsuga canadensis) / Tiarella cordifolia Forest (CEGL006502).
Acer rubrum / Nemopanthus mucronatus - Vaccinium corymbosum Forest (CEGL006220).
Acer rubrum / Rhododendron viscosum - Clethra alnifolia Forest (CEGL006156).

Related Concepts:

Inland Red Maple Swamp (Breden 1989) B
Palustrine Broad-leaved Deciduous Forested Wetlands (PFO1) (Cowardin et al. 1979) ?
Red or Silver Maple-Green Ash Swamp (Thompson 1996) ?
Southern New England stream bottom forest (Rawinski 1984) ?

SOURCES

Description Authors: L. A. Sneddon, mod. S. C. Gawler and G. P. Fleming.

References: Breden 1989, Breden et al. 2001, Cowardin et al. 1979, Eastern Ecology Working Group n.d., Edinger et al. 2002, Ehrenfeld 1977, Enser 1993, Golet et al. 1993, Harrison 2004, Metzler and Barrett 2001, NRCS 2001b, NRCS 2004, Rawinski 1984, Reschke 1990, Sperduto and Nichols 2004, Swain and Kearsley 2001, Thompson 1996, Thompson and Sorenson 2000.



Figure E7. Southern New England Red Maple Seepage Swamp in Gateway National Recreation Area, Jamaica Bay Unit (Accuracy Assessment Point 236, photo no. 1168). 8/17/2006. NAD 1983 / UTM easting 599419, northing 4497380.

COMMON NAME (PARK-SPECIFIC): RED MAPLE - BLACKGUM BASIN SWAMP

SYNONYMS

NVC English Name: **Red Maple - Blackgum - Yellow Birch / Peatmoss species Forest**
NVC Scientific Name: ***Acer rubrum - Nyssa sylvatica - Betula alleghaniensis / Sphagnum* spp. Forest**
NVC Identifier: **CEGL006014**

LOCAL INFORMATION

Environmental Description: This association is bounded by Reed-grass Tidal Marsh (CEGL004187) and Successional Maritime Forest (CEGL006145) and is underlain by very deep, poorly drained, and frequently ponded Jamaica sand (NRCS 2001b).

Vegetation Description: This swamp is dominated by *Nyssa sylvatica* (blackgum) in the canopy and subcanopy layers. *Acer rubrum* (red maple) is also present in the canopy. Tall shrubs and saplings of *Vaccinium corymbosum* (highbush blueberry), *Viburnum dentatum* (southern arrowwood), *Nyssa sylvatica* (blackgum), and *Acer rubrum* (red maple) are present in moderately low abundance. *Toxicodendron radicans* (eastern poison ivy) and *Smilax rotundifolia* (roundleaf greenbrier) vines are also present at moderate abundance. Herbs are sparse; *Polygonum hydropiperoides* (swamp smartweed), *Maianthemum stellatum* (starry false lily of the valley), and *Carex* (sedge) spp. are the most common species.

Most Abundant Species:

Stratum	Lifeform	Species
Tree (canopy & subcanopy)	Broad-leaved deciduous tree	*Nyssa sylvatica* (blackgum)
Tall shrub/sapling	Broad-leaved deciduous shrub	*Vaccinium corymbosum* (highbush blueberry)
Herb (field)	Vine/Liana	*Toxicodendron radicans* (eastern poison ivy)
Herb (field)	Forb	*Polygonum hydropiperoides* (swamp smartweed)

Characteristic Species: *Acer rubrum* (red maple), *Nyssa sylvatica* (blackgum), *Polygonum hydropiperoides* (swamp smartweed), *Smilax rotundifolia* (roundleaf greenbrier), *Toxicodendron radicans* (eastern poison ivy), *Vaccinium corymbosum* (highbush blueberry), *Viburnum dentatum* (southern arrowwood).

Other Noteworthy Species: Information not available.

Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
NY	SNR*	B	1	Red maple-black gum swamp	Edinger et al. 2002
NJ	.	=	1	*Acer rubrum-Nyssa sylvatica-Betula alleghaniensis/Sphagnum* spp. Forest	Breden et al. 2001

Local Range: This association is only known to occur in the Sandy Hook Unit.

Classification Comments: None.

Other Comments: None.

Local Description Authors: G. J. Edinger and A. L. Feldmann.

Plots: ref3.

Gateway National Recreation Area Inventory Notes: Information not available.

GLOBAL INFORMATION

NVC CLASSIFICATION

Physiognomic Class	Forest (I)
Physiognomic Subclass	Deciduous forest (I.B.)
Physiognomic Group	Cold-deciduous forest (I.B.2.)
Physiognomic Subgroup	Natural/Semi-natural cold-deciduous forest (I.B.2.N.)
Formation	Saturated cold-deciduous forest (I.B.2.N.g.)
Alliance	*Acer rubrum - Nyssa sylvatica* Saturated Forest Alliance (A.348)
Alliance (English name)	Red Maple - Blackgum Saturated Forest Alliance
Association	*Acer rubrum - Nyssa sylvatica - Betula alleghaniensis / Sphagnum* spp. Forest
Association (English name)	Red Maple - Blackgum - Yellow Birch / Peatmoss species Forest
Ecological System(s):	Laurentian-Acadian Pine-Hemlock-Hardwood Forest (CES201.563). Appalachian (Hemlock)-Northern Hardwood Forest (CES202.593). Northeastern Interior Dry-Mesic Oak Forest (CES202.592). North-Central Appalachian Acidic Swamp (CES202.604).

GLOBAL DESCRIPTION

Concept Summary: This blackgum basin swamp of the northeastern United States is found from the Central Appalachians north to central New England, at the northern range limit for *Nyssa sylvatica* (blackgum). It occupies saturated or seasonally wet basins, typically perched basins in small watersheds within upland forests. In most settings, the mineral soil is overlain with a shallow to deep peat layer. Conditions are highly acidic and nutrient-poor. The tree canopy varies from an open woodland to nearly complete. Shrubs are well-represented and may be locally dense. Herbs are likewise patchy, and the herb layer is usually dominated by only a few species. The bryoid layer varies but is often extensive. Hummock-and-hollow microtopography is often pronounced, with bryophytes common on the hummocks and in those hollows where water does not stand for long periods. The canopy is dominated by *Acer rubrum* (red maple) and *Nyssa sylvatica* (blackgum); however, even where red maple is more abundant, the longevity and stature of the blackgum trees give them a strong impact. *Betula alleghaniensis* (yellow birch), *Tsuga canadensis* (eastern hemlock), *Pinus strobus* (eastern white pine), and occasionally *Picea rubens* (red spruce) or *Picea mariana* (black spruce) may be minor canopy associates. The most abundant shrubs are *Ilex verticillata* (common winterberry) and *Vaccinium corymbosum* (highbush blueberry); associated shrub species include *Viburnum nudum var. cassinoides* (withe-rod), *Nemopanthus mucronatus* (catberry), *Kalmia angustifolia* (sheep laurel), *Gaylussacia baccata* (black huckleberry), *Chamaedaphne calyculata* (leatherleaf), *Lyonia ligustrina* (maleberry), *Spiraea alba var. latifolia* (white meadowsweet), and *Cephalanthus occidentalis* (common buttonbush). *Osmunda cinnamomea* (cinnamon fern) is the characteristic dominant in the herb layer, with associates including *Osmunda regalis* (royal fern), *Thelypteris palustris* (eastern marsh fern), *Woodwardia virginica* (Virginia chainfern), *Glyceria canadensis* (rattlesnake mannagrass), *Coptis trifolia* (threeleaf goldthread), *Carex atlantica* (prickly bog sedge), *Carex trisperma* (threeseeded sedge), *Carex folliculata* (northern long sedge), *Carex intumescens* (greater bladder sedge), *Calla palustris* (water arum), *Triadenum virginicum* (Virginia marsh St. Johnswort), and *Symplocarpus foetidus* (skunk cabbage). Mosses

are primarily *Sphagnum* (sphagnum) spp., including *Sphagnum palustre* (prairie sphagnum) and *Sphagnum magellanicum* (Magellan's sphagnum). These swamps are distinguished from other basin swamps in the Northern Appalachians by the presence of *Nyssa sylvatica* (blackgum). They are distinguished from blackgum swamps further south by the absence of more Central Appalachian species such as *Liquidambar styraciflua* (sweetgum), *Rhododendron maximum* (great laurel), *Rhododendron viscosum* (swamp azalea), and *Magnolia virginiana* (sweetbay).

Environmental Description: This blackgum basin swamp of the northeastern United States is found from the Central Appalachians north to central New England, at the northern range limit for *Nyssa sylvatica* (blackgum). It occupies saturated or seasonally wet basins, typically perched basins in small watersheds within upland forests. In most settings, the mineral soil is overlain with a shallow to deep peat layer. Conditions are highly acidic and nutrient-poor.

Vegetation Description: The tree canopy varies from an open woodland to nearly complete. Shrubs are well-represented and may be locally dense. Herbs are likewise patchy, and the herb layer is usually dominated by only a few species. The bryoid layer varies but is often extensive. Hummock-and-hollow microtopography is often pronounced, with bryophytes common on the hummocks and in those hollows where water does not stand for long periods. The canopy is dominated by *Acer rubrum* (red maple) and *Nyssa sylvatica* (blackgum); however, even where red maple is more abundant, the longevity and stature of the blackgum trees give them a strong impact. *Betula alleghaniensis* (yellow birch), *Tsuga canadensis* (eastern hemlock), *Pinus strobus* (eastern white pine), and in the north *Picea rubens* (red spruce) may be minor canopy associates. The most abundant shrubs are *Ilex verticillata* (common winterberry) and *Vaccinium corymbosum* (highbush blueberry); associated shrub species include *Viburnum nudum var. cassinoides* (withe-rod), *Nemopanthus mucronatus* (catberry), *Kalmia angustifolia* (sheep laurel), *Gaylussacia baccata* (black huckleberry), *Chamaedaphne calyculata* (leatherleaf), *Lyonia ligustrina* (maleberry), *Spiraea alba var. latifolia* (white meadowsweet), and *Cephalanthus occidentalis* (common buttonbush). *Osmunda cinnamomea* (cinnamon fern) is the characteristic dominant in the herb layer, with associates including *Osmunda regalis* (royal fern), *Thelypteris palustris* (eastern marsh fern), *Woodwardia virginica* (Virginia chainfern), *Glyceria canadensis* (rattlesnake mannagrass), *Coptis trifolia* (threeleaf goldthread), *Carex atlantica* (prickly bog sedge), *Carex trisperma* (threeseeded sedge), *Carex folliculata* (northern long sedge), *Carex intumescens* (greater bladder sedge), *Calla palustris* (water arum), *Triadenum virginicum* (Virginia marsh St. Johnswort), and *Symplocarpus foetidus* (skunk cabbage). Mosses are primarily *Sphagnum* (sphagnum) spp., including *Sphagnum palustre* (prairie sphagnum) and *Sphagnum magellanicum* (Magellan's sphagnum).

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Acer rubrum* (red maple), *Nyssa sylvatica* (blackgum)
Tall shrub/sapling	Broad-leaved deciduous shrub	*Ilex verticillata* (common winterberry), *Vaccinium corymbosum* (highbush blueberry)
Short shrub/sapling	Broad-leaved deciduous shrub	*Kalmia angustifolia* (sheep laurel), *Spiraea alba* var. *latifolia* (white meadowsweet)
Herb (field)	Forb	*Symplocarpus foetidus* (skunk cabbage)
Herb (field)	Graminoid	*Carex folliculata* (northern long sedge)
Herb (field)	Fern or fern ally	*Osmunda cinnamomea* (cinnamon fern), *Thelypteris palustris* (eastern marsh fern)

Characteristic Species: *Acer rubrum* (red maple), *Betula alleghaniensis* (yellow birch), *Carex folliculata* (northern long sedge), *Chamaedaphne calyculata* (leatherleaf), *Ilex verticillata* (common winterberry), *Nyssa sylvatica* (blackgum), *Osmunda cinnamomea* (cinnamon fern), *Vaccinium corymbosum* (highbush blueberry).
Other Noteworthy Species: Information not available.
USFWS Wetland System: Palustrine.

DISTRIBUTION
Range: Information not available.
States/Provinces: CT, MA:S2, MD?, ME, NH:S1S2, NJ, NY, PA, VT.
Federal Lands: NPS (Delaware Water Gap, Gateway).

CONSERVATION STATUS
Rank: GNR (1-Dec-1997).
Reasons: Information not available.

CLASSIFICATION INFORMATION
Status: Standard.
Confidence: 2 - Moderate.
Comments: Information not available.
Similar Associations:
Acer rubrum - Betula alleghaniensis / Lindera benzoin Forest (CEGL006936).
Acer rubrum - Nyssa sylvatica - Magnolia virginiana / Viburnum nudum var. *nudum / Osmunda cinnamomea - Woodwardia areolata* Forest (CEGL006238).
Acer rubrum - Nyssa sylvatica High Allegheny Plateau, Central Appalachian Forest (CEGL006132).
Acer rubrum / Rhododendron viscosum - Clethra alnifolia Forest (CEGL006156).
Acer saccharum - Betula alleghaniensis - Fraxinus pennsylvanica / Lindera benzoin Forest (CEGL006956).
Tsuga canadensis - Betula alleghaniensis / Ilex verticillata / Sphagnum spp. Forest (CEGL006226).
Related Concepts:
Black gum-red maple swamp (NAP pers. comm. 1998) ?
Palustrine Broad-leaved Deciduous Saturated Forested Wetland (PFO1B) (Cowardin et al. 1979) ?
Red Maple-Black Gum Swamp (Thompson 1996) ?
Southern New England acidic seepage swamp, black gum swamp (Rawinski 1984) ?
Southern New England basin swamp, black gum association (Rawinski 1984) ?

SOURCES
Description Authors: S. C. Gawler.
References: Breden et al. 2001, Cain and Penfound 1938, Cowardin et al. 1979, Eastern Ecology Working Group n.d., Edinger et al. 2002, Fike 1999, Gawler 2002, Golet et al. 1993, Harrison 2004, Metzler and Barrett 2001, NAP pers. comm. 1998, NRCS 2001b, Rawinski 1984, Sperduto 2000b, Sperduto et al. 2000b, Swain and Kearsley 2001, Thompson 1996, Thompson and Sorenson 2000, Vogelmann 1976, Windisch 1995c, Zebryk 1990.



Figure E8. Red Maple - Blackgum Basin Swamp in Gateway National Recreation Area, Sandy Hook Unit (Accuracy Assessment Point Ref3, photo no. 1215). 8/23/2006. NAD 1983 / UTM easting 584886, northing 4478997.

COMMON NAME (PARK-SPECIFIC): MARITIME RED-CEDAR WOODLAND

SYNONYMS

NVC English Name: **Eastern Red-cedar / Northern Bayberry Woodland**

NVC Scientific Name: ***Juniperus virginiana* var. *virginiana* / *Morella pensylvanica* Woodland**

NVC Identifier: **CEGL006212**

LOCAL INFORMATION

Environmental Description: This association occurs on inactive, old sand dunes in association with maritime holly forest or maritime dunes or on the upper edge of low salt marsh. Most commonly, the substrate is fine sand consisting of very deep, excessively drained soils formed in eolian sands or sandy marine sediments. The community has also formed on sandy dredge spoils. Soils are in the Hooksan, Bigapple, and Jamaica series (NRCS 2001b).

Vegetation Description: This maritime woodland community has an open canopy (just over 50% cover) that is strongly dominated by *Juniperus virginiana* (eastern redcedar). The most abundant associated canopy species are *Prunus serotina* (black cherry), *Ilex opaca* (American holly), and *Celtis occidentalis* (common hackberry); occasionally individual trees will also extend up above the canopy into a sparse emergent layer. Additional tree species are *Pinus thunbergiana* (Japanese black pine), *Quercus marilandica* (blackjack oak), *Quercus velutina* (black oak), *Quercus rubra* (northern red oak), *Robinia pseudoacacia* (black locust), and *Acer rubrum* (red maple). Tall shrubs and saplings are moderately abundant (nearly 30% cover) and consist of a mix of species, many of which are also represented in the canopy. *Prunus serotina* (black cherry) is the most abundant, with lesser amounts of *Morella pensylvanica* (northern bayberry), *Rhus copallinum* (flameleaf sumac), and *Juniperus virginiana* (eastern redcedar) and scattered *Ilex opaca* (American holly), *Quercus marilandica* (blackjack oak), *Prunus maritima* (beach plum), *Baccharis halimifolia* (eastern baccharis), and others. The short-shrub layer is equally well-developed. Common low shrubs and saplings are *Morella pensylvanica* (northern bayberry), *Rhus copallinum* (flameleaf sumac), *Prunus maritima* (beach plum), *Prunus serotina* (black cherry), and *Juniperus virginiana* (eastern redcedar) with lesser amounts of *Baccharis halimifolia* (eastern baccharis), *Ilex opaca* (American holly), *Iva frutescens* (Jesuit's bark), *Hudsonia tomentosa* (woolly beachheather), *Rosa carolina* (Carolina rose), and *Viburnum dentatum* (southern arrowwood). Vines are most abundant in the shrub layer (at about 25% cover); *Toxicodendron radicans* (eastern poison ivy) is the most common species with *Parthenocissus quinquefolia* (Virginia creeper), *Lonicera japonica* (Japanese honeysuckle), *Smilax rotundifolia* (roundleaf greenbrier), and *Rubus flagellaris* (northern dewberry). Herbs are usually patchily distributed in openings and include many species from the surrounding dune associations, among others. They include *Opuntia humifusa* (devil's-tongue), *Solidago sempervirens* (seaside goldenrod), *Mitchella repens* (partridgeberry), *Alliaria petiolata* (garlic mustard), *Maianthemum stellatum* (starry false lily of the valley), *Schizachyrium scoparium* (little bluestem), *Artemisia campestris* (field sagewort), *Carex pensylvanica* (Pennsylvania sedge), *Atriplex patula* (spear saltbush), *Euthamia graminifolia* (flat-top goldentop), and *Panicum virgatum* (switchgrass). Lichen diversity can be high; species include *Cladonia chlorophaea*, *Cladonia coniocraea*, *Cladonia peziziformis*, *Cladonia cristatella* (cup lichens) and *Placynthiella uliginosa* (placynthiella lichen).

Most Abundant Species:

Stratum	Lifeform	Species
Tree (canopy & subcanopy)	Needle-leaved tree	*Juniperus virginiana* (eastern redcedar)
Shrub/sapling (tall & short)	Needle-leaved shrub	*Juniperus virginiana* (eastern redcedar)
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Morella pensylvanica* (northern bayberry), *Rhus copallinum* (flameleaf sumac)
Tall shrub/sapling	Broad-leaved deciduous shrub	*Prunus serotina* (black cherry)
Herb (field)	Succulent shrub	*Opuntia humifusa* (devil's-tongue)
Herb (field)	Vine/Liana	*Toxicodendron radicans* (eastern poison ivy)
Herb (field)	Forb	*Mitchella repens* (partridgeberry), *Solidago sempervirens* (seaside goldenrod)

Characteristic Species: *Ilex opaca* (American holly), *Juniperus virginiana* (eastern redcedar), *Mitchella repens* (partridgeberry), *Morella pensylvanica* (northern bayberry), *Opuntia humifusa* (devil's-tongue), *Prunus serotina* (black cherry), *Rhus copallinum* (flameleaf sumac), *Solidago sempervirens* (seaside goldenrod), *Toxicodendron radicans* (eastern poison ivy).
Other Noteworthy Species: Information not available.
Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
NY	S1	=	1	Maritime red cedar forest	Edinger et al. 2002
NJ	S1	=	1	*Juniperus virginiana* var. *virginiana/Morella pensylvanica* Woodland	Breden et al. 2001

Local Range: This association is only found in the Sandy Hook Unit, New Jersey.
Classification Comments: None.
Other Comments: None.
Local Description Authors: G. J. Edinger and A. L. Feldmann.
Plots: 3am, 3t, 5an, 6an, 7an, 15, 23XX, 24XX, 28, 29XX, 31, 32XX, 33YY, 45XX, 49, 50YY, 53, 56, 67, 73XX, 75, 76, 169XX, ref1.
Gateway National Recreation Area Inventory Notes: Information not available.

GLOBAL INFORMATION

NVC CLASSIFICATION

Physiognomic Class	Woodland (II)
Physiognomic Subclass	Evergreen woodland (II.A.)
Physiognomic Group	Temperate or subpolar needle-leaved evergreen woodland (II.A.4.)
Physiognomic Subgroup	Natural/Semi-natural temperate or subpolar needle-leaved evergreen woodland (II.A.4.N.)
Formation	Conical-crowned temperate or subpolar needle-leaved evergreen woodland (II.A.4.N.b.)
Alliance	*Juniperus virginiana* Woodland Alliance (A.545)
Alliance (English name)	Eastern Red-cedar Woodland Alliance
Association	*Juniperus virginiana* var. *virginiana / Morella pensylvanica* Woodland
Association (English name)	Eastern Red-cedar / Northern Bayberry Woodland

Ecological System(s): Northern Atlantic Coastal Plain Dune and Maritime Grassland (CES203.264).
Northern Atlantic Coastal Plain Tidal Salt Marsh (CES203.519).
Northern Atlantic Coastal Plain Maritime Forest (CES203.302).

GLOBAL DESCRIPTION

Concept Summary: This maritime woodland community dominated by *Juniperus virginiana* (eastern redcedar) occurs on sand dunes, upper edges of salt marshes, and less commonly on rocky headlands of the northern and mid-Atlantic coast. The physiognomy of this association is variable, ranging from dense tall-shrub thickets to open woodlands; trees are generally shorter than 4 m. Canopy trees are stunted and salt-pruned. *Juniperus virginiana* (eastern redcedar) may form pure stands, but more often grows in association with *Pinus rigida* (pitch pine), *Quercus stellata* (post oak), *Prunus serotina* (black cherry), *Amelanchier canadensis* (Canadian serviceberry), *Ilex opaca* (American holly), *Celtis occidentalis* (common hackberry), or *Quercus velutina* (black oak), which tend to have low percent cover. In the southern portion of the range *Pinus taeda* (loblolly pine), *Quercus falcata* (southern red oak), *Sassafras albidum* (sassafras), *Diospyros virginiana* (common persimmon), and *Quercus phellos* (willow oak) can be infrequent canopy associates. A shrub layer may be well-developed where the canopy is more open and include *Morella pensylvanica* (northern bayberry), *Morella cerifera* (wax myrtle) (at the southern end of the range), *Juniperus communis* (common juniper), *Baccharis halimifolia* (eastern baccharis), *Iva frutescens* (Jesuit's bark), *Prunus maritima* (beach plum), or *Vaccinium corymbosum* (highbush blueberry). Vines can be dense in the shrub layer and extend into the canopy; species include *Toxicodendron radicans* (eastern poison ivy), *Smilax rotundifolia* (roundleaf greenbrier), *Smilax glauca* (cat greenbrier), and *Parthenocissus quinquefolia* (Virginia creeper). Herbs are usually patchily distributed in openings and include many species from the surrounding dune associations among others. They include *Opuntia humifusa* (devil's-tongue), *Dichanthelium ovale* (eggleaf rosette grass), *Schizachyrium scoparium* (little bluestem), *Deschampsia flexuosa* (wavy hairgrass), *Cyperus grayi* (Gray's flatsedge), *Polygonella articulata* (coastal jointweed), *Hieracium gronovii* (queendevil), *Panicum amarum var. amarulum* (bitter panicgrass), *Solidago sempervirens* (seaside goldenrod), *Panicum virgatum* (switchgrass), *Spartina patens* (saltmeadow cordgrass), and *Lechea intermedia* (largepod pinweed).

Environmental Description: This maritime woodland community occurs on sand dunes, the upper edges of salt marshes, and less commonly on rocky headlands. It is influenced by onshore winds and salt spray, plus infrequent sand deposition and tidal overwash from severe storms.

Vegetation Description: The physiognomy of this association is variable, ranging from dense tall-shrub thickets to open woodlands; trees are generally shorter than 4 m. Canopy trees are stunted and salt-pruned. *Juniperus virginiana* (eastern redcedar) may form pure stands, but more often grows in association with *Pinus rigida* (pitch pine), *Quercus stellata* (post oak), *Prunus serotina* (black cherry), *Amelanchier canadensis* (Canadian serviceberry), *Ilex opaca* (American holly), *Celtis occidentalis* (common hackberry), or *Quercus velutina* (black oak), which tend to have low percent cover. In the southern portion of the range *Pinus taeda* (loblolly pine), *Quercus falcata* (southern red oak), *Sassafras albidum* (sassafras), *Diospyros virginiana* (common persimmon), and *Quercus phellos* (willow oak) can be infrequent canopy associates. A shrub layer may be well-developed where the canopy is more open and include *Morella pensylvanica* (northern bayberry), *Morella cerifera* (wax myrtle) (at the southern end of the range), *Juniperus communis* (common juniper), *Baccharis halimifolia* (eastern baccharis), *Iva frutescens* (Jesuit's bark), *Prunus maritima* (beach plum), or *Vaccinium corymbosum* (highbush blueberry). Vines

can be dense in the shrub layer and extend into the canopy; species include *Toxicodendron radicans* (eastern poison ivy), *Smilax rotundifolia* (roundleaf greenbrier), *Smilax glauca* (cat greenbrier), and *Parthenocissus quinquefolia* (Virginia creeper). Herbs are usually patchily distributed in openings and include many species from the surrounding dune associations among others. They include *Opuntia humifusa* (devil's-tongue), *Dichanthelium ovale* (eggleaf rosette grass), *Schizachyrium scoparium* (little bluestem), *Deschampsia flexuosa* (wavy hairgrass), *Cyperus grayi* (Gray's flatsedge), *Polygonella articulata* (coastal jointweed), *Hieracium gronovii* (queendevil), *Panicum amarum var. amarulum* (bitter panicgrass), *Solidago sempervirens* (seaside goldenrod), *Panicum virgatum* (switchgrass), *Spartina patens* (saltmeadow cordgrass), and *Lechea intermedia* (largepod pinweed).

Most Abundant Species:

Stratum	Lifeform	Species
Tree (canopy & subcanopy)	Needle-leaved tree	*Juniperus virginiana* (eastern redcedar)
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Morella pensylvanica* (northern bayberry)
Short shrub/sapling	Vine/Liana	*Toxicodendron radicans* (eastern poison ivy)

Characteristic Species: *Juniperus virginiana* (eastern redcedar), *Toxicodendron radicans* (eastern poison ivy).

Other Noteworthy Species: Information not available.

USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: This association occurs along the northern and mid-Atlantic coast from Delaware to Massachusetts.

States/Provinces: CT, DE:S1, MA:S1, MD, NJ:S1, NY:S1, VA.

Federal Lands: NPS (Boston Harbor Islands, Cape Cod, Gateway); USFWS (Prime Hook).

CONSERVATION STATUS

Rank: G2 (18-Nov-1997).

Reasons: This maritime woodland community is naturally restricted to major coastal dune systems. An estimated maximum of 30 occurrences exist, ranging in size from less than an acre up to a maximum of 100, with an average size of less than 10 acres. The habitat is threatened by many of the same threats common to coastal dune systems: dune stabilization, commercial and residential development. This community is further threatened even on "protected" lands in some cases by a lack of recognition that this vegetation is a unique community.

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 2 - Moderate.

Comments: Information not available.

Similar Associations:

Prunus serotina - Rhus typhina Scrub Forest (CEGL006399).

Related Concepts:

Coastal dune woodland (Breden 1989) ?
High red cedar thicket, Red cedar woodland, Red cedar-pine woodland (Martin 1959b) ?
Maritime Forest on Dunes: Maritime Red Cedar Forest/Woodland Variant (Lundgren 2000) ?
Red Cedar Maritime Forest (Greller 1977) ?
SNE Maritime Forest on Dunes/Maritime Juniper Forest (Rawinski 1984) ?

SOURCES

Description Authors: S. L. Neid and L. A. Sneddon, mod. E. Largay.

References: Bowman 2000, Breden 1989, Breden et al. 2001, Clancy 1996, Eastern Ecology Working Group n.d., Edinger et al. 2002, Fleming et al. 2001, Greller 1977, Harrison 2004, Lundgren 2000, Martin 1959b, Rawinski 1984, Reschke 1990, Swain and Kearsley 2001.



Figure E9a. Maritime Red-cedar Woodland in Gateway National Recreation Area, Sandy Hook Unit (Accuracy Assessment Point 50YY, photo no. 1209 taken from road). 8/23/2006. NAD 1983 / UTM easting 585275, northing 4479091.



Figure E9b. Maritime Red-cedar Woodland in Gateway National Recreation Area, Sandy Hook Unit (Accuracy Assessment Point 50YY, photo no. 1208 taken within woodland). 8/23/2006. NAD 1983 / UTM easting 585275, northing 4479091.

COMMON NAME (PARK-SPECIFIC): EARLY-SUCCESSIONAL WOODLAND/FOREST

SYNONYMS

NVC English Name: **(Quaking Aspen, Bigtooth Aspen) - (Gray Birch, Paper Birch) Woodland**

NVC Scientific Name: ***Populus (tremuloides, grandidentata) - Betula (populifolia, papyrifera)*** **Woodland**

NVC Identifier: **CEGL006303**

LOCAL INFORMATION

Environmental Description: These successional northern hardwoods occur in various settings following disturbance such as clearing, fragmentation, and deposition of fill material. Substrate is coarse sand formed from sandy dredge fill in the Barren, Fortress, Jamaica, and Bigapple series (NRCS 2001b). The community often occurs in a mosaic with other disturbed or successional communities, such as Japanese Black Pine Forest (CEGL006012), Successional Maritime Forest (CEGL006145), and Reed-grass Tidal Marsh (CEGL004187), or paved areas, but it is also occasionally bounded by Northern Tall Maritime Shrubland (CEGL006379).

Vegetation Description: The physiognomy of this successional association is variable, ranging from dense tall-shrub thickets to open woodlands and forests. In the forested or woodland expression, the open canopy is comprised of a mix of early-successional species, including *Populus alba* (white poplar), *Populus tremuloides* (quaking aspen), *Betula populifolia* (gray birch), and *Prunus serotina* (black cherry) with associates that can include *Populus grandidentata* (bigtooth aspen), *Acer rubrum* (red maple), *Acer platanoides* (Norway maple), *Morus alba* (white mulberry), *Ailanthus altissima* (tree of heaven), *Pinus thunbergiana* (Japanese black pine), *Tilia americana* (American basswood), *Catalpa speciosa* (northern catalpa), *Frangula alnus* (glossy buckthorn), and *Liquidambar styraciflua* (sweetgum). Many of these canopy species are also represented in the subcanopy; *Elaeagnus umbellata* (autumn olive) and *Rhus copallinum* (flameleaf sumac) can also be present. *Morella pensylvanica* (northern bayberry) and *Frangula alnus* (glossy buckthorn) are the most abundant species in the tall- and short-shrub layers. Associated species that occur in the shrub strata are *Prunus serotina* (black cherry), *Populus alba* (white poplar), *Betula populifolia* (gray birch), *Viburnum dentatum* (southern arrowwood), *Ligustrum vulgare* (European privet), *Rhus copallinum* (flameleaf sumac), *Rhus glabra* (smooth sumac), *Rosa multiflora* (multiflora rose), *Robinia pseudoacacia* (black locust), and *Elaeagnus umbellata* (autumn olive). Vines, particularly *Toxicodendron radicans* (eastern poison ivy) and *Celastrus orbiculata* (Asian bittersweet), are important in this community and extend into the tall-shrub layer. Additional species can be *Lonicera japonica* (Japanese honeysuckle), *Parthenocissus quinquefolia* (Virginia creeper), *Ampelopsis brevipedunculata* (Amur peppervine), and *Calystegia sepium* (hedge false bindweed). The herbaceous layer is somewhat sparse (just over 10% cover) and is characterized by *Artemisia vulgaris* (common wormwood) and *Phragmites australis* (common reed) with lesser amounts of *Solidago rugosa* (wrinkleleaf goldenrod), *Osmunda cinnamomea* (cinnamon fern), *Panicum virgatum* (switchgrass), *Heterotheca subaxillaris* (camphorweed), *Teucrium canadense* (Canada germander), *Polygonum punctatum* (dotted smartweed), and *Chimaphila maculata* (striped prince's pine).

The shrubland expression of this community is characterized by a dense layer of tall shrubs that are strongly dominated by *Populus alba* (white poplar) with *Morella pensylvanica* (northern bayberry) and *Prunus serotina* (black cherry). The short-shrub layer is also well-developed and dominated by *Populus alba* (white poplar); associated low shrubs unique to this layer are *Rhus copallinum* (flameleaf sumac) and *Hudsonia tomentosa* (woolly beachheather). A few scattered *Populus alba* (white poplar) trees can extend into an extremely sparse tree canopy layer over the shrubs. Vines are not as well-developed as in the forest/woodland variant; *Parthenocissus quinquefolia* (Virginia creeper) is the most abundant species. Herbs are strongly dominated by *Corynephorus canescens* (gray clubawn grass); *Schizachyrium scoparium* (little bluestem), *Aristida tuberculosa* (seaside threeawn), *Heterotheca subaxillaris* (camphorweed), *Lechea maritima* (beach pinweed), *Cyperus grayi* (Gray's flatsedge), *Solidago sempervirens* (seaside goldenrod), *Oenothera biennis* (common evening-primrose), *Pseudognaphalium obtusifolium* (rabbittobacco), and *Conyza canadensis* (Canadian horseweed) can be present in low abundance.

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Betula populifolia* (gray birch), *Populus alba* (white poplar), *Populus tremuloides* (quaking aspen)
Tree subcanopy	Broad-leaved deciduous tree	*Elaeagnus umbellata* (autumn olive), *Prunus serotina* (black cherry)
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Frangula alnus* (glossy buckthorn), *Morella pensylvanica* (northern bayberry), *Populus alba* (white poplar), *Prunus serotina* (black cherry)
Short shrub/sapling	Broad-leaved deciduous shrub	*Viburnum dentatum* (southern arrowwood)
Herb (field)	Vine/Liana	*Toxicodendron radicans* (eastern poison ivy)
Herb (field)	Forb	*Artemisia vulgaris* (common wormwood)
Herb (field)	Graminoid	*Corynephorus canescens* (gray clubawn grass), *Phragmites australis* (common reed)

Characteristic Species: *Artemisia vulgaris* (common wormwood), *Betula populifolia* (gray birch), *Celastrus orbiculata* (Asian bittersweet), *Corynephorus canescens* (gray clubawn grass), *Elaeagnus umbellata* (autumn olive), *Frangula alnus* (glossy buckthorn), *Morella pensylvanica* (northern bayberry), *Phragmites australis* (common reed), *Populus alba* (white poplar), *Populus grandidentata* (bigtooth aspen), *Populus tremuloides* (quaking aspen), *Prunus serotina* (black cherry), *Toxicodendron radicans* (eastern poison ivy), *Viburnum dentatum* (southern arrowwood)

Other Noteworthy Species: Information not available.

Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
NY	S5*	B	.	Successional northern hardwoods	Edinger et al. 2002
NJ	.	=	1	*Populus (tremuloides, grandidentata)-Betula (populifolia, papyrifera)* Woodland	Walz et al. 2007

Local Range: This association occurs in New York in the Great Kills section of the Staten Island Unit and in the Fort Tilden, Floyd Bennett Field, Canarsie Pier, and Jamaica Bay Wildlife Refuge sections of the Jamaica Bay Unit.

Classification Comments: The examples of this association at Gateway typically include species that are representative of its Coastal Plain setting; this could be seen as a maritime variant of successional northern hardwoods. We have also included an early-successional

shrubland variant of this association in our vegetation description because the shrubland is expected to develop into this type and no better USNVC association could be found.
Other Comments: None.
Local Description Authors: G. J. Edinger and A. L. Feldmann.
Plots: 2, 2ad, 2j, 2y, 3v, 3w, 4n, 4v, 7y, 8XX, 9XX, 11YY, 12XX, 12YY, 89XX, 164, 165, 186, 264, 276, 283, 287.
Gateway National Recreation Area Inventory Notes: Information not available.

GLOBAL INFORMATION

NVC CLASSIFICATION

Physiognomic Class	Woodland (II)
Physiognomic Subclass	Deciduous woodland (II.B.)
Physiognomic Group	Cold-deciduous woodland (II.B.2.)
Physiognomic Subgroup	Natural/Semi-natural cold-deciduous woodland (II.B.2.N.)
Formation	Cold-deciduous woodland (II.B.2.N.a.)
Alliance	*Populus tremuloides* Woodland Alliance (A.610)
Alliance (English name)	Quaking Aspen Woodland Alliance
Association	*Populus (tremuloides, grandidentata) - Betula (populifolia, papyrifera)* Woodland
Association (English name)	(Quaking Aspen, Bigtooth Aspen) - (Gray Birch, Paper Birch) Woodland
Ecological System(s):	Boreal Aspen-Birch Forest (CES103.020). Laurentian-Acadian Northern Hardwoods Forest (CES201.564**).**

GLOBAL DESCRIPTION

Concept Summary: This is a common successional deciduous forest of the northern Appalachian Mountains, from New England, New York and adjacent Canada across to the northern Great Lakes. Small patches of this type are found on the Coastal Plain but are dominated by one or more of the following: *Populus tremuloides* (quaking aspen), *Populus grandidentata* (bigtooth aspen) or the nonnative *Populus alba* (white poplar), and *Betula populifolia* (gray birch). It occurs in various settings, often over thin glacial till. Elevation and aspect vary. The community is broadly defined and includes vegetation developing after severe disturbance such as logging, fires, severe hurricanes, or simply heavily fragmented residential development. This community can occur as closed-canopy forest or open woodland; in a few very exposed areas, it has been seen to grade to shrubland. Understory shrub cover varies from sparse to well-developed depending primarily on canopy closure. Herbs are typically sparse but may be locally dense. Bryoids are typically minor. The tree canopy is a heterogeneous mixture of light-requiring, wind-dispersed trees usually composed of several co-dominant species, including *Populus tremuloides* (quaking aspen), *Populus grandidentata* (bigtooth aspen), *Betula papyrifera* (paper birch), *Betula populifolia* (gray birch), *Populus balsamifera* (balsam poplar), *Acer rubrum* (red maple), *Prunus serotina* (black cherry), and/or *Prunus pensylvanica* (pin cherry). More minor components can include *Pinus strobus* (eastern white pine), *Picea rubens* (red spruce), *Abies balsamea* (balsam fir), *Acer saccharum* (sugar maple), *Quercus rubra* (northern red oak), *Fraxinus americana* (white ash), *Fraxinus pennsylvanica* (green ash), or *Ulmus americana* (American elm) in the northern portions of the range. Scattered individuals of *Juniperus virginiana* (eastern redcedar) may occur in southern examples of this community. The shrub

layer can include *Viburnum dentatum* (southern arrowwood), *Lonicera morrowii* (Morrow's honeysuckle), *Frangula alnus* (glossy buckthorn), *Rhus typhina* (staghorn sumac), *Rhus copallinum* (flameleaf sumac), *Morella pensylvanica* (northern bayberry), *Rubus* (blackberry) spp., and/or *Viburnum dentatum* (southern arrowwood), in the southern portion of the range, or *Sorbus americana* (American mountain ash), *Acer pensylvanicum* (striped maple), *Viburnum nudum var. cassinoides* (withe-rod), or *Hamamelis virginiana* (American witchhazel). *Vaccinium angustifolium* (lowbush blueberry), *Kalmia angustifolia* (sheep laurel), *Gaylussacia baccata* (black huckleberry), and *Comptonia peregrina* (sweet fern) may form a dwarf-shrub layer in the northern portion of the range. Associated herbs to the north typically include *Pteridium aquilinum* (western brackenfern), *Deschampsia flexuosa* (wavy hairgrass), *Festuca trachyphylla* (hard fescue), *Cornus canadensis* (bunchberry dogwood), *Doellingeria umbellata* (parasol whitetop), *Eurybia macrophylla* (bigleaf aster), *Danthonia spicata* (poverty oatgrass), *Carex lucorum* (Blue Ridge sedge) and related species, and *Maianthemum canadense* (Canada mayflower). Typical bryoids include *Polytrichum commune* (polytrichum moss), *Polytrichum juniperinum* (juniper polytrichum moss), *Dicranum* (dicranum moss) spp., and *Cladonia* (cup lichen) spp. Herbs in southern examples of this community are typically old-field grasses and *Solidago* (goldenrod) spp. In the absence of major disturbance, these forests mostly succeed to northern hardwood, spruce-fir, mixed northern hardwood-spruce-fir, or red oak - northern hardwood forests in the northern portion of the range.

Environmental Description: It occurs in various settings, often over thin glacial till. Elevation and aspect vary. The community is broadly defined, and includes vegetation developing after severe disturbance such as logging, fires, severe hurricanes, or simply heavily fragmented residential development.

Vegetation Description: This community can occur as closed-canopy forest or open woodland; in a few very exposed areas, it has been seen to grade to shrubland. Understory shrub cover varies from sparse to well-developed depending primarily on canopy closure. Herbs are typically sparse, but may be locally dense. Bryoids are typically minor. The tree canopy is a heterogeneous mixture of light-requiring, wind-dispersed trees usually composed of several co-dominant species including *Populus tremuloides* (quaking aspen), *Populus grandidentata* (bigtooth aspen), *Betula papyrifera* (paper birch), *Betula populifolia* (gray birch), *Populus balsamifera* (balsam poplar), *Acer rubrum* (red maple), *Prunus serotina* (black cherry), and/or *Prunus pensylvanica* (pin cherry). More minor components can include *Pinus strobus* (eastern white pine), *Picea rubens* (red spruce), *Abies balsamea* (balsam fir), *Acer saccharum* (sugar maple), *Quercus rubra* (northern red oak), *Fraxinus americana* (white ash), *Fraxinus pennsylvanica* (green ash), or *Ulmus americana* (American elm). The shrub layer in the northern portion of the range includes *Sorbus americana* (American mountain ash), *Acer pensylvanicum* (striped maple), *Viburnum nudum var. cassinoides* (withe-rod), or *Hamamelis virginiana* (American witchhazel). *Vaccinium angustifolium* (lowbush blueberry), *Kalmia angustifolia* (sheep laurel), *Gaylussacia baccata* (black huckleberry), and *Comptonia peregrina* (sweet fern) may form a dwarf-shrub layer. Associated herbs to the north typically include *Pteridium aquilinum* (western brackenfern), *Deschampsia flexuosa* (wavy hairgrass), *Festuca trachyphylla* (hard fescue), *Cornus canadensis* (bunchberry dogwood), *Doellingeria umbellata* (parasol whitetop), *Eurybia macrophylla* (bigleaf aster), *Danthonia spicata* (poverty oatgrass), *Carex lucorum* (Blue Ridge sedge) and related species, and *Maianthemum canadense* (Canada mayflower). Typical bryoids include *Polytrichum commune* (polytrichum moss), *Polytrichum juniperinum* (juniper polytrichum moss), *Dicranum* (dicranum moss) spp., and *Cladonia* (cup

lichen) spp. Herbs in southern examples of this community are typically old-field grasses and *Solidago* (goldenrod) spp. Small patches of this type are found on the Coastal Plain but are dominated by one or more of the following: *Populus tremuloides* (quaking aspen), *Populus grandidentata* (bigtooth aspen), or the nonnative *Populus alba* (white poplar), and *Betula populifolia* (gray birch) (usually not *Betula lenta* (sweet birch) or *Betula alleghaniensis* (yellow birch)).

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Betula papyrifera* (paper birch), *Betula populifolia* (gray birch), *Populus grandidentata* (bigtooth aspen), *Populus tremuloides* (quaking aspen)
Tall shrub/sapling	Broad-leaved deciduous shrub	*Viburnum dentatum* (southern arrowwood), *Viburnum nudum* var. *cassinoides* (withe-rod)
Herb (field)	Graminoid	*Deschampsia flexuosa* (wavy hairgrass), *Festuca trachyphylla* (hard fescue)

Characteristic Species: *Betula populifolia* (gray birch), *Populus grandidentata* (bigtooth aspen).

Other Noteworthy Species:

Species	GRank	Type	Note
Dendroica pensylvanica (chestnut-sided warbler)	-	animal	
Sphyrapicus varius (yellow-bellied sapsucker)	-	animal	
Vermivora ruficapilla (nashville warbler)	-	animal	

USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: Information not available.

States/Provinces: MA, ME:S5, NB, NH, NY, VT.

Federal Lands: NPS (Acadia, Boston Harbor Islands, Gateway, Saratoga); USFS (Finger Lakes); USFWS (Aroostook, Assabet River, Carlton Pond?, Moosehorn, Nulhegan Basin).

CONSERVATION STATUS

Rank: G5 (20-Apr-2000).

Reasons: Information not available.

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 3 - Weak.

Comments: Information not available.

Similar Associations: Information not available.

Related Concepts:

CNE mesic hardwood forest on acidic bedrock/till (Rawinski 1984) B

Mesic Northern Hardwood Forest (Beech-Birch-Maple Forest) (Thompson 1996) B

SOURCES

Description Authors: S. C. Gawler, mod. E. Largay.

References: Eastern Ecology Working Group n.d., Edinger et al. 2002, Gawler 2002, NRCS 2001b, Rawinski 1984, Swain and Kearsley 2001, Thompson 1996, Thompson and Sorenson 2000.



Figure E10. Early-Successional Woodland/Forest in Gateway National Recreation Area, Jamaica Bay Unit (Accuracy Assessment Point 283, photo no. 1265a). 8/30/2006. NAD 1983 / UTM easting 599896, northing 4496786.

COMMON NAME (PARK-SPECIFIC): NORTHEASTERN SUCCESSIONAL SHRUBLAND

SYNONYMS

NVC English Name: **Autumn-olive - Gray Dogwood - Multiflora Rose - Eastern Red-cedar Shrubland**

NVC Scientific Name: ***Elaeagnus umbellata - Cornus racemosa - Rosa multiflora - Juniperus virginiana* Shrubland**

NVC Identifier: **CEGL006451**

LOCAL INFORMATION

Environmental Description: This association occurs in areas that have been altered significantly by human activities. At Floyd Bennett Field, it is underlain by Greenbelt loam, a very deep, well-drained loamy soil that was formed in layers of fill that were compacted as they were deposited by heavy machinery. The substrates that support this community are variable, however, and can also include well-drained fine sands (NRCS 2001b).

Vegetation Description: This successional association is characterized by a mix of native and nonnative tall shrubs draped by a dense cover of vines that extends into the sparse, short tree canopy. The shrub layer is dominated by *Rosa multiflora* (multiflora rose) with associated species that include *Viburnum dentatum* (southern arrowwood), *Elaeagnus umbellata* (autumn olive), *Prunus serotina* (black cherry), *Rubus allegheniensis* (Allegheny blackberry), and *Morella pensylvanica* (northern bayberry). The thick vine layer (with >85% cover) is codominated by *Lonicera japonica* (Japanese honeysuckle), *Celastrus orbiculata* (Asian bittersweet), and *Parthenocissus quinquefolia* (Virginia creeper) with *Toxicodendron radicans* (eastern poison ivy) present at lower abundance. Scattered trees include *Prunus serotina* (black cherry), *Populus alba* (white poplar), and *Elaeagnus umbellata* (autumn olive). The herbaceous layer is extremely sparse, with *Phytolacca americana* (American pokeweed), *Phragmites australis* (common reed), *Artemisia vulgaris* (common wormwood), and *Solidago rugosa* (wrinkleleaf goldenrod).

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Populus alba* (white poplar), *Prunus serotina* (black cherry)
Tall shrub/sapling	Broad-leaved deciduous shrub	*Rosa multiflora* (multiflora rose)
Herb (field)	Vine/Liana	*Celastrus orbiculata* (Asian bittersweet), *Lonicera japonica* (Japanese honeysuckle), *Parthenocissus quinquefolia* (Virginia creeper)
Herb (field)	Forb	*Phytolacca americana* (American pokeweed)
Herb (field)	Graminoid	*Phragmites australis* (common reed)

Characteristic Species: *Celastrus orbiculata* (Asian bittersweet), *Elaeagnus umbellata* (autumn olive), *Lonicera japonica* (Japanese honeysuckle), *Parthenocissus quinquefolia* (Virginia creeper), *Phragmites australis* (common reed), *Phytolacca americana* (American pokeweed), *Populus alba* (white poplar), *Prunus serotina* (black cherry), *Rosa multiflora* (multiflora rose), *Toxicodendron radicans* (eastern poison ivy), *Viburnum dentatum* (southern arrowwood).

Other Noteworthy Species: Information not available.

Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
NY	S4*	I	1	Successional shrubland	Edinger et al. 2002
NJ	.	=	1	*Elaeagnus umbellata-Cornus racemosa-Rosa multiflora-Juniperus virginiana* Shrubland	Walz et al. 2007

Local Range: This association occurs in the Floyd Bennett Field section of the Jamaica Bay Unit.
Classification Comments: This association was chosen as a temporary placeholder for this successional shrubland type until a Coastal Plain successional shrubland association is developed.
Other Comments: None.
Local Description Authors: G. J. Edinger and A. L. Feldmann.
Plots: 2ac, 232.
Gateway National Recreation Area Inventory Notes: Information not available.

GLOBAL INFORMATION

NVC CLASSIFICATION

Physiognomic Class	Shrubland (III)
Physiognomic Subclass	Deciduous shrubland (III.B.)
Physiognomic Group	Cold-deciduous shrubland (III.B.2.)
Physiognomic Subgroup	Natural/Semi-natural cold-deciduous shrubland (III.B.2.N.)
Formation	Temperate cold-deciduous shrubland (III.B.2.N.a.)
Alliance	*Cornus drummondii* Shrubland Alliance (A.3558)
Alliance (English name)	Roughleaf Dogwood Shrubland Alliance
Association	*Elaeagnus umbellata - Cornus racemosa - Rosa multiflora - Juniperus virginiana* Shrubland
Association (English name)	Autumn-olive - Gray Dogwood - Multiflora Rose - Eastern Red-cedar Shrubland
Ecological System(s):	Information not available.

GLOBAL DESCRIPTION

Concept Summary: This association comprises shrubby old fields dominated by thickets of *Elaeagnus angustifolia* (Russian olive), *Cornus racemosa* (gray dogwood), *Viburnum prunifolium* (blackhaw), *Lonicera japonica* (Japanese honeysuckle), *Lonicera morrowii* (Morrow's honeysuckle), *Ligustrum vulgare* (European privet), *Euonymus alatus* (winged burning bush), *Rosa multiflora* (multiflora rose), *Rhus glabra* (smooth sumac), and *Rhus typhina* (staghorn sumac), with patches of herbaceous vegetation among the shrubs. Shorter shrubs include *Berberis thunbergii* (Japanese barberry) and *Rubus* (blackberry) spp., and in some fields *Gaylussacia baccata* (black huckleberry), *Vaccinium pallidum* (Blue Ridge blueberry), *Vaccinium stamineum* (deerberry), and/or *Vaccinium angustifolium* (lowbush blueberry). Small trees are often present but form <25% cover; they include *Juniperus virginiana* (eastern redcedar), *Betula populifolia* (gray birch), *Prunus virginiana* (chokecherry), *Cornus florida* (flowering dogwood), *Acer rubrum* (red maple), *Juglans nigra* (black walnut), *Prunus serotina* (black cherry), *Robinia pseudoacacia* (black locust), and *Fraxinus americana* (white ash). The herbaceous layer is variable depending on the density of shrub cover. Typical species are those

associated with old fields, grasslands, and agricultural sites. Common species include *Solidago rugosa* (wrinkleleaf goldenrod), *Solidago gigantea* (giant goldenrod), *Solidago nemoralis* (gray goldenrod), *Monarda fistulosa* (wild bergamot), *Anthoxanthum odoratum* (sweet vernalgrass), *Poa pratensis* (Kentucky bluegrass), *Oxalis stricta* (common yellow oxalis), *Viola sororia* (common blue violet), *Euthamia graminifolia* (flat-top goldentop), *Festuca rubra* (red fescue), *Schizachyrium scoparium* (little bluestem), *Pycnanthemum virginianum* (Virginia mountainmint), *Alliaria petiolata* (garlic mustard), *Galium mollugo* (false baby's breath), *Potentilla simplex* (common cinquefoil), *Achillea millefolium* (common yarrow), *Daucus carota* (Queen Anne's lace), *Trifolium repens* (white clover), *Bromus inermis* (smooth brome), *Agrostis gigantea* (redtop), and *Elymus repens* (quackgrass), among many others. Vines can be absent or dominant, sometimes covering the tall and short shrubs. Common vines are *Vitis aestivalis* (summer grape), *Vitis labrusca* (fox grape), *Toxicodendron radicans* (eastern poison ivy), *Celastrus orbiculata* (Asian bittersweet), *Parthenocissus quinquefolia* (Virginia creeper), and *Lonicera japonica* (Japanese honeysuckle).

Environmental Description: This association occurs on former agricultural lands and old fields that are no longer intensively mowed, plowed or managed. These sites contain moderately well-drained to well-drained soils. The shrublands are flat to gently sloping, often bounded by stonewalls or fencerows.

Vegetation Description: The structure of this association varies from open fields with scattered tall and short shrubs covering 25% of the field, with herbaceous vegetation in the interstices, to dense "closed-canopy" tall shrublands with sparse ground layer vegetation. Common shrubs include *Elaeagnus angustifolia* (Russian olive), *Cornus racemosa* (gray dogwood), *Viburnum prunifolium* (blackhaw), *Lonicera japonica* (Japanese honeysuckle), *Lonicera morrowii* (Morrow's honeysuckle), *Ligustrum vulgare* (European privet), *Euonymus alatus* (winged burning bush), *Rosa multiflora* (multiflora rose), *Rhus glabra* (smooth sumac), and *Rhus typhina* (staghorn sumac), with patches of herbaceous vegetation among the shrubs. Shorter shrubs include *Berberis thunbergii* (Japanese barberry) and *Rubus* (blackberry) spp., and in some fields *Gaylussacia baccata* (black huckleberry), *Vaccinium pallidum* (Blue Ridge blueberry), *Vaccinium stamineum* (deerberry), and/or *Vaccinium angustifolium* (lowbush blueberry). Small trees are often present but form <25% cover; they include *Juniperus virginiana* (eastern redcedar), *Betula populifolia* (gray birch), *Prunus virginiana* (chokecherry), *Cornus florida* (flowering dogwood), *Acer rubrum* (red maple), *Juglans nigra* (black walnut), *Prunus serotina* (black cherry), *Robinia pseudoacacia* (black locust), and *Fraxinus americana* (white ash). The herbaceous layer is variable depending on the density of shrub cover. Typical species are those associated with old fields, grasslands, and agricultural sites. Common species include *Solidago rugosa* (wrinkleleaf goldenrod), *Solidago gigantea* (giant goldenrod), *Solidago nemoralis* (gray goldenrod), *Monarda fistulosa* (wild bergamot), *Anthoxanthum odoratum* (sweet vernalgrass), *Poa pratensis* (Kentucky bluegrass), *Oxalis stricta* (common yellow oxalis), *Viola sororia* (common blue violet), *Euthamia graminifolia* (flat-top goldentop), *Festuca rubra* (red fescue), *Schizachyrium scoparium* (little bluestem), *Pycnanthemum virginianum* (Virginia mountainmint), *Alliaria petiolata* (garlic mustard), *Galium mollugo* (false baby's breath), *Potentilla simplex* (common cinquefoil), *Achillea millefolium* (common yarrow), *Daucus carota* (Queen Anne's lace), *Trifolium repens* (white clover), *Bromus inermis* (smooth brome), *Agrostis gigantea* (redtop), and *Elymus repens* (quackgrass), among many others. Vines can be absent or dominant, sometimes covering the tall and short shrubs. Common vines are *Vitis aestivalis* (summer grape), *Vitis labrusca* (fox grape), *Toxicodendron radicans* (eastern poison ivy),

Celastrus orbiculata (Asian bittersweet), *Parthenocissus quinquefolia* (Virginia creeper), and *Lonicera japonica* (Japanese honeysuckle).

Most Abundant Species:

Stratum	Lifeform	Species
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Cornus racemosa* (gray dogwood), *Elaeagnus umbellata* (autumn olive), *Rhus glabra* (smooth sumac), *Rosa multiflora* (multiflora rose)
Tall shrub/sapling	Needle-leaved shrub	*Juniperus virginiana* (eastern redcedar)
Herb (field)	Vine/Liana	*Celastrus orbiculatus* (Asian bittersweet), *Vitis aestivalis* (summer grape), *Vitis labrusca* (fox grape)
Herb (field)	Forb	*Monarda fistulosa* (wild bergamot), *Solidago altissima* (tall goldenrod), *Solidago rugosa* (wrinkleleaf goldenrod)
Herb (field)	Graminoid	*Anthoxanthum odoratum* (sweet vernalgrass), *Schizachyrium scoparium* (little bluestem)

Characteristic Species: *Anthoxanthum odoratum* (sweet vernalgrass), *Celastrus orbiculata* (Asian bittersweet), *Cornus racemosa* (gray dogwood), *Elaeagnus umbellata* (autumn olive), *Juniperus virginiana* (eastern redcedar), *Monarda fistulosa* (wild bergamot), *Rhus glabra* (smooth sumac), *Rhus typhina* (staghorn sumac), *Rosa multiflora* (multiflora rose), *Solidago altissima* (tall goldenrod), *Solidago rugosa* (wrinkleleaf goldenrod), *Vitis aestivalis* (summer grape)

Other Noteworthy Species: Information not available.

USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: This community is common in former agricultural areas in the northeastern U.S.

States/Provinces: CT, DE, MA, NJ, NY, PA.

Federal Lands: NPS (Delaware Water Gap, Gateway, Saratoga, Upper Delaware, Valley Forge); USFWS (Prime Hook).

CONSERVATION STATUS

Rank: GNA (ruderal) (23-Jun-2006).

Reasons: Information not available.

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 2 - Moderate.

Comments: This is a broadly defined type intended for shrubby vegetation on abandoned cropland or pasture.

Similar Associations:

Cornus (amomum, sericea) - *Viburnum dentatum* - *Rosa multiflora* Shrubland (CEGL006576).

Related Concepts: Information not available.

SOURCES

Description Authors: S. C. Gawler.

References: Eastern Ecology Working Group n.d., Keever 1979, NRCS 2001b, NRCS 2004, Newbold et al. 1988, Overlease 1987.



Figure E11. Northeastern Successional Shrubland in Gateway National Recreation Area, Jamaica Bay Unit (Accuracy Assessment Point 232, photo no. 1311). 9/20/2006. NAD 1983 / UTM easting 594415, northing 4495523.

COMMON NAME (PARK-SPECIFIC): NORTHERN BAYBERRY DUNE SHRUBLAND

SYNONYMS
NVC English Name: **Northern Bayberry - Beach Plum Shrubland**
NVC Scientific Name: ***Morella pensylvanica - Prunus maritima* Shrubland**
NVC Identifier: **CEGL006295**

LOCAL INFORMATION

Environmental Description: This association occurs on protected slopes and hollows of dry, stabilized maritime backdunes. Substrate is coarse to fine sand consisting of very deep, excessively drained soils formed in eolian sands, sandy marine sediments, or sandy dredge spoils. The soils are primarily in the Bigapple, Hooksan, Hooksan-Dune land complex, Barren, and Jamaica series (NRCS 2001b).

Vegetation Description: The vegetation of this dense, short maritime shrubland is dominated by *Morella pensylvanica* (northern bayberry) with *Rhus copallinum* (flameleaf sumac). Additional shrubs that can be present at lower abundance include *Rosa rugosa* (rugosa rose), *Prunus serotina* (black cherry), *Prunus maritima* (beach plum), *Frangula alnus* (glossy buckthorn), *Populus alba* (white poplar), and *Vaccinium corymbosum* (highbush blueberry). These low shrubs are often draped with vines, primarily *Celastrus orbiculata* (Asian bittersweet), *Parthenocissus quinquefolia* (Virginia creeper), and *Toxicodendron radicans* (eastern poison ivy) with lesser amounts of *Lonicera japonica* (Japanese honeysuckle), *Smilax rotundifolia* (roundleaf greenbrier), and *Polygonum scandens* (climbing false buckwheat). An open, sparse tall-shrub layer of *Prunus serotina* (black cherry), *Prunus maritima* (beach plum), *Morella pensylvanica* (northern bayberry), *Populus alba* (white poplar), *Rhus copallinum* (flameleaf sumac), *Morus alba* (white mulberry), and *Frangula alnus* (glossy buckthorn) can form above the dominant low shrubs. In addition, a few widely scattered trees can be present; species include *Prunus serotina* (black cherry), *Juniperus virginiana* (eastern redcedar), *Ailanthus altissima* (tree of heaven), *Pinus thunbergiana* (Japanese black pine), *Populus alba* (white poplar), *Ilex opaca* (American holly), *Rhus typhina* (staghorn sumac), and *Prunus virginiana* (chokecherry). The herbaceous layer tends to be sparse and can include dune grassland or adjacent upland species such as *Schizachyrium scoparium* (little bluestem), *Centaurea biebersteinii* (spotted knapweed), *Solidago sempervirens* (seaside goldenrod), *Ammophila breviligulata* (American beachgrass), *Bromus tectorum* (cheatgrass), *Spartina patens* (saltmeadow cordgrass), *Chenopodium album* (lambsquarters), *Linaria vulgaris* (butter and eggs), *Artemisia vulgaris* (common wormwood), *Cakile edentula* (American searocket), *Phragmites australis* (common reed), *Corynephorus canescens* (gray clubawn grass), *Heterotheca subaxillaris* (camphorweed), *Oenothera biennis* (common evening-primrose), and many others.

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Juniperus virginiana* (eastern redcedar)
Tree canopy	Broad-leaved deciduous tree	*Prunus serotina* (black cherry)
Tall shrub/sapling	Broad-leaved deciduous tree	*Prunus serotina* (black cherry)
Short shrub/sapling	Broad-leaved deciduous shrub	*Morella pensylvanica* (northern bayberry)
Herb (field)	Vine/Liana	*Celastrus orbiculata* (Asian bittersweet), *Parthenocissus quinquefolia* (Virginia creeper), *Toxicodendron radicans* (eastern poison ivy)
Herb (field)	Graminoid	*Schizachyrium scoparium* (little bluestem)

Characteristic Species: *Ailanthus altissima* (tree of heaven), *Celastrus orbiculata* (Asian bittersweet), *Morella pensylvanica* (northern bayberry), *Parthenocissus quinquefolia* (Virginia creeper), *Prunus maritima* (beach plum), *Prunus serotina* (black cherry), *Rhus copallinum* (flameleaf sumac), *Rosa rugosa* (rugosa rose), *Schizachyrium scoparium* (little bluestem), *Toxicodendron radicans* (eastern poison ivy).
Other Noteworthy Species: Information not available.
Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
NY	S3*	I	2	Maritime dunes	Edinger et al. 2002
NY	S4*	I	2	Maritime shrubland	Edinger et al. 2002
NJ	S1S2	=	1	*Morella pensylvanica-Rosa rugosa* Shrubland	Breden et al. 2001

Local Range: This association occurs in the Sandy Hook Unit and in the Breezy Point, Fort Tilden, Floyd Bennett Field, Canarsie Pier, and Jamaica Bay Wildlife Refuge sections of the Jamaica Bay Unit.
Classification Comments: This association is used for short (under 2-m tall) maritime shrublands dominated by *Morella pensylvanica* (northern bayberry). Tall *Morella*-dominated shrublands are classed as Northern Tall Maritime Shrubland (CEGL006379).
Other Comments: None.
Local Description Authors: G. J. Edinger and A. L. Feldmann.
Plots: 1p, 1x, 2w, 4ac, 8ac, 13, 15a, 15b, 17XX, 69XX, 112YY, 123YY, 161XX, 177, 178, 268, 274, ref2.
Gateway National Recreation Area Inventory Notes: Information not available.

GLOBAL INFORMATION

NVC CLASSIFICATION

Physiognomic Class	Shrubland (III)
Physiognomic Subclass	Deciduous shrubland (III.B.)
Physiognomic Group	Cold-deciduous shrubland (III.B.2.)
Physiognomic Subgroup	Natural/Semi-natural cold-deciduous shrubland (III.B.2.N.)
Formation	Temperate cold-deciduous shrubland (III.B.2.N.a.)
Alliance	*Morella pensylvanica - (Prunus maritima)* Shrubland Alliance (A.902)
Alliance (English name)	Northern Bayberry - (Beach Plum) Shrubland Alliance
Association	*Morella pensylvanica - Prunus maritima* Shrubland
Association (English name)	Northern Bayberry - Beach Plum Shrubland
Ecological System(s):	Northern Atlantic Coastal Plain Dune and Maritime Grassland (CES203.264). Northern Atlantic Coastal Plain Maritime Forest (CES203.302). Acadian-North Atlantic Rocky Coast (CES201.573)**.**

GLOBAL DESCRIPTION

Concept Summary: This association comprises maritime dune shrublands of protected slopes and hollows of dry, stabilized maritime backdunes along the northern Atlantic Coast. It is dominated by *Morella pensylvanica* (northern bayberry) and *Prunus maritima* (beach plum). Additional shrubs that are commonly present but with low cover can include *Rosa carolina* (Carolina rose), *Rosa rugosa* (rugosa rose), *Baccharis halimifolia* (eastern baccharis), *Rhus typhina* (staghorn sumac), or *Juniperus virginiana* (eastern redcedar). Although *Rosa rugosa* (rugosa rose) is not a native species, it is naturalized and is nearly restricted to this vegetation, where it grows in similar habit and physiognomy as the other two shrubs characteristic of this vegetation. The herbaceous layer tends to be sparse and low, particularly where shrub growth is dense, and can include dune grassland or adjacent upland species such as *Ammophila breviligulata* (American beachgrass), *Solidago sempervirens* (seaside goldenrod), *Hudsonia tomentosa* (woolly beachheather), *Lechea maritima* (beach pinweed), *Juncus greenei* (Greene's rush), *Carex silicea* (beach sedge), *Polygonella articulata* (coastal jointweed), *Symphyotrichum subulatum* (eastern annual saltmarsh aster), *Solidago rugosa* (wrinkleleaf goldenrod), *Achillea millefolium* (common yarrow), *Oenothera parviflora* (northern evening-primrose), *Euthamia* (goldentop) spp., *Cyperus grayi* (Gray's flatsedge), *Cyperus polystachyos* (manyspike flatsedge), *Schizachyrium scoparium* (little bluestem), and others. Typical vine associates are *Toxicodendron radicans* (eastern poison ivy), *Parthenocissus quinquefolia* (Virginia creeper), and *Smilax* (greenbrier) spp. Large patches of open unvegetated or sparsely vegetated sand are present in some examples. Depending on exposure, these shrublands range from over 2 m tall in sheltered areas to less than 1 m tall in areas with greater exposure to winds and storms.

Environmental Description: This association occurs on protected slopes and hollows of dry, stabilized maritime backdunes where the water table is greater than 1 m from the surface.

Vegetation Description: This shrubland vegetation is dominated by *Morella pensylvanica* (northern bayberry) and *Prunus maritima* (beach plum). Additional shrubs that are commonly present but with low cover can include *Rosa carolina* (Carolina rose), *Rosa rugosa* (rugosa rose), *Baccharis halimifolia* (eastern baccharis), *Rhus copallinum* (flameleaf sumac), *Rhus typhina* (staghorn sumac), or *Juniperus virginiana* (eastern redcedar). The herbaceous layer tends to be sparse and can include dune grassland or adjacent upland species such as *Ammophila breviligulata* (American beachgrass), *Solidago sempervirens* (seaside goldenrod), *Hudsonia tomentosa* (woolly beachheather), *Lechea maritima* (beach pinweed), *Juncus greenei* (Greene's rush), *Carex silicea* (beach sedge), *Polygonella articulata* (coastal jointweed), *Symphyotrichum subulatum* (eastern annual saltmarsh aster), *Solidago rugosa* (wrinkleleaf goldenrod), *Achillea millefolium* (common yarrow), *Oenothera parviflora* (northern evening-primrose), *Euthamia* (goldentop) spp., *Cyperus grayi* (Gray's flatsedge), *Cyperus polystachyos* (manyspike flatsedge), *Schizachyrium scoparium* (little bluestem), and others. Typical vine associates are *Toxicodendron radicans* (eastern poison ivy), *Parthenocissus quinquefolia* (Virginia creeper), and *Smilax* (greenbrier) spp. Large patches of open unvegetated or sparsely vegetated sand are present in some examples. Depending on exposure, these shrublands range from over 2 m tall in sheltered areas to less than 1 m tall in areas with greater exposure to winds and storms.

Most Abundant Species:

Stratum	Lifeform	Species
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Morella pensylvanica* (northern bayberry), *Prunus maritima* (beach plum)

Characteristic Species: *Morella pensylvanica* (northern bayberry), *Prunus maritima* (beach plum).
Other Noteworthy Species: Information not available.
USFWS Wetland System: Not applicable.

DISTRIBUTION
Range: This association occurs from Maine to New Jersey.
States/Provinces: CT, DE, MA, ME, NH:S1, NJ:S1S2, NY, RI.
Federal Lands: NPS (Boston Harbor Islands, Cape Cod, Fire Island, Gateway,); USFWS (Monomoy, Muskeget Island, Nomans Land Island, Parker River).

CONSERVATION STATUS
Rank: G4 (1-Dec-1997).
Reasons: Information not available.

CLASSIFICATION INFORMATION
Status: Standard.
Confidence: 2 - Moderate.
Comments: This vegetation is compositionally similar to maritime rocky headland, *Prunus serotina - Rhus typhina* Scrub Forest (CEGL006399). *Morella pensylvanica / Diodia teres* Shrubland (CEGL003881) is the southern analog of this association.
Similar Associations:
Morella pensylvanica / Diodia teres Shrubland (CEGL003881).
Prunus serotina - Rhus typhina Scrub Forest (CEGL006399).
Related Concepts:
Morella thicket (Chrysler 1930) ?
Coastal dune community (Rawinski 1984) ?
Dune shrubland (Breden 1989) ?
Low dune thicket (Martin 1959b) ?
Maritime Shrubland on Dunes (Lundgren 2000) ?
SNE coastal rocky headland community (Rawinski 1984) ?
Short shrub thicket (Dunlop and Crow 1985) ?

SOURCES
Description Authors: S. L. Neid and L. A. Sneddon, mod. E. Largay.
References: Art 1976, Breden 1989, Breden et al. 2001, Chrysler 1930, Conard 1935, Dunlop and Crow 1985, Eastern Ecology Working Group n.d., Edinger et al. 2002, Enser 1999, Gawler 2001, Gawler 2002, Lundgren 2000, Martin 1959b, McDonnell 1979, Metzler and Barrett 2001, Metzler and Barrett 2004, Moul 1969, NRCS 2001b, Nelson and Fink 1980, Nichols 1920, Rawinski 1984, Reschke 1990, Sneddon and Lundgren 2001, Sperduto 1997b, Sperduto 2000a, Swain and Kearsley 2001.



Figure E12. Northern Bayberry Dune Shrubland in Gateway National Recreation Area, Jamaica Bay Unit (Accuracy Assessment Point 17XX, photo no. 1279a). 8/31/2006. NAD 1983 / UTM easting 594121, northing 4490543.

COMMON NAME (PARK-SPECIFIC): NORTH ATLANTIC COASTAL PLAIN VINE DUNE

SYNONYMS
NVC English Name: **Whiteleaf Greenbrier - Eastern Poison-ivy Vine-Shrubland**
NVC Scientific Name: ***Smilax glauca - Toxicodendron radicans* Vine-Shrubland**
NVC Identifier: **CEGL003886**

LOCAL INFORMATION

Environmental Description: This community occurs on foredunes where vegetation is exposed to wind, salt spray and periodic overwash by storm tides. Vines, such as *Toxicodendron radicans*, grow in upright shrub form in dense, low thickets. Substrate ranges from fine sand to gravelly fine sand and consists of very deep, excessively drained soils in the Hooksan series formed in eolian sands or sandy marine sediments (NRCS 2001b).
Vegetation Description: This association is dominated by the shrub-form of *Toxicodendron radicans* (eastern poison ivy) that forms a low (around 1 m in height) dense shrub/vine thicket on dune crests that are fully exposed to the maritime influences of salt spray and strong winds. *Parthenocissus quinquefolia* (Virginia creeper) and *Lonicera japonica* (Japanese honeysuckle) can also be present. Short (1- to 2.5-m) shrubs such as *Rhus copallinum* (flameleaf sumac), *Prunus maritima* (beach plum), *Prunus serotina* (black cherry), *Juniperus virginiana* (eastern redcedar), *Rosa rugosa* (rugosa rose), and *Elaeagnus umbellata* (autumn olive) can be poking up amidst the vines, and very scattered individual trees such as *Prunus serotina* (black cherry) or *Juniperus virginiana* (eastern redcedar) could also be included in this community. Open patches can contain sparse herbaceous cover of species such as *Artemisia campestris* (field sagewort), *Ammophila breviligulata* (American beachgrass), *Solidago sempervirens* (seaside goldenrod), *Opuntia humifusa* (devil's-tongue), and *Lepidium virginicum* (Virginia pepperweed). Vegetation covers more than 80% of the ground, the remainder is exposed sand.
Most Abundant Species:

Stratum	Lifeform	Species
Tree subcanopy	Needle-leaved tree	*Juniperus virginiana* (eastern redcedar)
Tree subcanopy	Broad-leaved deciduous tree	*Prunus serotina* (black cherry)
Short shrub/sapling	Broad-leaved deciduous shrub	*Prunus maritima* (beach plum), *Prunus serotina* (black cherry), *Rhus copallinum* (flameleaf sumac)
Herb (field)	Vine/Liana	*Parthenocissus quinquefolia* (Virginia creeper), *Toxicodendron radicans* (eastern poison ivy)

Characteristic Species: *Juniperus virginiana* (eastern redcedar), *Lonicera japonica* (Japanese honeysuckle), *Parthenocissus quinquefolia* (Virginia creeper), *Prunus maritima* (beach plum), *Prunus serotina* (black cherry), *Rhus copallinum* (flameleaf sumac), *Rosa rugosa* (rugosa rose), *Toxicodendron radicans* (eastern poison ivy)
Other Noteworthy Species: Information not available.
Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
NY	S3*	B	.	Maritime dunes	Edinger et al. 2002
NJ	.	=	1	*Smilax glauca-Toxicodendron radicans* Vine-Shrubland	Walz et al. 2007

Local Range: This association occurs in the Sandy Hook Unit and in the Fort Tilden, Canarsie Pier, and Jamaica Bay Wildlife Refuge sections of the Jamaica Bay Unit.
Classification Comments: Maritime shrublands (tall and short) with vines draped over them were usually classified as one of the shrubland types: Northern Bayberry Dune Shrubland (CEGL006295) or Northern Tall Maritime Shrubland (CEGL006379). North Atlantic Coastal Plain Vine Dune (CEGL003886) is reserved for the patches dominated by the shrub form of poison-ivy.
Other Comments: None.
Local Description Authors: G .J. Edinger and A. L. Feldmann.
Plots: 1u, 27XX, 100XX, 244, 249.
Gateway National Recreation Area Inventory Notes: Information not available.

GLOBAL INFORMATION

NVC CLASSIFICATION

Physiognomic Class	Shrubland (III)
Physiognomic Subclass	Deciduous shrubland (III.B.)
Physiognomic Group	Cold-deciduous shrubland (III.B.2.)
Physiognomic Subgroup	Natural/Semi-natural cold-deciduous shrubland (III.B.2.N.)
Formation	Temperate cold-deciduous shrubland (III.B.2.N.a.)
Alliance	*Smilax* spp. - *Toxicodendron radicans* Vine-Shrubland Alliance (A.909)
Alliance (English name)	Greenbrier species - Eastern Poison-ivy Vine-Shrubland Alliance
Association	*Smilax glauca* - *Toxicodendron radicans* Vine-Shrubland
Association (English name)	Whiteleaf Greenbrier - Eastern Poison-ivy Vine-Shrubland
Ecological System(s):	Northern Atlantic Coastal Plain Dune and Maritime Grassland (CES203.264).

GLOBAL DESCRIPTION

Concept Summary: This community is best described as vine-covered maritime sand dunes. Generally confined to barrier beach systems of the North Atlantic, this vegetation is comprised of dense vines that cover the crests of dunes exposed to wind, salt spray and periodic overwash by storm tides. Very little soil development occurs, and the water table is well below 1 m in depth. The dominant species of any single dune may be one of several vine species such as *Smilax glauca* (cat greenbrier), *Smilax rotundifolia* (roundleaf greenbrier), *Vitis rotundifolia* (muscadine), *Parthenocissus quinquefolia* (Virginia creeper), or *Toxicodendron radicans* (eastern poison ivy). In some cases, the vines are shallowly rooted in sand or growing over older vine stems or other living or dead shrubs such as *Morella pensylvanica* (northern bayberry). Scattered dune grassland species may be present such as *Ammophila breviligulata* (American beachgrass), *Lechea maritima* (beach pinweed), *Solidago sempervirens* (seaside goldenrod), and *Hudsonia tomentosa* (woolly beachheather). Diagnostic species are *Smilax glauca* (cat greenbrier), *Smilax rotundifolia* (roundleaf greenbrier), *Toxicodendron radicans* (eastern poison ivy), and *Parthenocissus quinquefolia* (Virginia creeper). The vegetation is generally low to the ground (less than half a meter tall) and generally covers 70-80% of the surface of the ground, the remainder being exposed sand. This vegetation is not widely described in the literature, but is likely to occur in New England south to Maryland and perhaps Virginia.

Environmental Description: This community occurs on maritime sand dunes, generally of barrier beach systems, where vegetation is exposed to wind, salt spray and periodic overwash by storm tides. Vegetation is shallowly rooted in sand or draped over living or dead shrubs. Very little soil development occurs, and the water table is well below 1 m in depth (Martin 1959b).
Vegetation Description: The dominant species of any single dune may be one of several vine species such as *Smilax glauca* (cat greenbrier), *Smilax rotundifolia* (roundleaf greenbrier), *Vitis rotundifolia* (muscadine), *Parthenocissus quinquefolia* (Virginia creeper), or *Toxicodendron radicans* (eastern poison ivy). In some cases, the vines are shallowly rooted in the sand or grow over older vine stems or other living or dead shrubs such as *Morella pensylvanica* (northern bayberry) and *Prunus serotina* (black cherry). Scattered dune grassland species may be present such as *Ammophila breviligulata* (American beachgrass), *Lechea maritima* (beach pinweed), *Solidago sempervirens* (seaside goldenrod), and *Hudsonia tomentosa* (woolly beachheather). The vegetation is generally low to the ground (less than half a meter tall) and generally covers 70-80% of the surface of the ground, the remainder being exposed sand. Invasive species, including *Lonicera japonica* (Japanese honeysuckle) and *Celastrus orbiculata* (Asian bittersweet), may also be present.

Most Abundant Species:

Stratum	Lifeform	Species
Shrub/sapling (tall & short)	Vine/Liana	*Smilax glauca* (cat greenbrier), *Smilax rotundifolia* (roundleaf greenbrier), *Toxicodendron radicans* (eastern poison ivy)

Characteristic Species: *Parthenocissus quinquefolia* (Virginia creeper), *Smilax glauca* (cat greenbrier), *Smilax rotundifolia* (roundleaf greenbrier), *Toxicodendron radicans* (eastern poison ivy).
Other Noteworthy Species: Information not available.
USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: This type is likely to occur in New England south to Maryland and perhaps Virginia.
States/Provinces: DE, MA, MD, NJ, NY, VA?
Federal Lands: NPS (Assateague Island, Cape Cod, Fire Island, Gateway); USFWS (Parker River?).

CONSERVATION STATUS

Rank: G1G2 (18-Jan-2006).
Reasons: This small-patch community is restricted to coastal sand dunes of only four states. Total number of occurrences is 21-100, and total acreage is well less than 2000 acres.

CLASSIFICATION INFORMATION

Status: Standard.
Confidence: 2 - Moderate.
Comments: Information not available.
Similar Associations:
Smilax auriculata - Toxicodendron radicans Vine-Shrubland (CEGL003885)--is the southern analog of this association.
Related Concepts:
Coastal dune community (Rawinski 1984) ?
Greenbrier thicket (Martin 1959b) ?
SNE coastal rocky headland community (Rawinski 1984) ?

SOURCES

Description Authors: S. L. Neid and L. A. Sneddon, mod. E. Largay.

References: Berdine 1998, Bowman 2000, Dowhan and Rozsa 1989, Eastern Ecology Working Group n.d., Edinger et al. 2002, Harrison 2004, Harrison and Stango 2003, Martin 1959b, NRCS 2001b, Rawinski 1984, Reschke 1990, Sneddon and Lundgren 2001, Swain and Kearsley 2001.



Figure E13. North Atlantic Coastal Plain Vine Dune in Gateway National Recreation Area, Sandy Hook Unit (Accuracy Assessment Point 27XX, photo no. 1218). 8/23/2006. NAD 1983 / UTM easting 586503, northing 4474089.

COMMON NAME (PARK-SPECIFIC): MID-ATLANTIC MARITIME SALT SHRUB

SYNONYMS
NVC English Name: **Maritime Marsh-elder / Saltmeadow Cordgrass Shrubland**
NVC Scientific Name: ***Iva frutescens / Spartina patens* Shrubland**
NVC Identifier: **CEGL006848**

LOCAL INFORMATION

Environmental Description: This estuarine shrubland usually forms an ecotone between high salt marsh and adjacent upland vegetation, but it also occurs in patches on areas of slightly higher elevation within maritime dunes. It occurs above mean high tide but can be flooded by storm tides. Substrate is primarily fine sand to mucky fine sandy loam consisting of very deep, excessively drained to very poorly drained soils formed in eolian sands, sandy marine sediments, dredge fill, or thick sandy deposits with a thin organic surface layer. Soils are in the Hooksan, Jamaica, and Sandyhook series (NRCS 2001b).

Vegetation Description: This tidal shrubland is dominated by a fairly dense cover of *Iva frutescens* (Jesuit's bark) and *Baccharis halimifolia* (eastern baccharis). Associated tall and short shrubs are *Morella pensylvanica* (northern bayberry), *Rhus copallinum* (flameleaf sumac), *Prunus serotina* (black cherry), and *Rosa palustris* (swamp rose). A few scattered trees can be included in the community; *Ailanthus altissima* (tree of heaven) and *Juniperus virginiana* (eastern redcedar) are the most commonly encountered. Vines, primarily *Toxicodendron radicans* (eastern poison ivy), are present but are generally not abundant. Additional vine species can include *Calystegia sepium* (hedge false bindweed), *Smilax rotundifolia* (roundleaf greenbrier), *Parthenocissus quinquefolia* (Virginia creeper), and *Celastrus orbiculata* (Asian bittersweet). Herbaceous cover can be quite high, particularly that of *Phragmites australis* (common reed), which is an extremely common invasive associate in this community at Gateway. *Spartina patens* (saltmeadow cordgrass) and *Juncus gerardii* (saltmeadow rush) are also characteristic associates, with *Limonium carolinianum* (Carolina sealavender), *Distichlis spicata* (inland saltgrass), *Suaeda maritima* (herbaceous seepweed), *Spartina alterniflora* (smooth cordgrass), *Panicum virgatum* (switchgrass), and *Solidago sempervirens* (seaside goldenrod) also present at lower abundance.

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Ailanthus altissima* (tree of heaven)
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Baccharis halimifolia* (eastern baccharis), *Iva frutescens* (Jesuit's bark)
Herb (field)	Vine/Liana	*Toxicodendron radicans* (eastern poison ivy)
Herb (field)	Graminoid	*Phragmites australis* (common reed)

Characteristic Species: *Baccharis halimifolia* (eastern baccharis), *Iva frutescens* (Jesuit's bark), *Juncus gerardii* (saltmeadow rush), *Morella pensylvanica* (northern bayberry), *Phragmites australis* (common reed), *Spartina patens* (saltmeadow cordgrass), *Toxicodendron radicans* (eastern poison ivy)

Other Noteworthy Species: Information not available.

Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
NY	S4	B	1	Salt shrub	Edinger et al. 2002
NJ	S2S3	=	1	*Iva frutescens/Spartina patens* Shrubland	Breden et al. 2001

Local Range: This association occurs in the Sandy Hook Unit and in all sections of the Jamaica Bay Unit.
Classification Comments: None.
Other Comments: This association is susceptible to invasion by *Phragmites australis* (common reed). On aerial photos, *Phragmites* spp. (reed) often obscures salt shrub species that persist under its dense growth.
Local Description Authors: G. J. Edinger and A. L. Feldmann.
Plots: 1b, 1d, 1g, 2ah, 2an, 2s, 3ai, 3h, 5ai, 7aa, 14n, 36XX, 94, 133XX, 134XX, 135, 140XX, 148YY, 149, 152, 211, 254, ref1, ref6.
Gateway National Recreation Area Inventory Notes: Information not available.

GLOBAL INFORMATION

NVC CLASSIFICATION

Physiognomic Class	Shrubland (III)
Physiognomic Subclass	Deciduous shrubland (III.B.)
Physiognomic Group	Cold-deciduous shrubland (III.B.2.)
Physiognomic Subgroup	Natural/Semi-natural cold-deciduous shrubland (III.B.2.N.)
Formation	Tidal cold-deciduous shrubland (III.B.2.N.h.)
Alliance	*Baccharis halimifolia - Iva frutescens* Tidal Shrubland Alliance (A.1023)
Alliance (English name)	Groundsel-tree - Maritime Marsh-elder Tidal Shrubland Alliance
Association	*Iva frutescens / Spartina patens* Shrubland
Association (English name)	Maritime Marsh-elder / Saltmeadow Cordgrass Shrubland
Ecological System(s):	Atlantic Coastal Plain Embayed Region Tidal Salt and Brackish Marsh (CES203.260). Atlantic Coastal Plain Northern Salt Pond Marsh (CES203.892). Northern Atlantic Coastal Plain Tidal Salt Marsh (CES203.519). Central Atlantic Coastal Plain Salt and Brackish Tidal Marsh (CES203.270).

GLOBAL DESCRIPTION

Concept Summary: This maritime shrubland of the eastern Atlantic states occurs in association with salt marshes. In its natural condition, this community forms the ecotone between high salt marsh and adjacent upland vegetation. It also occurs in patches on areas of slightly higher elevation within the salt marsh or on spoil mounds adjacent to ditches. *Iva frutescens* (Jesuit's bark) is the most characteristic and dominant shrub species. *Spartina patens* (saltmeadow cordgrass) is a characteristic and usually abundant grass, often occurring as a monoculture beneath the shrub canopy. Other common herbaceous associates include *Distichlis spicata* (inland saltgrass) and *Spartina alterniflora* (smooth cordgrass); *Juncus gerardii* (saltmeadow rush) may also occur at the northern end of the range. Other less common associates may include *Cuscuta gronovii* (scaldweed), *Limonium carolinianum* (Carolina sealavender), *Lythrum lineare* (wand lythrum), and *Solidago sempervirens* (seaside goldenrod). The vegetation is characterized by an open and relatively evenly spaced shrub stratum of short stature, rarely exceeding one meter in height, with a well-developed herbaceous layer, reflecting an intergrading of this community with the adjacent high salt marsh. Storm-induced disturbance causes periodic die-back of the shrubs restricting the extent of their spread.

Environmental Description: This maritime and estuarine shrubland of the eastern Atlantic states occurs in association with salt marshes. It forms an ecotone between the high salt marsh and adjacent upland vegetation. It also occurs in patches on areas of slightly higher elevation within the salt marsh or on spoil mounds adjacent to ditches. This shrubland occurs above mean high tide but can be flooded by storm tides. Substrate is organic peat over glacial till, sand, or sandy loam.

Vegetation Description: *Iva frutescens* (Jesuit's bark) is the most characteristic and dominant shrub species. *Spartina patens* (saltmeadow cordgrass) is a characteristic and usually abundant grass, often occurring as a monoculture beneath the shrub canopy. Other common herbaceous associates include *Distichlis spicata* (inland saltgrass) and *Spartina alterniflora* (smooth cordgrass); *Juncus gerardii* (saltmeadow rush) may also occur at the northern end of the range. Other less common associates may include *Cuscuta gronovii* (scaldweed), *Limonium carolinianum* (Carolina sealavender), *Lythrum lineare* (wand lythrum), and *Solidago sempervirens* (seaside goldenrod). The vegetation is characterized by an open and relatively evenly spaced shrub stratum of short stature, rarely exceeding one meter in height, with a well-developed herbaceous layer, reflecting an intergrading of this community with the adjacent high salt marsh.

Most Abundant Species:

Stratum	Lifeform	Species
Short shrub/sapling	Semi-shrub	*Iva frutescens* (Jesuit's bark)
Herb (field)	Graminoid	*Spartina patens* (saltmeadow cordgrass)

Characteristic Species: *Iva frutescens* (Jesuit's bark).

Other Noteworthy Species: Information not available.

USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: This association ranges from Massachusetts to South Carolina.

States/Provinces: CT, DE:S5, MA, MD:S5, NC, NJ:S2S3, NY:S4, RI, SC, VA:S5.

Federal Lands: NPS (Assateague Island, Boston Harbor Islands, Cape Cod, Fire Island, Gateway, George Washington Birthplace); USFWS (Back Bay?, Chesapeake Marshlands, Chincoteague, Monomoy?, Parker River, Prime Hook).

CONSERVATION STATUS

Rank: G5 (1-Dec-1997).

Reasons: This vegetation occurs commonly in salt marshes of the eastern seaboard.

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 2 - Moderate.

Comments: As shrub cover decreases, the community often grades into high salt marsh associations such as *Panicum virgatum - Spartina patens* Herbaceous Vegetation (CEGL006150) or *Spartina patens* (saltmeadow cordgrass)-dominated high marsh associations. Southern analogs of this salt marsh-upland border shrubland include *Baccharis halimifolia - Iva frutescens - Morella cerifera - (Ilex vomitoria)* Shrubland (CEGL003920) along the southern Atlantic Coast from the Carolinas to Florida west to Louisiana and *Iva frutescens* ssp. *frutescens - Baccharis halimifolia / Spartina spartinae* Shrubland (CEGL004616) along the Texas Gulf Coast. This community is differentiated from *Morella cerifera - Baccharis halimifolia / Spartina patens* Shrubland (CEGL003809) by the presence of *Iva frutescens* (Jesuit's bark) and by the influence of tidal flooding. It is differentiated from *Baccharis halimifolia - Iva frutescens / Panicum*

virgatum Shrubland (CEGL006063) by a relatively lower species composition, lower elevation and more gradual transition to the adjacent high salt marsh, and by the unimportance of *Baccharis halimifolia* (eastern baccharis) and *Panicum virgatum* (switchgrass).

Similar Associations:

Baccharis halimifolia - Iva frutescens - Morella cerifera - (Ilex vomitoria) Shrubland (CEGL003920).
Baccharis halimifolia - Iva frutescens / Panicum virgatum Shrubland (CEGL006063).
Eleocharis rostellata - Spartina patens Herbaceous Vegetation (CEGL006611).
Iva frutescens / Spartina cynosuroides Tidal Shrubland (CEGL006847).
Iva frutescens ssp. *frutescens - Baccharis halimifolia / Spartina spartinae* Shrubland (CEGL004616).
Panicum virgatum - Spartina patens Herbaceous Vegetation (CEGL006150).

Related Concepts:

Baccharis halimifolia - Iva frutescens ssp. *oraria / Spartina patens* Shrubland (Bartgis 1986) B
Iva frutescens - Baccharis halimifolia / Spartina patens - Distichlis spicata Tidal Shrubland (VDNH 2003) =
Iva frutescens - Baccharis halimifolia (Good 1965) ?
Iva frutescens / Spartina patens Tidal Shrubland (Harrison and Stango 2003) =
Iva frutescens and *Baccharis halimifolia* (Klemas et al. 1973) B
Estuarine scrub-shrub wetland (Tiner 1985a) ?
Estuarine scrub-shrub wetland (Tiner 1985b) ?
Salt Marsh (Rawinski 1984) ?
Salt Marsh Complex, marsh-upland border (Breden 1989) B
Salt Shrub (High Subtype) (Schafale 2000) ?
Salt bush - salt meadow marsh (Daiber et al. 1976) =
Salt grass - marsh elder savanna (Martin 1959b) =
Salt marsh and upper border (Barry 1980) ?
Salt marsh community (Hill 1986) B
Salt shrub (Reschke 1990) B
Saltbush zone (Boule 1979) B
Shrub succession community (Higgins et al. 1971) B
Swamp thicket (Klotz 1986) B

SOURCES

Description Authors: S. L. Neid, E. F. Largay, mod. L. A. Sneddon.

References: Barry 1980, Bartgis 1986, Bell et al. 2002, Berdine 1998, Boule 1979, Bowman 2000, Breden 1989, Breden et al. 2001, Clancy 1996, Coulling 2002, Coulling pers. comm., Daiber et al. 1976, Dowhan and Rozsa 1989, Eastern Ecology Working Group n.d., Edinger et al. 2002, Enser 1999, Fleming 2001, Fleming et al. 2001, Fleming pers. comm., Good 1965, Harrison 2004, Harrison and Stango 2003, Higgins et al. 1971, Hill 1986, J. Harrison pers. comm., Klemas et al. 1973, Klotz 1986, Martin 1959b, Metzler and Barrett 2001, NRCS 2001b, Rawinski 1984, Reschke 1990, Schafale 2000, Schafale and Weakley 1990, Sneddon et al. 1995, Swain and Kearsley 2001, TNC 1995c, Tiner 1984, Tiner 1985a, Tiner 1985b, VDNH 2003.



Figure E14. Mid-Atlantic Maritime Salt Shrub in Gateway National Recreation Area, Sandy Hook Unit (Accuracy Assessment Point 148YY, photo no. 1237). 8/24/2006. NAD 1983 / UTM easting 585444, northing 4476038.

COMMON NAME (PARK-SPECIFIC): NORTHERN BEACH HEATHER DUNE SHRUBLAND

SYNONYMS

NVC English Name: **Woolly Beach-heather - Bearberry or Kinikinnick Dwarf-shrubland**

NVC Scientific Name: ***Hudsonia tomentosa* - *Arctostaphylos uva-ursi* Dwarf-shrubland**

NVC Identifier: **CEGL006143**

LOCAL INFORMATION

Environmental Description: This association occurs in well-developed sand dune systems on stable secondary dunes. Conditions are xeric; plants must be adapted to low moisture, high surface temperature, and high light intensity. Substrate is fine sand in the Hooksan series (NRCS 2001b). The natural setting for this community is in flat openings within Northern Tall Maritime Shrubland (CEGL006379), Maritime Red-cedar Woodland (CEGL006212), Maritime Holly Forest (CEGL006376), and Mid-Atlantic Maritime Salt Shrub (CEGL006848). At Gateway, it can also be found in a disturbed setting surrounded by Japanese Black Pine Forest (CEGL006012).

Vegetation Description: This dwarf-shrubland is characterized by *Hudsonia tomentosa* (woolly beachheather) occurring with other low-growing shrubs, including *Juniperus virginiana* (eastern redcedar), *Prunus maritima* (beach plum), *Rhus copallinum* (flameleaf sumac), *Pinus thunbergiana* (Japanese black pine), *Morella pensylvanica* (northern bayberry), and *Prunus serotina* (black cherry). *Populus alba* (white poplar) can be present in extremely low abundance, making up a scattered tall-shrub layer. Vine cover is also sparse and consists primarily of *Parthenocissus quinquefolia* (Virginia creeper). Herbaceous species generally occur in low abundance and include *Ammophila breviligulata* (American beachgrass), *Corynephorus canescens* (gray clubawn grass), *Cyperus grayi* (Gray's flatsedge), *Artemisia campestris* (field sagewort), *Solidago sempervirens* (seaside goldenrod), *Schizachyrium scoparium* (little bluestem), *Heterotheca subaxillaris* (camphorweed), *Eragrostis spectabilis* (purple lovegrass), *Lechea maritima* (beach pinweed), *Spartina patens* (saltmeadow cordgrass), *Polygonella articulata* (coastal jointweed), *Opuntia humifusa* (devil's-tongue), *Triplasis purpurea* (purple sandgrass), *Nuttallanthus canadensis* (Canada toadflax), *Aristida tuberculosa* (seaside threeawn), *Bromus tectorum* (cheatgrass), *Conyza canadensis* (Canadian horseweed), *Carex silicea* (beach sedge), and *Cyperus polystachyos* (manyspike flatsedge). *Cladonia* (cup lichen) spp. can be common, particularly in more stabilized settings.

Most Abundant Species:

Stratum	Lifeform	Species
Short shrub/sapling	Dwarf-shrub	*Hudsonia tomentosa* (woolly beachheather)
Herb (field)	Vine/Liana	*Parthenocissus quinquefolia* (Virginia creeper)
Herb (field)	Graminoid	*Ammophila breviligulata* (American beachgrass)

Characteristic Species: *Ammophila breviligulata* (American beachgrass), *Artemisia campestris* (field sagewort), *Cyperus grayi* (Gray's flatsedge), *Heterotheca subaxillaris* (camphorweed), *Hudsonia tomentosa* (woolly beachheather), *Juniperus virginiana* (eastern redcedar), *Parthenocissus quinquefolia* (Virginia creeper), *Schizachyrium scoparium* (little bluestem), *Solidago sempervirens* (seaside goldenrod).

Other Noteworthy Species: Information not available.

Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
NY	S3*	B	.	Maritime dunes	Edinger et al. 2002
NJ	.	=	1	*Hudsonia tomentosa-Arctostaphylos uva-ursi* Dwarf-shrubland	Walz et al. 2007

Local Range: This association occurs in the Sandy Hook Unit and in the Fort Tilden and Floyd Bennett Field sections of the Jamaica Bay Unit.
Classification Comments: This association is similar to, and shares many characteristic species with, North Atlantic Coast Backdune Grassland (CEGL006161). Both types have similar distributions in the park and can grade from one to the other. North Atlantic Coast Backdune Grassland (CEGL006161) is dominated by *Schizachyrium scoparium* (little bluestem) and Northern Beach Heather Dune Shrubland (CEGL006143) is dominated by *Hudsonia tomentosa* (woolly beachheather).
Other Comments: None.
Local Description Authors: G. J. Edinger and A. L. Feldmann.
Plots: 2l, 10XX, 63XX, 86, 99XX, 136XX, 153XX.
Gateway National Recreation Area Inventory Notes: Information not available.

GLOBAL INFORMATION

NVC CLASSIFICATION

Physiognomic Class	Dwarf-shrubland (IV)
Physiognomic Subclass	Evergreen dwarf-shrubland (IV.A.)
Physiognomic Group	Needle-leaved or microphyllous evergreen dwarf-shrubland (IV.A.1.)
Physiognomic Subgroup	Natural/Semi-natural needle-leaved or microphyllous evergreen dwarf-shrubland (IV.A.1.N.)
Formation	Cespitose needle-leaved or microphyllous evergreen dwarf-shrubland (IV.A.1.N.a.)
Alliance	*Hudsonia tomentosa* Dwarf-shrubland Alliance (A.1062)
Alliance (English name)	Woolly Beach-heather Dwarf-shrubland Alliance
Association	*Hudsonia tomentosa - Arctostaphylos uva-ursi* Dwarf-shrubland
Association (English name)	Woolly Beach-heather - Bearberry or Kinikinnick Dwarf-shrubland
Ecological System(s):	Northern Atlantic Coastal Plain Dune and Maritime Grassland (CES203.264).

GLOBAL DESCRIPTION

Concept Summary: This association comprises dune heathlands of the north Atlantic coast from southern Maine to Long Island, New York, dominated by *Hudsonia tomentosa* (woolly beachheather). It occurs in well-developed dune systems in the lee side of primary dunes or on secondary dunes with active sand deposition and movement. *Hudsonia tomentosa* (woolly beachheather) is a dominant as well as keystone species of this community, binding sand in place and forming more suitable habitat for other plants to become established. Associated herbs generally occur in low abundance and include *Polygonella articulata* (coastal jointweed), *Lechea maritima* (beach pinweed), *Deschampsia flexuosa* (wavy hairgrass), *Minuartia caroliniana* (pinebarren stitchwort), *Ionactis linariifolius* (flaxleaf whitetop aster), *Solidago sempervirens*

(seaside goldenrod), *Lathyrus japonicus* (beach pea), *Artemisia stelleriana* (oldwoman), *Carex silicea* (beach sedge), *Chamaesyce polygonifolia* (seaside sandmat), *Cyperus polystachyos* (manyspike flatsedge), and scattered *Ammophila breviligulata* (American beachgrass). Older, more stabilized dunes tend to have greater species diversity and less sand deposition. In these areas *Arctostaphylos uva-ursi* (kinnikinnick) can displace *Hudsonia tomentosa* (woolly beachheather) or co-dominate, and Asteraceae species and *Cladina* (reindeer lichen) spp. are common. Scattered individuals of *Morella pensylvanica* (northern bayberry), *Rosa rugosa* (rugosa rose), *Prunus maritima* (beach plum), or *Gaylussacia baccata* (black huckleberry) may occur within this community.

Environmental Description: This association occurs in well-developed sand dune systems in the lee side of primary dunes or on secondary dunes with active sand deposition and movement. Conditions are xeric; plants must be adapted to low moisture, high surface temperature, and high light intensity.

Vegetation Description: This dwarf-shrubland is dominated by *Hudsonia tomentosa* (woolly beachheather). Associated species generally occur in low abundance and include *Polygonella articulata* (coastal jointweed), *Lechea maritima* (beach pinweed), *Minuartia caroliniana* (pinebarren stitchwort), *Ionactis linariifolius* (flaxleaf whitetop aster), *Solidago sempervirens* (seaside goldenrod), *Lathyrus japonicus* (beach pea), *Artemisia stelleriana* (oldwoman), *Carex silicea* (beach sedge), *Chamaesyce polygonifolia* (seaside sandmat), *Cyperus polystachyos* (manyspike flatsedge), and scattered *Ammophila breviligulata* (American beachgrass). Older, more stabilized dunes tend to have greater species diversity and less sand deposition. In these areas *Arctostaphylos uva-ursi* (kinnikinnick) can displace *Hudsonia tomentosa* (woolly beachheather) or co-dominate, and Asteraceae species and *Cladina* (reindeer lichen) spp. are common. Scattered individuals of *Morella pensylvanica* (northern bayberry), *Rosa rugosa* (rugosa rose), *Prunus maritima* (beach plum), or *Gaylussacia baccata* (black huckleberry) may occur within this community.

Most Abundant Species:

Stratum	Lifeform	Species
Short shrub/sapling	Dwarf-shrub	*Hudsonia tomentosa* (woolly beachheather)

Characteristic Species: *Hudsonia tomentosa* (woolly beachheather).

Other Noteworthy Species: Information not available.

USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: This association is restricted to coastal sand dunes from southern Maine to Long Island, New York.

States/Provinces: CT, MA, ME, NJ, NY, RI.

Federal Lands: NPS (Cape Cod, Fire Island, Gateway); USFWS (Monomoy, Parker River).

CONSERVATION STATUS

Rank: G2G3 (30-Jan-2007).

Reasons: This small-patch community is restricted to coastal sand dunes from southern Maine to Long Island, New York, and is faced with threats to most coastal areas of the Northeast in general: commercial and residential development, trampling by beach users, and beach stabilization in particular. An estimated 70 occurrences covering 1000-1300 acres in total exist rangewide.

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 2 - Moderate.

Comments: *Hudsonia tomentosa / Panicum amarum var. amarulum* Dwarf-shrubland (CEGL003950) is a southern analog of this association.

Similar Associations:

Ammophila breviligulata - Lathyrus japonicus Herbaceous Vegetation (CEGL006274).
Hudsonia tomentosa / Panicum amarum var. *amarulum* Dwarf-shrubland (CEGL003950).

Related Concepts:

Coastal dune community (Rawinski 1984) ?
Dune heath (Johnson 1985b) ?
Interdune (McDonnell 1979) ?
New England heath sand barrens / coastal heathland (Rawinski 1984) ?

SOURCES

Description Authors: S. L. Neid.

References: Conard 1935, Dowhan and Rozsa 1989, Dunlop and Crow 1985, Eastern Ecology Working Group n.d., Edinger et al. 2002, Enser 1999, Gawler 2002, Godfrey et al. 1978, Gwilliam unpubl. data 1998, Johnson 1985b, Lundgren 1998, Lundgren et al. 2000, McDonnell 1979, Metzler and Barrett 2001, NRCS 2001b, Nelson and Fink 1980, Rawinski 1984, Reschke 1990, Robichaud and Buell 1973, Swain and Kearsley 2001, Van Luven 1990, Zaremba 1989.



Figure E15. Northern Beach Heather Dune Shrubland in Gateway National Recreation Area, Jamaica Bay Unit (Accuracy Assessment Point 86, photo no. 1274a). 8/30/2006. NAD 1983 / UTM easting 593999, northing 4490547.

COMMON NAME (PARK-SPECIFIC): NORTHERN BEACHGRASS DUNE

SYNONYMS
NVC English Name: **American Beachgrass - Beach Pea Herbaceous Vegetation**
NVC Scientific Name: ***Ammophila breviligulata - Lathyrus japonicus* Herbaceous Vegetation**
NVC Identifier: **CEGL006274**

LOCAL INFORMATION

Environmental Description: This association primarily occurs on active maritime dunes, on both foredunes that are exposed to onshore winds and salt spray, as well as more protected interdunes. Substrate is primarily coarse to fine sand with little to no soil profile development, primarily in the Hooksan-Dune land complex. The community has also developed on the very deep soils formed from sandy dredge fill in the Barren, Bigapple, Fortress, and Jamaica series, as well as on Matunuck mucky peat, which consists of thick sandy sediments overlain by a thin organic surface layer (NRCS 2001b). This *Ammophila* (beachgrass)-dominated maritime dune association typically occurs in a complex with other dune types, including Overwash Dune Grassland (CEGL004097), Beachgrass-Panicgrass Dune Grassland (CEGL004043), North Atlantic Coast Backdune Grassland (CEGL006161), and North Atlantic Coastal Plain Vine Dune (CEGL003886). Patches of Mid-Atlantic Maritime Salt Shrub (CEGL003921) and Northern Bayberry Dune Shrubland (CEGL006295) are often surrounded by this association as well. At Sandy Hook, Japanese Sedge Maritime Dunes (CEGL006615) is invading and overtaking this community in some areas.

Vegetation Description: This association is characterized and dominated by *Ammophila breviligulata* (American beachgrass), which can occur monotypically, especially on foredunes or other areas of active and rapid sand deposition. The most common associated herbaceous species are *Solidago sempervirens* (seaside goldenrod), *Schizachyrium scoparium* (little bluestem), *Spartina patens* (saltmeadow cordgrass), and *Heterotheca subaxillaris* (camphorweed). Many other species can also be present, but at quite low frequency and abundance, including *Panicum virgatum* (switchgrass), *Conyza canadensis* (Canadian horseweed), *Artemisia campestris* (field sagewort), *Eragrostis spectabilis* (purple lovegrass), *Lepidium virginicum* (Virginia pepperweed), *Oenothera biennis* (common evening-primrose), *Pseudognaphalium obtusifolium* (rabbittobacco), *Artemisia vulgaris* (common wormwood), *Corynephorus canescens* (gray clubawn grass), *Cakile edentula* (American searocket), *Lathyrus japonicus* (beach pea), *Panicum amarum* (bitter panicgrass), *Polygonella articulata* (coastal jointweed), and *Lechea maritima* (beach pinweed). Rarely, stunted trees (*Pinus thunbergiana* (Japanese black pine) and *Ailanthus altissima* (tree of heaven)) colonize within this association. More commonly, stunted or dwarf-shrubs occur in small patches within the herbaceous dune vegetation. Species include *Morella pensylvanica* (northern bayberry), *Rhus copallinum* (flameleaf sumac), *Prunus maritima* (beach plum), *Rosa rugosa* (rugosa rose), *Prunus serotina* (black cherry), and *Hudsonia tomentosa* (woolly beachheather). Low-growing vines, primarily *Parthenocissus quinquefolia* (Virginia creeper) and *Toxicodendron radicans* (eastern poison ivy), occur infrequently.

Most Abundant Species:

Stratum	Lifeform	Species
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Morella pensylvanica* (northern bayberry)
Herb (field)	Vine/Liana	*Parthenocissus quinquefolia* (Virginia creeper)
Herb (field)	Graminoid	*Ammophila breviligulata* (American beachgrass)

Characteristic Species: *Ammophila breviligulata* (American beachgrass), *Heterotheca subaxillaris* (camphorweed), *Parthenocissus quinquefolia* (Virginia creeper), *Schizachyrium scoparium* (little bluestem), *Solidago sempervirens* (seaside goldenrod), *Spartina patens* (saltmeadow cordgrass).

Other Noteworthy Species:

Species	GRank	Type	Note
Cenchrus tribuloides (sanddune sandbur)	-	plant	State threatened plant (NY)
Oenothera oakesiana (Oakes' evening-primrose)	-	plant	State threatened plant (NY)

Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
NY	S3*	B	.	Maritime dunes	Edinger et al. 2002
NJ	S2S3	=	1	*Ammophila breviligulata-Lathyrus japonicus* Herbaceous Vegetation	Breden et al. 2001

Local Range: This association is distributed across all sections of the park; it occurs in the Sandy Hook Unit, the Staten Island Unit, and the Jamaica Bay Unit.

Classification Comments: None.

Other Comments: None.

Local Description Authors: G. J. Edinger and A. L. Feldmann.

Plots: 1aa, 1ad, 2aa, 2ae, 2ai, 2aj, 3f, 3k, 3r, 4, 4ad, 4aj, 4f, 4z, 5m, 5s, 6, 6aj, 6n, 7ac, 7aj, 7am, 8aa, 8n, 10aj, 11an, 13an, 14an, 17n, 48XX, 58ZZ, 79XX, 92YY, 93, 97XX, 104YY, 110XX, 134YY, 155XX, 225, 245, 275, ref1, ref4.

Gateway National Recreation Area Inventory Notes: Information not available.

GLOBAL INFORMATION

NVC CLASSIFICATION

Physiognomic Class	Herbaceous Vegetation (V)
Physiognomic Subclass	Perennial graminoid vegetation (V.A.)
Physiognomic Group	Temperate or subpolar grassland (V.A.5.)
Physiognomic Subgroup	Natural/Semi-natural temperate or subpolar grassland (V.A.5.N.)
Formation	Medium-tall sod temperate or subpolar grassland (V.A.5.N.c.)
Alliance	*Ammophila breviligulata* Herbaceous Alliance (A.1207)
Alliance (English name)	American Beachgrass Herbaceous Alliance
Association	*Ammophila breviligulata - Lathyrus japonicus* Herbaceous Vegetation
Association (English name)	American Beachgrass - Beach Pea Herbaceous Vegetation
Ecological System(s):	Northern Atlantic Coastal Plain Dune and Maritime Grassland (CES203.264).

GLOBAL DESCRIPTION

Concept Summary: This dune grassland of maritime beaches occurs along the North Atlantic coast from New Jersey north to central Maine. This association primarily occurs on active maritime dunes, on both foredunes that are exposed to onshore winds and salt spray as well as more protected interdunes. The substrate is wind-deposited sand with no soil development. *Ammophila breviligulata* (American beachgrass) is the dominant species, often occurring

monotypically. *Lathyrus japonicus* (beach pea) is a common associate and can be co-dominant. Other associated species include *Solidago sempervirens* (seaside goldenrod), *Lechea maritima* (beach pinweed), *Aristida tuberculosa* (seaside threeawn), *Schizachyrium scoparium* (little bluestem), *Carex silicea* (beach sedge), *Polygonella articulata* (coastal jointweed), and *Artemisia stelleriana* (oldwoman). Dwarf-shrubs, such as *Hudsonia tomentosa* (woolly beachheather), can occur sporadically and form locally dominant patches. Vegetation cover is often sparse, and bare sand is usually evident.

Environmental Description: This association primarily occurs on active maritime dunes, on both foredunes that are exposed to onshore winds and salt spray as well as more protected interdunes. This grassland generally occurs beyond the influence of storm tides. Substrate is sand with no soil profile development.

Vegetation Description: This association is characterized and dominated by *Ammophila breviligulata* (American beachgrass), which can occur monotypically, especially on foredunes or other areas of active and rapid sand deposition. *Lathyrus japonicus* (beach pea) is the most common associate and can be co-dominant. Other associated species include *Solidago sempervirens* (seaside goldenrod), *Lechea maritima* (beach pinweed), *Aristida tuberculosa* (seaside threeawn), *Schizachyrium scoparium* (little bluestem), *Carex silicea* (beach sedge), *Polygonella articulata* (coastal jointweed), and *Artemisia stelleriana* (oldwoman). Dwarf-shrubs, such as *Hudsonia tomentosa* (woolly beachheather), *Rosa rugosa* (rugosa rose), *Morella pensylvanica* (northern bayberry), or stunted *Prunus maritima* (beach plum), can occur sporadically and form locally dominant patches within the grassland.

Most Abundant Species:

Stratum	Lifeform	Species
Herb (field)	Forb	*Lathyrus japonicus* (beach pea)
Herb (field)	Graminoid	*Ammophila breviligulata* (American beachgrass)

Characteristic Species: *Ammophila breviligulata* (American beachgrass).

Other Noteworthy Species: Information not available.

USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: This association occurs along the northern Atlantic Coast from Maine to New Jersey.

States/Provinces: CT, DE?, MA, ME:S2, NH:S1, NJ:S2S3, NY, RI.

Federal Lands: NPS (Acadia, Boston Harbor Islands, Cape Cod, Fire Island, Gateway, Sagamore Hill); USFWS (Monomoy, Muskeget Island, Nomans Land Island, Parker River).

CONSERVATION STATUS

Rank: G4? (1-Dec-1997).

Reasons: Information not available.

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 2 - Moderate.

Comments: The southern analog of this dune grassland association is *Ammophila breviligulata - Panicum amarum var. amarum* Herbaceous Vegetation (CEGL004043), which is differentiated by having *Panicum amarum* (bitter panicgrass) as a co-dominant species in addition to the presence of more southern species such as *Cenchrus tribuloides* (sanddune sandbur) and *Oenothera humifusa* (seabeach evening-primrose), plus the absence of *Lathyrus japonicus* (beach pea). These two *Ammophila breviligulata* (American beachgrass)-dominated associations overlap geographically in New Jersey. This association is often adjacent to *Hudsonia tomentosa*

(woolly beachheather) dwarf-shrublands and they have much species overlap; when dwarf-shrub cover exceeds 25%, the community is considered *Hudsonia tomentosa - Arctostaphylos uva-ursi* Dwarf-shrubland (CEGL006143).

Similar Associations:

Ammophila breviligulata - Panicum amarum var. *amarum* Herbaceous Vegetation (CEGL004043).
Hudsonia tomentosa - Arctostaphylos uva-ursi Dwarf-shrubland (CEGL006143).

Related Concepts:

Coastal dune community (Rawinski 1984) ?
Coastal dune grass community (Breden 1989) B
Dune grass community (Nelson and Fink 1980) =
Dunegrass (Martin 1959b) ?

SOURCES

Description Authors: S. L. Neid.

References: Breden 1989, Breden et al. 2001, Dowhan and Rozsa 1989, Eastern Ecology Working Group n.d., Edinger et al. 2002, Enser 1999, Gawler 2001, Gawler 2002, Johnson 1981b, Johnson 1985b, Martin 1959b, Metzler and Barrett 2001, Moul 1969, NRCS 2001b, Nelson and Fink 1980, Rawinski 1984, Reschke 1990, Sperduto 1997a, Swain and Kearsley 2001, Zaremba and Leatherman 1984.



Figure E16. Northern Beachgrass Dune in Gateway National Recreation Area, Jamaica Bay Unit (Accuracy Assessment Point Ref1, photo no. 1282b). 9/13/2006. NAD 1983 / UTM easting 592523, northing 4490060.

COMMON NAME (PARK-SPECIFIC): BEACHGRASS - PANICGRASS DUNE GRASSLAND

SYNONYMS
NVC English Name: **American Beachgrass - Bitter Panicgrass Herbaceous Vegetation**
NVC Scientific Name: ***Ammophila breviligulata* - *Panicum amarum* var. *amarum* Herbaceous Vegetation**
NVC Identifier: **CEGL004043**

LOCAL INFORMATION

Environmental Description: This dune grassland occurs exclusively in a complex with Northern Beachgrass Dune (CEGL006274) on sandy, unstable, droughty foredunes with no soil development. Eolian processes cause active sand deposition and erosion. The substrate is fine sand and consists of very deep, excessively drained soils in the Hooksan series formed in eolian sands or sandy marine sediments (NRCS 2001b).
Vegetation Description: This maritime dune grassland is dominated by *Panicum amarum* (bitter panicgrass) with lesser amounts of *Ammophila breviligulata* (American beachgrass). Common associates are *Artemisia campestris* (field sagewort), *Strophostyles umbellata* (pink fuzzybean), *Heterotheca subaxillaris* (camphorweed), *Schizachyrium scoparium* (little bluestem), *Solidago sempervirens* (seaside goldenrod), *Lepidium virginicum* (Virginia pepperweed), *Artemisia stelleriana* (oldwoman), and *Artemisia campestris* (field sagewort). Additional, infrequently occurring herbs are *Xanthium strumarium* (rough cockleburr), *Aristida tuberculosa* (seaside threeawn), *Conyza canadensis* (Canadian horseweed), *Triplasis purpurea* (purple sandgrass), *Cyperus grayi* (Gray's flatsedge), *Oenothera biennis* (common evening-primrose), and *Chamaesyce polygonifolia* (seaside sandmat). Stunted shrubs occur within the community in widely scattered patches; species include *Morella pensylvanica* (northern bayberry), *Prunus serotina* (black cherry), *Juniperus virginiana* (eastern redcedar), *Rhus copallinum* (flameleaf sumac), and *Prunus maritima* (beach plum). Low-growing vines, primarily *Toxicodendron radicans* (eastern poison ivy) but also *Parthenocissus quinquefolia* (Virginia creeper), also occur infrequently. Lichens associated with this community, at low frequency and abundance, are *Placynthiella uliginosa (*placynthiella lichen), *Cladonia coniocraea*, *Cladonia chlorophaea*, and *Cladonia cristatella* (cup lichens).
Most Abundant Species:

Stratum	Lifeform	Species
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Morella pensylvanica* (northern bayberry)
Herb (field)	Vine/Liana	*Toxicodendron radicans* (eastern poison ivy)
Herb (field)	Graminoid	*Panicum amarum* (bitter panicgrass)

Characteristic Species: *Ammophila breviligulata* (American beachgrass), *Artemisia campestris* (field sagewort), *Morella pensylvanica* (northern bayberry), *Panicum amarum* (bitter panicgrass), *Prunus serotina* (black cherry), *Toxicodendron radicans* (eastern poison ivy)
Other Noteworthy Species: Information not available.
Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
NY	SNR	B	1	Maritime dunes	Edinger et al. 2002
NJ	S1S2	=	1	*Ammophila breviligulata-Panicum amarum* Herbaceous Vegetation	Breden et al. 2001

Local Range: This association is only documented in the northern tip of the Sandy Hook Unit in New Jersey.
Classification Comments: None.
Other Comments: None.
Local Description Authors: G. J. Edinger and A. L. Feldmann.
Plots: 4am, 6al, 143, 146.
Gateway National Recreation Area Inventory Notes: Information not available.

GLOBAL INFORMATION

NVC CLASSIFICATION

Physiognomic Class	Herbaceous Vegetation (V)
Physiognomic Subclass	Perennial graminoid vegetation (V.A.)
Physiognomic Group	Temperate or subpolar grassland (V.A.5.)
Physiognomic Subgroup	Natural/Semi-natural temperate or subpolar grassland (V.A.5.N.)
Formation	Medium-tall sod temperate or subpolar grassland (V.A.5.N.c.)
Alliance	*Ammophila breviligulata* Herbaceous Alliance (A.1207)
Alliance (English name)	American Beachgrass Herbaceous Alliance
Association	*Ammophila breviligulata - Panicum amarum* var. *amarum* Herbaceous Vegetation
Association (English name)	American Beachgrass - Bitter Panicgrass Herbaceous Vegetation
Ecological System(s):	Northern Atlantic Coastal Plain Dune and Maritime Grassland (CES203.264).

GLOBAL DESCRIPTION

Concept Summary: This community is a maritime dune grassland dominated by *Ammophila breviligulata* (American beachgrass) or *Panicum amarum var. amarum* (bitter panicgrass). This dune grassland occurs almost exclusively on sandy, unstable, droughty substrates 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. It is found on maritime dunes from southern New Jersey (Cape May) south to the Chesapeake Bay, Virginia, as well as on the northern North Carolina coast. Plant cover is variable, ranging from 10-75%, but is usually low. Other associated species include *Solidago sempervirens* (seaside goldenrod), *Artemisia campestris* ssp. *caudata* (field sagewort), *Strophostyles helvula* (trailing fuzzybean), *Triplasis purpurea* (purple sandgrass), *Cenchrus tribuloides* (sanddune sandbur), *Chamaesyce polygonifolia* (seaside sandmat), *Oenothera humifusa* (seabeach evening-primrose), *Schoenoplectus pungens* (common threesquare) (where overwashed by sand), *Diodia teres* (poorjoe), *Cakile edentula* ssp. *edentula* (American searocket), *Nuttallanthus canadensis* (Canada toadflax), *Salsola kali* ssp. *kali* (Russian thistle), *Lechea maritima* (beach pinweed), *Cyperus grayi* (Gray's flatsedge), and *Spartina patens* (saltmeadow cordgrass). Sparse individuals of stunted *Morella pensylvanica* (northern bayberry) shrubs and seedlings occur but make up less than 2% of the total vegetation cover. Diagnostic species are *Ammophila breviligulata* (American beachgrass), *Solidago sempervirens* (seaside goldenrod), *Panicum amarum var. amarum* (bitter panicgrass), and *Oenothera humifusa* (seabeach evening-primrose).

Environmental Description: This dune grassland community occurs almost exclusively on sandy, unstable, droughty substrates 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.
Vegetation Description: This maritime dune grassland is dominated by *Ammophila breviligulata* (American beachgrass) or *Panicum amarum var. amarum* (bitter panicgrass). Plant cover is variable, ranging from 10-75%, but is usually low. Other associated species include *Solidago sempervirens* (seaside goldenrod), *Artemisia campestris* ssp. *caudata* (field sagewort), *Strophostyles helvula* (trailing fuzzybean), *Triplasis purpurea* (purple sandgrass), *Cenchrus tribuloides* (sanddune sandbur), *Chamaesyce polygonifolia* (seaside sandmat), *Oenothera humifusa* (seabeach evening-primrose), *Schoenoplectus pungens* (common threesquare) (where overwashed by sand), *Diodia teres* (poorjoe), *Cakile edentula* ssp. *edentula* (American searocket), *Nuttallanthus canadensis* (Canada toadflax), *Salsola kali* ssp. *kali* (Russian thistle), *Lechea maritima* (beach pinweed), *Cyperus grayi* (Gray's flatsedge), and *Spartina patens* (saltmeadow cordgrass). Sparse individuals of stunted *Morella pensylvanica* (northern bayberry) shrubs and seedlings occur but make up less than 2% of the total vegetation cover. Diagnostic species are *Ammophila breviligulata* (American beachgrass), *Solidago sempervirens* (seaside goldenrod), *Panicum amarum var. amarum* (bitter panicgrass), and *Oenothera humifusa* (seabeach evening-primrose). *Oenothera humifusa* (seabeach evening-primrose) and *Spartina patens* (saltmeadow cordgrass) differentiate this community from its northern beachgrass counterpart. This association (CEGL004043) contains several species characteristic to *Cakile edentula* ssp. *edentula - Mertensia maritima* Sparse Vegetation (CEGL006106), but it is differentiated by (1) its location beyond storm tide influence, (2) dominance by perennial rather than annual species, (3) greater plant cover on average, and (4) greater prevalence of *Solidago sempervirens* (seaside goldenrod).
Most Abundant Species:

Stratum	Lifeform	Species
Herb (field)	Graminoid	*Ammophila breviligulata* (American beachgrass), *Panicum amarum* var. *amarulum* (bitter panicgrass)

Characteristic Species: *Ammophila breviligulata* (American beachgrass), *Oenothera humifusa* (seabeach evening-primrose), *Panicum amarum* var. *amarulum* (bitter panicgrass), *Solidago sempervirens* (seaside goldenrod).
Other Noteworthy Species: Information not available.
USFWS Wetland System: Not applicable.

DISTRIBUTION
Range: This community occurs on maritime dunes from Long Island, New York south to North Carolina.
States/Provinces: DE:S2?, MD, NC, NJ:S1S2, NY, VA.
Federal Lands: NPS (Assateague Island, Gateway); USFWS (Prime Hook).

CONSERVATION STATUS
Rank: G2 (8-Oct-1998).
Reasons: Although 65-100 Element Occurrences (Eos) are estimated to occur over the range, total acreage likely does not exceed 3000 acres for this small-patch community. Many of the highest quality EOs are on public land, but they continue to be threatened by trampling, ORVs,

and in some cases grazing by feral horses. The association is highly fragile and does not recover well from these actions.

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 2 - Moderate.

Comments: This grassland often occurs in a complex with *Morella pensylvanica / Diodia teres* Shrubland (CEGL003881). It contains several species characteristic to *Cakile edentula* ssp. *edentula - Mertensia maritima* Sparse Vegetation (CEGL006106), but this grassland is differentiated by (1) its location beyond storm tide influence, (2) dominance by perennial rather than annual species, (3) greater plant cover on average, and (4) greater prevalence of *Solidago sempervirens* (seaside goldenrod). *Ammophila breviligulata - Lathyrus japonicus* Herbaceous Vegetation (CEGL006274) is the northern analog of this association; it is the beach grass-dominated primary dune association of the North Atlantic Coast. This association differs in being codominated by *Panicum amarum* (bitter panicgrass), whereas CEGL006274 lacks *Panicum amarum* (bitter panicgrass) as a significant component and has or is codominated by *Lathyrus japonicus* (beach pea). These two associations overlap geographically in southern New Jersey.

Similar Associations:

Ammophila breviligulata - Lathyrus japonicus Herbaceous Vegetation (CEGL006274).
Cakile edentula ssp. *edentula - Mertensia maritima* Sparse Vegetation (CEGL006106).
Carex kobomugi Herbaceous Vegetation (CEGL006615).
Hudsonia tomentosa / Panicum amarum var. *amarulum* Dwarf-shrubland (CEGL003950).

Related Concepts:

Ammophila breviligulata - Panicum amarum Herbaceous Vegetation (Bartgis 1986) =
Ammophila, Panicum amarum dunes (Harvill 1965) =
Panicum, Ammophila community (Egler 1962) =
Coastal dune grass community (Breden 1989) B
Dune Grass (Northern Subtype) (Schafale 2000) ?
Dune community (Baumann 1978b) =
Dunegrass community (Clampitt 1991) B
Dunegrass community (Hill 1986) =
Dunegrass community (Higgins et al. 1971) =
Foredune (Boule 1979) =
Foredune (Klotz 1986) =
Mid-Atlantic *Ammophila breviligulata, Panicum amarulum* dune grassland variant (Clancy 1993a) =
Primary dune (Stalter and Lamont 1990) B
Sand dune (Fender 1937) =

SOURCES

Description Authors: L. A. Sneddon, mod. E. F. Largay.

References: Bartgis 1986, Baumann 1978b, Berdine 1998, Boule 1979, Bowman 2000, Breden 1989, Breden et al. 2001, Clampitt 1991, Clancy 1993a, Clancy 1996, Eastern Ecology Working Group n.d., Egler 1962, Fender 1937, Fleming 2001, Fleming et al. 2001, Harrison 2004, Harvill 1965, Higgins et al. 1971, Hill 1986, Klotz 1986, Martin 1959b, NRCS 2001b, Schafale 2000, Schafale 2003b, Schafale and Weakley 1990, Stalter and Lamont 1990, Zaremba and Leatherman 1984.



Figure E17. Beachgrass - Panicgrass Dune Grassland in Gateway National Recreation Area, Sandy Hook Unit (Accuracy Assessment Point 146, photo no. 1187). 8/22/2006. NAD 1983 / UTM easting 583621, northing 4480908.

COMMON NAME (PARK-SPECIFIC): LITTLE BLUESTEM OLD FIELD

SYNONYMS

NVC English Name: **Little Bluestem - (Broomsedge Bluestem) - Goldenrod species Herbaceous Vegetation**

NVC Scientific Name: ***Schizachyrium scoparium - (Andropogon virginicus) - Solidago* spp. Herbaceous Vegetation**

NVC Identifier: **CEGL006333**

LOCAL INFORMATION

Environmental Description: This association occurs on coarse sand to sandy loam and consists of well-drained to somewhat poorly drained soils formed in sandy dredge fill and loamy fill over sandy sediments primarily in the Bigapple, Barren, Fortress, Verrazano series (NRCS 2001b). The vegetation occurs in disturbed areas and is generally maintained by mowing. Adjacent communities include Northern Tall Maritime Shrubland (CEGL006379), Northern Bayberry Dune Shrubland (CEGL006295), Northeastern Old Field (CEGL006107), and North Atlantic Coast Backdune Grassland (CEGL006161) as well as parking lots and airstrips.

Vegetation Description: This successional vegetation is dominated and characterized by *Schizachyrium scoparium* (little bluestem). Associated species vary widely according to land-use history and adjacent vegetation; they can include *Eragrostis curvula* (weeping lovegrass), *Eragrostis spectabilis* (purple lovegrass), *Corynephorus canescens* (gray clubawn grass), *Panicum virgatum* (switchgrass), *Poa pratensis* (Kentucky bluegrass), *Juncus tenuis* (poverty rush), *Melilotus officinalis* (yellow sweetclover), *Trifolium arvense* (rabbitfoot clover), *Agrostis hyemalis* (winter bentgrass), *Spartina patens* (saltmeadow cordgrass), *Heterotheca subaxillaris* (camphorweed), *Bouteloua curtipendula* (sideoats grama), *Linaria vulgaris* (butter and eggs), *Eupatorium hyssopifolium* (hyssopleaf thoroughwort), *Euphorbia cyparissias, Chamaecrista fasciculata* (sleepingplant), *Daucus carota* (Queen Anne's lace), *Artemisia vulgaris* (common wormwood), *Conyza canadensis* (Canadian horseweed), *Verbascum thapsus* (common mullein), and *Achillea millefolium* (common yarrow). Scattered trees and saplings, primarily *Prunus serotina* (black cherry) and *Elaeagnus umbellata* (autumn olive), can be present. Low shrubs and seedlings can be somewhat common, but their proliferation is generally limited by mowing. Species are *Prunus serotina* (black cherry), *Rhus copallinum* (flameleaf sumac), *Rubus flagellaris* (northern dewberry), *Morella pensylvanica* (northern bayberry), *Rubus allegheniensis* (Allegheny blackberry), *Elaeagnus angustifolia* (Russian olive), *Rosa canina* (dog rose), *Rosa rugosa* (rugosa rose), *Juniperus virginiana* (eastern redcedar), and *Rosa multiflora* (multiflora rose). Vines can include *Parthenocissus quinquefolia* (Virginia creeper), *Celastrus orbiculata* (Asian bittersweet), and *Toxicodendron radicans* (eastern poison ivy).

Most Abundant Species:

Stratum	Lifeform	Species
Tree (canopy & subcanopy)	Broad-leaved deciduous tree	*Prunus serotina* (black cherry)
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Prunus serotina* (black cherry), *Rhus copallinum* (flameleaf sumac)
Herb (field)	Vine/Liana	*Parthenocissus quinquefolia* (Virginia creeper)
Herb (field)	Graminoid	*Schizachyrium scoparium* (little bluestem)

Characteristic Species: *Prunus serotina* (black cherry), *Rhus copallinum* (flameleaf sumac), *Schizachyrium scoparium* (little bluestem).

Other Noteworthy Species: Information not available.

Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
NY	S4*	I	1	Successional old field	Edinger et al. 2002
NY	SNR*	B	.	Successional northern sandplain grassland	Edinger et al. 2002
NJ	.	=	1	*Schizachyrium scoparium-(Andropogon virginicus)-Solidago* spp. Herbaceous Vegetation	Walz et al. 2007

Local Range: This association occurs in the Great Kills section of the Staten Island Unit and the Fort Tilden, Floyd Bennett Field, and Spring Creek sections of the Jamaica Bay Unit.
Classification Comments: None.
Other Comments: None.
Local Description Authors: G. J. Edinger and A. L. Feldmann.
Plots: 1ag, 2q, 3ag, 3n, 5ag, 6ag, 7ag, 10ac, 27YY, 40, 41, 43, 57XX, 58YY, 60YY, 173.
Gateway National Recreation Area Inventory Notes: Information not available.

GLOBAL INFORMATION

NVC CLASSIFICATION

Physiognomic Class	Herbaceous Vegetation (V)
Physiognomic Subclass	Perennial graminoid vegetation (V.A.)
Physiognomic Group	Temperate or subpolar grassland (V.A.5.)
Physiognomic Subgroup	Natural/Semi-natural temperate or subpolar grassland (V.A.5.N.)
Formation	Medium-tall sod temperate or subpolar grassland (V.A.5.N.c.)
Alliance	*Andropogon virginicus* Herbaceous Alliance (A.1208)
Alliance (English name)	Broomsedge Bluestem Herbaceous Alliance
Association	*Schizachyrium scoparium - (Andropogon virginicus) - Solidago* spp. Herbaceous Vegetation
Association (English name)	Little Bluestem - (Broomsedge Bluestem) - Goldenrod species Herbaceous Vegetation
Ecological System(s):	Information not available.

GLOBAL DESCRIPTION

Concept Summary: This broadly defined vegetation type includes old fields of well-drained soils, either sandy or shallow to bedrock. They are characterized by dominance of warm-season grasses. *Schizachyrium scoparium* (little bluestem) is characteristic and nearly always present. Species composition is variable, depending on land-use history, but in general this vegetation is quite wide-ranging in northeastern and midwestern states. In addition to the nominal species, other associates may include *Andropogon virginicus* (broomsedge bluestem), *Eragrostis spectabilis* (purple lovegrass), *Festuca rubra* (red fescue), *Deschampsia flexuosa* (wavy hairgrass), *Danthonia spicata* (poverty oatgrass), *Nuttallanthus canadensis* (Canada toadflax), *Rubus flagellaris* (northern dewberry), *Panicum virgatum* (switchgrass), *Dichanthelium depauperatum* (starved panicgrass), *Potentilla simplex* (common cinquefoil), *Dichanthelium meridionale* (matting rosette grass), *Dichanthelium dichotomum* (cypress panicgrass), *Solidago rugosa* (wrinkleleaf goldenrod), and *Carex pensylvanica* (Pennsylvania sedge). Scattered shrubs are often present, including *Comptonia peregrina* (sweet fern), *Morella pensylvanica* (northern bayberry), *Gaylussacia baccata* (black huckleberry), and scattered tree saplings, such as *Prunus serotina* (black cherry), *Sassafras albidum* (sassafras), and *Juniperus virginiana* (eastern

redcedar). *Polytrichum juniperinum* (juniper polytrichum moss) and other *Polytrichum* (polytrichum moss) spp. are common bryophytes.
Environmental Description: This vegetation occurs on well-drained soils, either on sandy flats or on dry knolls with shallow soils. The vegetation arises spontaneously after soil disturbance.
Vegetation Description: *Schizachyrium scoparium* (little bluestem) is characteristic and nearly always present. Species composition is variable, depending on land-use history, but in general, this vegetation is quite wide-ranging in northeastern and midwestern states. In addition to the nominal species, other associates may include *Andropogon virginicus* (broomsedge bluestem), *Eragrostis spectabilis* (purple lovegrass), *Festuca rubra* (red fescue), *Deschampsia flexuosa* (wavy hairgrass), *Centaurea biebersteinii* (spotted knapweed), *Danthonia spicata* (poverty oatgrass), *Hypericum perforatum* (common St. Johnswort), *Nuttallanthus canadensis* (Canada toadflax), *Rubus flagellaris* (northern dewberry), *Panicum virgatum* (switchgrass), *Dichanthelium depauperatum* (starved panicgrass), *Potentilla simplex* (common cinquefoil), *Dichanthelium meridionale* (matting rosette grass), *Dichanthelium dichotomum* (cypress panicgrass), *Solidago juncea* (early goldenrod), *Solidago nemoralis* (gray goldenrod), *Solidago rugosa* (wrinkleleaf goldenrod), *Hieracium* (hawkweed) spp., and *Carex pensylvanica* (Pennsylvania sedge). Scattered shrubs are often present, including *Comptonia peregrina* (sweet fern), *Morella pensylvanica* (northern bayberry), *Gaylussacia baccata* (black huckleberry), and scattered tree saplings, such as *Prunus serotina* (black cherry), *Sassafras albidum* (sassafras), and *Juniperus virginiana* (eastern redcedar).
Most Abundant Species:

Stratum	Lifeform	Species
Short shrub/sapling	Dwarf-shrub	*Rubus flagellaris* (northern dewberry)
Herb (field)	Forb	*Solidago juncea* (early goldenrod), *Solidago nemoralis* (gray goldenrod), *Solidago rugosa* (wrinkleleaf goldenrod)
Herb (field)	Graminoid	*Schizachyrium scoparium* (little bluestem)

Characteristic Species: *Andropogon virginicus* (broomsedge bluestem), *Schizachyrium scoparium* (little bluestem), *Solidago juncea* (early goldenrod), *Solidago nemoralis* (gray goldenrod), *Solidago rugosa* (wrinkleleaf goldenrod).
Other Noteworthy Species: Information not available.
USFWS Wetland System: Not applicable.

DISTRIBUTION
Range: This vegetation is quite wide-ranging in northeastern and midwestern states, and possibly occurs at higher elevations in the southeastern states.
States/Provinces: CT, MA, ME, NH, NJ, NY, PA, RI, VT.
Federal Lands: NPS (Boston Harbor Islands, Cape Cod, Delaware Water Gap, Fire Island, Gateway, Saratoga, Upper Delaware, Weir Farm); USFWS (Great Swamp).

CONSERVATION STATUS
Rank: GNA (invasive) (19-Jan-2006).
Reasons: This vegetation type includes pasture and post-agricultural fields.

CLASSIFICATION INFORMATION
Status: Standard.
Confidence: 3 - Weak.
Comments: This type is distinguished, in theory, from the very similar *Dactylis glomerata* - *Phleum pratense* - *Festuca* spp. - *Solidago* (goldenrod) spp. Herbaceous Vegetation

(CEGL006107) by the dominance of warm-season grasses as opposed to cool-season grasses (*Phleum* (timothy), *Festuca* (fescue)) dominating CEGL006017. Additional data will be required to see how this distinction holds up and what geographic differences might accompany such a distinction.

Similar Associations:

Dactylis glomerata - Phleum pratense - Festuca spp. - *Solidago* spp. Herbaceous Vegetation (CEGL006107).
Lolium (arundinaceum, pratense) Herbaceous Vegetation (CEGL004048).
Phleum pratense - Bromus pubescens - Helenium autumnale Herbaceous Vegetation (CEGL004018).

Related Concepts: Information not available.

SOURCES

Description Authors: L. A. Sneddon, mod. S. C. Gawler.

References: Eastern Ecology Working Group n.d., Edinger et al. 2002, House 1917, NRCS 2001b, NRCS 2004, Newbold et al. 1988, Niering et al. 1970.



Figure E18. Little Bluestem Old Field in Gateway National Recreation Area, Staten Island Unit (Accuracy Assessment Point 173, photo no. 1046). 7/18/2006. NAD 1983 / UTM easting 573887, northing 4488537.

COMMON NAME (PARK-SPECIFIC): NORTHEASTERN OLD FIELD

SYNONYMS

NVC English Name: **Orchard Grass - Timothy - Fescue species - Goldenrod species Herbaceous Vegetation**

NVC Scientific Name: ***Dactylis glomerata* - *Phleum pratense* - *Festuca* spp. - *Solidago* spp. Herbaceous Vegetation**

NVC Identifier: **CEGL006107**

LOCAL INFORMATION

Environmental Description: This association occurs in an extremely variable assortment of sites, from mowed fields to disturbed maritime dunes. Substrate ranges from coarse sand and sandy loam to mucky peat in the Bigapple, Bulkhead, and Pawcatuck series.

Vegetation Description: The vegetation of these successional old fields is extremely variable and depends on past and current land use as well as surrounding vegetation. The herbaceous layer is often dominated by *Artemisia vulgaris* (common wormwood), and associates can be *Dactylis glomerata* (orchardgrass), *Linaria vulgaris* (butter and eggs), *Euthamia graminifolia* (flat-top goldentop), *Bromus tectorum* (cheatgrass), *Solidago juncea* (early goldenrod), *Melilotus officinalis* (yellow sweetclover), *Corynephorus canescens* (gray clubawn grass), *Phragmites australis* (common reed), *Poa pratensis* (Kentucky bluegrass), *Daucus carota* (Queen Anne's lace), *Schizachyrium scoparium* (little bluestem), *Bromus inermis* (smooth brome), *Ammophila breviligulata* (American beachgrass), *Achillea millefolium* (common yarrow), *Juncus tenuis* (poverty rush), *Solidago rugosa* (wrinkleleaf goldenrod), *Melissa officinalis* (common balm), *Coronilla varia* (purple crownvetch), *Ambrosia artemisiifolia* (annual ragweed), *Potentilla recta* (sulphur cinquefoil), *Solidago canadensis* (Canada goldenrod), *Plantago lanceolata* (narrowleaf plantain), *Silene latifolia* (bladder campion), *Rumex crispus* (curly dock), *Apocynum cannabinum* (Indianhemp), and many others. Occasional tall and short shrubs, which are generally limited by mowing, are *Morella pensylvanica* (northern bayberry), *Rhus copallinum* (flameleaf sumac), *Ailanthus altissima* (tree of heaven), *Frangula alnus* (glossy buckthorn), *Prunus serotina* (black cherry), and *Rubus flagellaris* (northern dewberry). Low-growing vines can be moderately abundant and include *Celastrus orbiculata* (Asian bittersweet), *Parthenocissus quinquefolia* (Virginia creeper), *Cynanchum vincetoxicum* (white swallow-wort), *Rubus flagellaris* (northern dewberry), *Ampelopsis brevipedunculata* (Amur peppervine), *Lonicera japonica* (Japanese honeysuckle), *Calystegia sepium* (hedge false bindweed), *Vitis labrusca* (fox grape), and *Toxicodendron radicans* (eastern poison ivy).

Most Abundant Species:

Stratum	Lifeform	Species
Tall shrub/sapling	Broad-leaved deciduous shrub	*Ailanthus altissima* (tree of heaven)
Short shrub/sapling	Broad-leaved deciduous shrub	*Morella pensylvanica* (northern bayberry), *Rhus copallinum* (flameleaf sumac)
Herb (field)	Vine/Liana	*Celastrus orbiculata* (Asian bittersweet)
Herb (field)	Forb	*Artemisia vulgaris* (common wormwood)

Characteristic Species: *Artemisia vulgaris* (common wormwood), *Celastrus orbiculata* (Asian bittersweet), *Dactylis glomerata* (orchardgrass), *Parthenocissus quinquefolia* (Virginia creeper), *Prunus serotina* (black cherry), *Rhus copallinum* (flameleaf sumac)

Other Noteworthy Species: Information not available.

Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
NY	S4*	B	2	Successional old field	Edinger et al. 2002
NJ	.	=	1	*Dactylis glomerata-Phleum pratense-Festuca* spp.-*Solidago* spp. Herbaceous Vegetation	Walz et al. 2007

Local Range: This association occurs in the Great Kills section of the Staten Island Unit and in the Fort Tilden, Floyd Bennett Field, and Canarsie Pier sections of the Jamaica Bay Unit.
Classification Comments: None.
Other Comments: None.
Local Description Authors: G. J. Edinger and A. L. Feldmann.
Plots: 2a, 2ag, 3a, 3g, 4ag, 4b, 5h, 7ad, 16YY, 42, 59YY, 73YY, 88, 139, 141XX, 142XX, 144, 169YY, 170, 187, ref5.
Gateway National Recreation Area Inventory Notes: Information not available.

GLOBAL INFORMATION

NVC CLASSIFICATION

Physiognomic Class	Herbaceous Vegetation (V)
Physiognomic Subclass	Perennial graminoid vegetation (V.A.)
Physiognomic Group	Temperate or subpolar grassland (V.A.5.)
Physiognomic Subgroup	Natural/Semi-natural temperate or subpolar grassland (V.A.5.N.)
Formation	Medium-tall sod temperate or subpolar grassland (V.A.5.N.c.)
Alliance	*Dactylis glomerata* - *Rumex acetosella* Herbaceous Alliance (A.1190)
Alliance (English name)	Orchard Grass - Common Sheep Sorrel Herbaceous Alliance
Association	*Dactylis glomerata* - *Phleum pratense* - *Festuca* spp. - *Solidago* spp. Herbaceous Vegetation
Association (English name)	Orchard Grass - Timothy - Fescue species - Goldenrod species Herbaceous Vegetation
Ecological System(s):	Information not available.

GLOBAL DESCRIPTION

Concept Summary: This broadly defined vegetation type includes pastures and post-agricultural fields and is largely composed of nonnative cool-season grasses and herbs (generally of European origin) in the early stages of succession. The fields are typically mowed at least annually. Physiognomically, these grasslands are generally comprised of mid-height (1-3 feet tall) grasses and forbs, with occasional scattered shrubs. Species composition varies from site to site, depending on land-use history and perhaps soil type, but in general this vegetation is quite wide-ranging in northeastern and midwestern states and at higher elevations (610-1220 m [2000-4000 feet]) in the southeastern states. Dominant grasses vary from site to site but generally feature the nominal species. Other graminoid associates may include *Agrostis stolonifera* (creeping bentgrass), *Agrostis hyemalis* (winter bentgrass), *Elymus repens* (quackgrass), *Bromus inermis* (smooth brome), *Bromus tectorum* (cheatgrass), *Lolium perenne* (perennial ryegrass), *Poa pratensis* (Kentucky bluegrass), *Poa compressa* (Canada bluegrass), *Schizachyrium scoparium* (little bluestem) (not in abundance), and *Anthoxanthum odoratum* (sweet vernalgrass). Forbs scattered among the grasses are varied but include *Hieracium* (hawkweed) spp., *Oxalis*

stricta (common yellow oxalis), *Achillea millefolium* (common yarrow), *Asclepias syriaca* (common milkweed), *Solidago rugosa* (wrinkleleaf goldenrod), *Solidago nemoralis* (gray goldenrod), *Solidago juncea* (early goldenrod), *Solidago canadensis* (Canada goldenrod), *Solidago altissima* (tall goldenrod), *Euthamia graminifolia* (flat-top goldentop), *Cerastium arvense* (field chickweed), *Oenothera biennis* (common evening-primrose), *Potentilla simplex* (common cinquefoil), *Symphyotrichum lateriflorum* (calico aster), *Symphyotrichum novae-angliae* (New England aster), *Symphyotrichum lanceolatum* (white panicle aster), *Daucus carota* (Queen Anne's lace), *Ambrosia artemisiifolia* (annual ragweed), *Vicia cracca* (bird vetch), *Trifolium* (clover) spp., and many others.

Environmental Description: This association occurs on pastures and land that has been tilled. Generally the fields are mowed at least annually.

Vegetation Description: In addition to *Dactylis glomerata* (orchardgrass) and *Phleum pratense* (timothy), these grassy fields are characterized by graminoids including *Agrostis stolonifera* (creeping bentgrass), *Agrostis hyemalis* (winter bentgrass), *Elymus repens* (quackgrass), *Bromus inermis* (smooth brome), *Bromus tectorum* (cheatgrass), *Lolium perenne* (perennial ryegrass), *Poa pratensis* (Kentucky bluegrass), *Poa compressa* (Canada bluegrass), *Schizachyrium scoparium* (little bluestem) (not in abundance), and *Anthoxanthum odoratum* (sweet vernalgrass). Forbs scattered among the grasses are varied but include *Hieracium* (hawkweed) spp., *Oxalis stricta* (common yellow oxalis), *Achillea millefolium* (common yarrow), *Asclepias syriaca* (common milkweed), *Solidago rugosa* (wrinkleleaf goldenrod), *Solidago nemoralis* (gray goldenrod), *Solidago juncea* (early goldenrod), *Solidago canadensis* (Canada goldenrod), *Solidago altissima* (tall goldenrod), *Euthamia graminifolia* (flat-top goldentop), *Cerastium arvense* (field chickweed), *Oenothera biennis* (common evening-primrose), *Potentilla simplex* (common cinquefoil), *Symphyotrichum lateriflorum* (calico aster), *Symphyotrichum novae-angliae* (New England aster), *Symphyotrichum lanceolatum* (white panicle aster), *Daucus carota* (Queen Anne's lace), *Ambrosia artemisiifolia* (annual ragweed), *Vicia cracca* (bird vetch), *Trifolium* (clover) spp., and many others.

Most Abundant Species:

Stratum	Lifeform	Species
Herb (field)	Forb	*Rumex acetosella* (common sheep sorrel)
Herb (field)	Graminoid	*Dactylis glomerata* (orchardgrass), *Festuca rubra* (red fescue), *Phleum pratense* (timothy)

Characteristic Species: *Achillea millefolium* (common yarrow), *Anthoxanthum odoratum* (sweet vernalgrass), *Dactylis glomerata* (orchardgrass), *Euthamia graminifolia* (flat-top goldentop), *Phleum pratense* (timothy), *Rumex acetosella* (common sheep sorrel), *Solidago altissima* (tall goldenrod), *Solidago canadensis* (Canada goldenrod), *Solidago rugosa* (wrinkleleaf goldenrod).

Other Noteworthy Species: Information not available.

USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: This vegetation is quite wide-ranging in northeastern and midwestern states and possibly occurs at higher elevations in the southeastern states.

States/Provinces: CT, DE, KY, MA, MD, ME, NB?, NH, NJ, NS?, NY, PA, QC?, RI, TN, VA, VT, WV.

Federal Lands: NPS (Allegheny Portage Railroad, Appomattox Court House, Booker T. Washington, Boston Harbor Islands, Cape Cod, Colonial, Delaware Water Gap, Fire Island, Fort Necessity, Fredericksburg-Spotsylvania, Friendship Hill, Gateway, George Washington Birthplace, Gettysburg, Johnstown Flood, Marsh-Billings-Rockefeller, Minute Man, Morristown, Petersburg, Richmond, Saint-Gaudens, Saratoga, Upper Delaware, Valley Forge, Weir Farm); USFWS (Aroostook, Assabet River, Carlton Pond, Erie, Great Meadows, Moosehorn, Nulhegan Basin, Oxbow, Parker River).

CONSERVATION STATUS

Rank: GNA (modified/managed) (8-Dec-2005).

Reasons: This vegetation type includes pasture and post-agricultural fields and is largely composed of nonnative grasses and herbs (generally of European origin).

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 3 - Weak.

Comments: *Schizachyrium scoparium* - *(Andropogon virginicus)* - *Solidago* spp. Herbaceous Vegetation (CEGL006333) is similar to this type but is dominated by warm-season grasses.

Similar Associations:

Lolium (arundinaceum, pratense) Herbaceous Vegetation (CEGL004048).

Phleum pratense - *Bromus pubescens* - *Helenium autumnale* Herbaceous Vegetation (CEGL004018).

Schizachyrium scoparium - *(Andropogon virginicus)* - *Solidago* spp. Herbaceous Vegetation (CEGL006333)--has a greater component of native species and occurs on drier soils.

Related Concepts: Information not available.

SOURCES

Description Authors: S. C. Gawler.

References: Clark 1986, Dowhan and Rozsa 1989, Eastern Ecology Working Group n.d., Edinger et al. 2002, Ehrenfeld 1977, Elliman 2003, Keever 1979, NRCS 2004, Newbold et al. 1988, Perles et al. 2006a, Perles et al. 2006b, Perles et al. 2006c, Podniesinski et al. 2006, Sneddon et al. 1995, TDNH unpubl. data.



Figure E19. Northeastern Old Field in Gateway National Recreation Area, Staten Island Unit (Accuracy Assessment Point 142XX, photo no. 1042). 7/18/2006. NAD 1983 / UTM easting 574131, northing 4488688.

COMMON NAME (PARK-SPECIFIC): OVERWASH DUNE GRASSLAND

SYNONYMS

NVC English Name: **Saltmeadow Cordgrass - Common Threesquare - Seaside Goldenrod Herbaceous Vegetation**

NVC Scientific Name: ***Spartina patens* - *Schoenoplectus pungens* - *Solidago sempervirens* Herbaceous Vegetation**

NVC Identifier: **CEGL004097**

LOCAL INFORMATION

Environmental Description: This maritime dune grassland is characterized by vegetation that colonizes water-deposited sand caused by storm surges. It occurs in a mosaic with Northern Beachgrass Dune (CEGL006274). Substrate is fine to coarse sand in the Bigapple, Hooksan, Barren and Jamaica series consisting of soils formed from overwash sand or sandy dredge fill deposits (NRCS 2001b).

Vegetation Description: The vegetation of this overwash dune community is dominated and characterized by *Spartina patens* (saltmeadow cordgrass) with *Solidago sempervirens* (seaside goldenrod) and *Ammophila breviligulata* (American beachgrass) occurring at lower abundance. Associated species, occurring less consistently, are *Heterotheca subaxillaris* (camphorweed), *Schizachyrium scoparium* (little bluestem), *Pseudognaphalium obtusifolium* (rabbittobacco), *Phragmites australis* (common reed), *Spartina patens* (saltmeadow cordgrass), *Chenopodium album* (lambsquarters), *Panicum virgatum* (switchgrass), *Centaurea biebersteinii* (spotted knapweed), *Chenopodium ambrosioides* (Mexican tea), *Cakile edentula* (American searocket), *Triplasis purpurea* (purple sandgrass), *Cyperus grayi* (Gray's flatsedge), *Saponaria officinalis* (bouncingbet), *Suaeda maritima* (herbaceous seepweed), *Distichlis spicata* (inland saltgrass), and *Conyza canadensis* (Canadian horseweed). Short shrubs, seedlings, and saplings can be scattered throughout the community; possible species include *Rhus copallinum* (flameleaf sumac), *Morella pensylvanica* (northern bayberry), *Iva frutescens* (Jesuit's bark), *Ailanthus altissima* (tree of heaven), and *Prunus serotina* (black cherry). Infrequent vines can be *Calystegia sepium* (hedge false bindweed), *Celastrus orbiculata* (Asian bittersweet), *Parthenocissus quinquefolia* (Virginia creeper), *Toxicodendron radicans* (eastern poison ivy), and *Lonicera japonica* (Japanese honeysuckle).

Most Abundant Species:

Stratum	Lifeform	Species
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Ailanthus altissima* (tree of heaven)
Short shrub/sapling	Broad-leaved deciduous shrub	*Rhus copallinum* (flameleaf sumac)
Herb (field)	Vine/Liana	*Calystegia sepium* (hedge false bindweed)
Herb (field)	Graminoid	*Spartina patens* (saltmeadow cordgrass)

Characteristic Species: *Ammophila breviligulata* (American beachgrass), *Solidago sempervirens* (seaside goldenrod), *Spartina patens* (saltmeadow cordgrass)

Other Noteworthy Species: Information not available.

Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
NY	S3*	B	1	Maritime dunes	Edinger et al. 2002
NJ	.	=	1	*Spartina patens-Schoenoplectus pungens-Solidago sempervirens* Herbaceous Vegetation	Breden et al. 2001

Local Range: This association occurs in the Sandy Hook Unit, the Great Kills section of the Staten Island Unit, and in all of the sections of the Jamaica Bay Unit.
Classification Comments: None.
Other Comments: None.
Local Description Authors: G. J. Edinger and A. L. Feldmann.
Plots: 1, 1am, 2af, 2o, 3o, 4aa, 5aa, 5am, 5p, 5YY, 5z, 6am, 14, 20YY, 66, 92XX, 98XX, 99YY, 105XX, 106YY, 111YY, 112XX, 113XX, 125YY, 127YY, 133YY, 205, ref2, ref3, ref6.
Gateway National Recreation Area Inventory Notes: Information not available.

GLOBAL INFORMATION

NVC CLASSIFICATION

Physiognomic Class	Herbaceous Vegetation (V)
Physiognomic Subclass	Perennial graminoid vegetation (V.A.)
Physiognomic Group	Temperate or subpolar grassland (V.A.5.)
Physiognomic Subgroup	Natural/Semi-natural temperate or subpolar grassland (V.A.5.N.)
Formation	Short sod temperate or subpolar grassland (V.A.5.N.e.)
Alliance	*Spartina patens - (Schoenoplectus pungens)* Herbaceous Alliance (A.1274)
Alliance (English name)	Saltmeadow Cordgrass - (Common Threesquare) Herbaceous Alliance
Association	*Spartina patens - Schoenoplectus pungens - Solidago sempervirens* Herbaceous Vegetation
Association (English name)	Saltmeadow Cordgrass - Common Threesquare - Seaside Goldenrod Herbaceous Vegetation
Ecological System(s):	Southern Atlantic Coastal Plain Dune and Maritime Grassland (CES203.273). Atlantic Coastal Plain Northern Salt Pond Marsh (CES203.892). Northern Atlantic Coastal Plain Dune and Maritime Grassland (CES203.264)**.**

GLOBAL DESCRIPTION

Concept Summary: This community is an upland dune grassland or overwash area of Atlantic barrier islands on embryo dunes or back sides of beaches forming from overwash terraces ranging from Massachusetts to North Carolina. It forms a drier, later successional phase beginning from water-deposited sand of storm overwash. Sand movement, plant burial, and dune formation rates are not so high as to form *Ammophila breviligulata* (American beachgrass)-dominated primary dunes, but can be found as a fringe around the outer edge of those dunes. *Spartina patens* (saltmeadow cordgrass) is dominant, ranging from quite sparse (25% cover) to dense, and can be monotypic in early-successional expressions. As the vegetation develops, common associated species can include *Schoenoplectus pungens* (common threesquare) or *Solidago sempervirens* (seaside goldenrod). Less common associates can include *Cyperus grayi* (Gray's flatsedge), *Cenchrus tribuloides* (sanddune sandbur), *Setaria parviflora* (marsh bristlegrass), *Festuca rubra* (red fescue), *Schizachyrium littorale* (shore little bluestem), *Pseudognaphalium obtusifolium* (rabbittobacco), and occasional scattered individuals of *Toxicodendron radicans* (eastern poison ivy) and seedlings of *Baccharis halimifolia* (eastern baccharis). Bare sand is often visible through the vegetation, and there is no soil profile

development. *Ammophila breviligulata* (American beachgrass) or *Uniola paniculata* (seaoats) may invade from the surrounding dunes. This community appears to be a successional step between interdunal herbaceous wetlands and interdunal herbaceous/shrub uplands.
Environmental Description: This community is an upland dune grassland or overwash area of Atlantic barrier islands on embryo dunes or back sides of beaches forming from overwash terraces. The plants of this community are influenced by water-deposited sand caused by storm surges. They differ ecologically from dune grasslands dominated by *Ammophila breviligulata* (American beachgrass) or *Uniola paniculata* (seaoats), which are primarily impacted by wind-deposited sand. Storm overwash is a prevalent natural disturbance to this community.
Vegetation Description: *Spartina patens* (saltmeadow cordgrass) is dominant, ranging from quite sparse (25% cover) to dense, and can be monotypic in early successional expressions. As the vegetation develops, common associated species can include *Schoenoplectus pungens* (common threesquare) or *Solidago sempervirens* (seaside goldenrod). Less common associates can include *Cyperus grayi* (Gray's flatsedge), *Cenchrus tribuloides* (sanddune sandbur), *Setaria parviflora* (marsh bristlegrass), *Festuca rubra* (red fescue), *Schizachyrium littorale* (shore little bluestem), *Pseudognaphalium obtusifolium* (rabbittobacco), and occasional scattered individuals of *Toxicodendron radicans* (eastern poison ivy) and seedlings of *Baccharis halimifolia* (eastern baccharis). *Ammophila breviligulata* (American beachgrass) or *Uniola paniculata* (seaoats) may invade from the surrounding dunes. This community is characterized by upland maritime dune grassland vegetation. *Spartina patens* (saltmeadow cordgrass), and sometimes *Schoenoplectus pungens* (common threesquare), or both are dominant on dunes or overwash terraces. Total vegetation cover is variable, ranging from quite sparse (25% cover) to dense. Bare sand is often visible through the vegetation, and there is no soil profile development. Species diversity is variable; although it may be quite low and confined to the nominate species in the northern part of the range, it may be of greater diversity, including *Strophostyles helvula* (trailing fuzzybean), *Solidago sempervirens* (seaside goldenrod), *Cenchrus tribuloides* (sanddune sandbur), *Setaria parviflora* (marsh bristlegrass), *Distichlis spicata* (inland saltgrass), *Sabatia stellaris* (rose of Plymouth), *Ammophila breviligulata* (American beachgrass), *Suaeda linearis* (annual seepweed), *Bassia hirsuta* (hairy smotherweed), *Atriplex patula* (spear saltbush), *Fimbristylis castanea* (marsh fimbry), and *Cakile edentula* ssp. *edentula* (American searocket).
Most Abundant Species:

Stratum	Lifeform	Species
Herb (field)	Forb	*Solidago sempervirens* (seaside goldenrod)
Herb (field)	Graminoid	*Schoenoplectus pungens* (common threesquare), *Spartina patens* (saltmeadow cordgrass)

Characteristic Species: *Schoenoplectus pungens* (common threesquare), *Solidago sempervirens* (seaside goldenrod), *Spartina patens* (saltmeadow cordgrass).
Other Noteworthy Species: Information not available.
USFWS Wetland System: Not applicable.

DISTRIBUTION
Range: This community is an upland dune grassland or overwash area of Atlantic barrier islands from Massachusetts to North Carolina.
States/Provinces: DE:S2S3, MA, MD, NC, NJ, NY, VA.
Federal Lands: NPS (Assateague Island, Boston Harbor Islands, Fire Island, Gateway, Sagamore Hill); USFWS (Back Bay?, Prime Hook).

CONSERVATION STATUS

Rank: G2G3 (4-Nov-1998).

Reasons: This dune grassland community is restricted to overwash areas of major maritime dune systems. It is typically small in extent, not usually more than a few acres in size. It is best developed on barrier islands of Delaware, Maryland, Virginia, and North Carolina; it extends sporadically farther north to Massachusetts. As part of a dynamic system, the community is in a sense ephemeral, being buried over time by sand deposition, and being formed anew in other areas subjected to overwash. Because of the dynamic forces structuring the community, it requires sufficient area in large dune systems to accommodate this shifting mosaic. Although not extremely rare (an estimated 100-200 occurrence exist rangewide), the community is restricted to a specialized habitat and is threatened by a number of activities, including dune stabilization, and outright destruction of habitat through human activities.

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 2 - Moderate.

Comments: This community differs ecologically from dune grasslands dominated by *Ammophila breviligulata* (American beachgrass) or *Uniola paniculata* (seaoats), which are primarily impacted by wind-deposited sand. This community is impacted by wave-deposited sand. It is drier than brackish swales and vegetation that immediately colonizes water-borne sand from storm overwash, such as *Spartina patens - Eleocharis parvula* Herbaceous Vegetation (CEGL006342). *Spartina patens - Schizachyrium maritimum - Solidago sempervirens* Herbaceous Vegetation (CEGL008445) is a southern analog of this association that occurs along the Gulf Coast.

Similar Associations:

Spartina patens - Eleocharis parvula Herbaceous Vegetation (CEGL006342).
Spartina patens - Schizachyrium maritimum - Solidago sempervirens Herbaceous Vegetation (CEGL008445).

Related Concepts:

Dry community of barrier flats (Travis and Godfrey 1976) B
Dry maritime grassland (Lea 2002b) ?
Dunegrass community (Higgins et al. 1971) B
Grassland community (Baumann 1978b) =
Low dune community (Boule 1979) =
Maritime Dry Grassland (Typic Subtype) (Schafale 2000) ?
Secondary dunes (Klotz 1986) B
Wash (Hill 1986) =
Wash (Higgins et al. 1971) =

SOURCES

Description Authors: L. A. Sneddon.

References: Baumann 1978b, Berdine 1998, Boule 1979, Bowman 2000, Breden et al. 2001, Eastern Ecology Working Group n.d., Edinger et al. 2002, Fleming et al. 2001, Harrison 2004, Harrison and Stango 2003, Higgins et al. 1971, Hill 1986, Klotz 1986, Lea 2002b, NRCS 2001b, Reschke 1990, Schafale 2000, Schafale 2003b, Schafale and Weakley 1990, TNC 1995c, Travis and Godfrey 1976, Zaremba and Leatherman 1984.



Figure E20. Overwash Dune Grassland in Gateway National Recreation Area, Jamaica Bay Unit (Accuracy Assessment Point 5YY, photo no. 1023). 7/13/2006. NAD 1983 / UTM easting 590649, northing 4489280.

COMMON NAME (PARK-SPECIFIC): WOOLGRASS MARSH

SYNONYMS
NVC English Name: **Woolgrass Bulrush Seasonally Flooded Herbaceous Vegetation**
NVC Scientific Name: ***Scirpus cyperinus* Seasonally Flooded Herbaceous Vegetation**
NVC Identifier: **CEGL006349**

LOCAL INFORMATION

Environmental Description: The hydrology of this irregularly flooded marsh is connected to that of the artificially maintained East Pond in the Jamaica Bay Wildlife Refuge. Substrate is very deep, poorly drained and frequently flooded sandy soil in the Jamaica series (NRCS 2001b).
Vegetation Description: This association is dominated by *Thelypteris palustris* (eastern marsh fern) with *Phragmites australis* (common reed) and *Scirpus cyperinus* (woolgrass). Herbaceous associates include *Verbena hastata* (swamp verbena), *Leersia oryzoides* (rice cutgrass), *Onoclea sensibilis* (sensitive fern), *Scutellaria galericulata* (marsh skullcap), *Epilobium hirsutum* (codlins and cream), *Typha angustifolia* (narrowleaf cattail), *Triadenum virginicum* (Virginia marsh St. Johnswort), *Cyperus polystachyos* (manyspike flatsedge), *Polygonum punctatum* (dotted smartweed), *Lythrum salicaria* (purple loosestrife), *Lycopus americanus* (American water horehound), and *Cyperus strigosus* (strawcolored flatsedge). *Toxicodendron radicans* (eastern poison ivy) is a frequently associated vine; low shrubs are also present in low abundance and include *Morella pensylvanica* (northern bayberry), *Betula populifolia* (gray birch), *Salix bebbiana* (Bebb willow), and *Baccharis halimifolia* (eastern baccharis).
Most Abundant Species:

Stratum	Lifeform	Species
Short shrub/sapling	Broad-leaved deciduous shrub	*Morella pensylvanica* (northern bayberry)
Herb (field)	Vine/Liana	*Toxicodendron radicans* (eastern poison ivy)
Herb (field)	Graminoid	*Phragmites australis* (common reed)
Herb (field)	Fern or fern ally	*Thelypteris palustris* (eastern marsh fern)

Characteristic Species: *Phragmites australis* (common reed), *Scirpus cyperinus* (woolgrass), *Thelypteris palustris* (eastern marsh fern), *Toxicodendron radicans* (eastern poison ivy).
Other Noteworthy Species: Information not available.
Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
NY	S5*	B	2	Shallow emergent marsh	Edinger et al. 2002
NJ	.	=	1	*Scirpus cyperinus* Seasonally Flooded Herbaceous Vegetation	Breden et al. 2001

Local Range: This association is only known within the Jamaica Bay Unit from the west side of East Pond in the Jamaica Bay Wildlife Refuge.
Classification Comments: None.
Other Comments: None.
Local Description Authors: G. J. Edinger and A. L. Feldmann.
Plots: 4w, ref1.
Gateway National Recreation Area Inventory Notes: Information not available.

GLOBAL INFORMATION

NVC CLASSIFICATION

Physiognomic Class	Herbaceous Vegetation (V)
Physiognomic Subclass	Perennial graminoid vegetation (V.A.)
Physiognomic Group	Temperate or subpolar grassland (V.A.5.)
Physiognomic Subgroup	Natural/Semi-natural temperate or subpolar grassland (V.A.5.N.)
Formation	Seasonally flooded temperate or subpolar grassland (V.A.5.N.k.)
Alliance	*Scirpus cyperinus* Seasonally Flooded Herbaceous Alliance (A.1386)
Alliance (English name)	Woolgrass Bulrush Seasonally Flooded Herbaceous Alliance
Association	*Scirpus cyperinus* Seasonally Flooded Herbaceous Vegetation
Association (English name)	Woolgrass Bulrush Seasonally Flooded Herbaceous Vegetation
Ecological System(s):	Laurentian-Acadian Wet Meadow-Shrub Swamp (CES201.582). Laurentian-Acadian Freshwater Marsh (CES201.594). High Allegheny Wetland (CES202.069).

GLOBAL DESCRIPTION

Concept Summary: This seasonally flooded marsh occurs in the northeastern United States. It is dominated or characterized by *Scirpus cyperinus* (woolgrass), but composition is variable. Associates include *Glyceria* (mannagrass) spp., *Thelypteris palustris* (eastern marsh fern), as well as other species of *Scirpus* (bulrush) including *Scirpus microcarpus* (panicled bulrush) and *Scirpus atrovirens* (green bulrush).

Environmental Description: These are seasonally flooded marshes.

Vegetation Description: This community is dominated or characterized by *Scirpus cyperinus* (woolgrass). Composition is variable. Associates include *Glyceria* (mannagrass) spp., *Thelypteris palustris* (eastern marsh fern), as well as other species of *Scirpus* (bulrush), including *Scirpus microcarpus* (panicled bulrush) and *Scirpus atrovirens* (green bulrush).

Most Abundant Species:

Stratum	Lifeform	Species
Herb (field)	Graminoid	*Scirpus cyperinus* (woolgrass)

Characteristic Species: *Scirpus cyperinus* (woolgrass).

Other Noteworthy Species: Information not available.

USFWS Wetland System: Palustrine.

DISTRIBUTION

Range: This seasonally flood marsh occurs throughout the northeastern U.S. from Maine to West Virginia.

States/Provinces: CT, DE, MA, MD, ME, NH, NJ, NY, PA, RI, VA, VT, WV:S3.

Federal Lands: NPS (Cape Cod, Gateway, Saratoga, Thomas Stone); USFS (Monongahela); USFWS (Assabet River?, Canaan Valley, Chincoteague, Erie, Great Meadows?).

CONSERVATION STATUS

Rank: GNR (1-Dec-1997).

Reasons: Information not available.

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 3 - Weak.

Comments: Information not available.

Similar Associations:

Calamagrostis canadensis - *Scirpus* spp. - *Dulichium arundinaceum* Herbaceous Vegetation (CEGL006519).

Related Concepts:

Shallow emergent marsh (Cowardin et al. 1979) ?

SOURCES

Description Authors: R. E. Zaremba and L. A. Sneddon.

References: Breden et al. 2001, Byers et al. 2007, Cowardin et al. 1979, Eastern Ecology Working Group n.d., Fike 1999, Gawler 2002, Harrison 2004, NRCS 2001b, NRCS 2004, Walbridge 1982.



Figure E21. Woolgrass Marsh in Gateway National Recreation Area, Jamaica Bay Unit (Accuracy Assessment Point Ref1, photo no. 1169). 8/17/2006. NAD 1983 / UTM easting 599421, northing 4497581.

COMMON NAME (PARK-SPECIFIC): NORTHEASTERN ATLANTIC BRACKISH INTERDUNAL SWALE

SYNONYMS
NVC English Name: **Saltmeadow Cordgrass - Dwarf Spikerush Herbaceous Vegetation**
NVC Scientific Name: ***Spartina patens* - *Eleocharis parvula* Herbaceous Vegetation**
NVC Identifier: **CEGL006342**

LOCAL INFORMATION

Environmental Description: This community occupies brackish interdunal swales and overwash flats between coastal sand dunes [Northern Beachgrass Dune (CEGL006274) and Overwash Dune Grassland (CEGL004097)] or is embedded within Northern Tall Maritime Shrubland (CEGL006379) just behind the dune complex. Substrate is very deep sand derived from eolian or marine sediment deposits in the Hooksan and Jamaica series (NRCS 2001b).
Vegetation Description: This association is primarily dominated by *Spartina patens* (saltmeadow cordgrass) with *Schoenoplectus americanus* (chairmaker's bulrush) and *Schoenoplectus pungens* (common threesquare) occurring as sub-dominants. Associated herbaceous species depend on the salinity and hydrology of a site and can include *Hibiscus moscheutos* (crimsoneyed rosemallow), *Polygonum ramosissimum* (bushy knotweed), *Phragmites australis* (common reed), *Panicum virgatum* (switchgrass), *Pluchea odorata* (sweetscent), *Solidago sempervirens* (seaside goldenrod), *Typha latifolia* (broadleaf cattail), *Cyperus filicinus* (fern flatsedge), *Schizachyrium scoparium* (little bluestem), *Apocynum cannabinum* (Indianhemp), *Polygonum punctatum* (dotted smartweed), *Panicum amarum* (bitter panicgrass), *Onoclea sensibilis* (sensitive fern), *Cyperus strigosus* (strawcolored flatsedge), and *Conyza canadensis* (Canadian horseweed). Shrubs and vines can occur on hummocks within the swale and include *Baccharis halimifolia* (eastern baccharis), *Morella pensylvanica* (northern bayberry), and *Parthenocissus vitacea* (woodbine).
Most Abundant Species:

Stratum	Lifeform	Species
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Baccharis halimifolia* (eastern baccharis)
Herb (field)	Vine/Liana	*Parthenocissus vitacea* (woodbine)
Herb (field)	Graminoid	*Spartina patens* (saltmeadow cordgrass)

Characteristic Species: *Baccharis halimifolia* (eastern baccharis), *Hibiscus moscheutos* (crimsoneyed rosemallow), *Schoenoplectus americanus* (chairmaker's bulrush), *Schoenoplectus pungens* (common threesquare), *Spartina patens* (saltmeadow cordgrass).
Other Noteworthy Species: Information not available.
Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
NY	S1S2	=	1	Brackish interdunal swales	Edinger et al. 2002
NJ	S1S2	=	1	*Spartina patens-Eleocharis parvula* Herbaceous Vegetation	Breden et al. 2001

Local Range: This association occurs in the Sandy Hook Unit and in the Breezy Point section of the Jamaica Bay Unit.
Classification Comments: None.
Other Comments: None.
Local Description Authors: G. J. Edinger and A. L. Feldmann.
Plots: 1e, 9aa, 10aa, 109YY, 140YY.

Gateway National Recreation Area Inventory Notes: Information not available.

GLOBAL INFORMATION

NVC CLASSIFICATION

Physiognomic Class	Herbaceous Vegetation (V)
Physiognomic Subclass	Perennial graminoid vegetation (V.A.)
Physiognomic Group	Temperate or subpolar grassland (V.A.5.)
Physiognomic Subgroup	Natural/Semi-natural temperate or subpolar grassland (V.A.5.N.)
Formation	Seasonally flooded temperate or subpolar grassland (V.A.5.N.k.)
Alliance	*Spartina patens* Seasonally Flooded Herbaceous Alliance (A.1390)
Alliance (English name)	Saltmeadow Cordgrass Seasonally Flooded Herbaceous Alliance
Association	*Spartina patens - Eleocharis parvula* Herbaceous Vegetation
Association (English name)	Saltmeadow Cordgrass - Dwarf Spikerush Herbaceous Vegetation
Ecological System(s):	Northern Atlantic Coastal Plain Dune and Maritime Grassland (CES203.264).

GLOBAL DESCRIPTION

Concept Summary: This brackish, interdunal swale and overwash community of the northeastern Atlantic coast occurs in low areas behind primary or secondary sand dunes. The substrate is sand with little or no organic accumulation. The water source for this wetland community is variable, including seasonally high groundwater table, salt spray, and sporadic tidal overwash, resulting in widely variable salinity levels. The dominant species is generally *Spartina patens* (saltmeadow cordgrass), but it can be *Eleocharis parvula* (dwarf spikerush), *Schoenoplectus pungens* (common threesquare), *Cyperus polystachyos* (manyspike flatsedge), and/or *Juncus articulatus* (jointleaf rush). Associated species depend on salinity and hydrology of a site and can include *Leptochloa fusca* ssp. *fascicularis* (bearded sprangletop), *Schoenoplectus maritimus* (cosmopolitan bulrush), *Juncus ambiguus* (seaside rush), *Juncus scirpoides* (needlepod rush), *Ptilimnium capillaceum* (herbwilliam), *Rumex maritimus* (golden dock), *Symphyotrichum subulatum* (eastern annual saltmarsh aster), *Chenopodium rubrum* (red goosefoot), *Pluchea odorata* (sweetscent), *Hibiscus moscheutos* ssp. *moscheutos* (crimsoneyed rosemallow), *Polygonum ramosissimum* (bushy knotweed), *Triglochin maritima* (seaside arrowgrass), *Panicum virgatum* (switchgrass), *Schoenoplectus robustus* (sturdy bulrush), and *Argentina anserina* (silverweed cinquefoil). *Iva frutescens* (Jesuit's bark) and *Baccharis halimifolia* (eastern baccharis) may occur on hummocks within the swale. Mats of blue-green and/or brown algae can proliferate across the soil surface.

Environmental Description: This community occupies brackish interdunal swales and overwash flats between coastal sand dunes. Surface water is oligo- to mesohaline; the dune surface intersects the freshwater lens with salinity input from salt spray and/or storm tide overwash. Substrate is deep sand with or without a layer of surficial peat.

Vegetation Description: This association is dominated by graminoids, especially *Spartina patens* (saltmeadow cordgrass), *Eleocharis parvula* (dwarf spikerush), *Schoenoplectus pungens* (common threesquare), *Cyperus polystachyos* (manyspike flatsedge), and *Juncus articulatus* (jointleaf rush), although local dominance can change from year to year. Associated species depend on salinity and hydrology of a site and can include *Leptochloa fusca* ssp. *fascicularis* (bearded sprangletop), *Schoenoplectus maritimus* (cosmopolitan bulrush), *Juncus ambiguus* (seaside rush), *Juncus scirpoides* (needlepod rush), *Ptilimnium capillaceum* (herbwilliam),

Rumex maritimus (golden dock), *Symphyotrichum subulatum* (eastern annual saltmarsh aster), *Chenopodium rubrum* (red goosefoot), *Pluchea odorata* (sweetscent), *Hibiscus moscheutos* ssp. *moscheutos* (crimsoneyed rosemallow), *Polygonum ramosissimum* (bushy knotweed), *Triglochin maritima* (seaside arrowgrass), *Panicum virgatum* (switchgrass), *Schoenoplectus robustus* (sturdy bulrush), and *Argentina anserina* (silverweed cinquefoil). *Iva frutescens* (Jesuit's bark) and *Baccharis halimifolia* (eastern baccharis) may occur on hummocks within the swale. Mats of blue-green and/or brown algae can proliferate across the soil surface. *Phragmites australis* (common reed) can readily invade in this environmental setting.

Most Abundant Species:

Stratum	Lifeform	Species
Herb (field)	Graminoid	*Eleocharis parvula* (dwarf spikerush), *Schoenoplectus pungens* (common threesquare), *Spartina patens* (saltmeadow cordgrass)

Characteristic Species: *Eleocharis parvula* (dwarf spikerush), *Spartina patens* (saltmeadow cordgrass).

Other Noteworthy Species: Information not available.

USFWS Wetland System: Palustrine.

DISTRIBUTION

Range: This association is currently described from Maryland, New Jersey, New York, Massachusetts, and New Hampshire. It likely occurs in other states.

States/Provinces: DE, MA, MD, NH, NJ:S1S2, NY:S1S2, VA?

Federal Lands: NPS (Fire Island, Gateway); USFWS (Monomoy?).

CONSERVATION STATUS

Rank: GNR (1-Dec-1997).

Reasons: Information not available.

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 2 - Moderate.

Comments: This association is similar to coastal salt pond vegetation, *Schoenoplectus pungens* - *Eleocharis parvula* Herbaceous Vegetation (CEGL006398).

Similar Associations:

Schoenoplectus pungens - *Eleocharis parvula* Herbaceous Vegetation (CEGL006398).
Spartina patens - *Schoenoplectus pungens* - *Solidago sempervirens* Herbaceous Vegetation (CEGL004097).

Related Concepts:

Coastal interdunal marsh/swale (Rawinski 1984) ?
Overwash Community (Lea 2002b) ?

SOURCES

Description Authors: D. Hunt, mod. S. L. Neid.

References: Breden et al. 2001, Dowhan and Rozsa 1989, Eastern Ecology Working Group n.d., Edinger et al. 2002, Harrison 2004, Hunt 1997b, Lea 2002b, Lundgren 1998, NRCS 2001b, Rawinski 1984, Reschke 1990, Sneddon and Lundgren 2001, Sperduto 2000b, Swain and Kearsley 2001.



Figure E22. Northeastern Atlantic Brackish Interdunal Swale in Gateway National Recreation Area, Sandy Hook Unit (Accuracy Assessment Point 109YY, photo no. 1412). 9/29/2006. NAD 1983 / UTM easting 585907, northing 4478351.

COMMON NAME (PARK-SPECIFIC): BRACKISH MEADOW

SYNONYMS
NVC English Name: **Switchgrass - Saltmeadow Cordgrass Herbaceous Vegetation**
NVC Scientific Name: ***Panicum virgatum* - *Spartina patens* Herbaceous Vegetation**
NVC Identifier: **CEGL006150**

LOCAL INFORMATION

Environmental Description: This brackish meadow generally occurs at the upland border of either North Atlantic Upper Ocean Beach (CEGL004400), North Atlantic Low Salt Marsh (CEGL004192), or North Atlantic High Salt Marsh (CEGL006006). It can also be found between Northern Bayberry Dune Shrubland (CEGL006295) and Mid-Atlantic Maritime Salt Shrub (CEGL006848) or surrounded by Maritime Red-cedar Woodland (CEGL006212). Substrate is fine sand to gravelly coarse sand originating from marine- or eolian-derived sands or sandy dredge fill. Soils are in the Hooksan, Bigapple, and Jamaica series (NRCS 2001b).
Vegetation Description: This tall, brackish grassland is dominated by *Panicum virgatum* (switchgrass) with *Spartina patens* (saltmeadow cordgrass), *Schizachyrium scoparium* (little bluestem), and *Solidago sempervirens* (seaside goldenrod) as common associates. Additional herbaceous species present at low abundance and frequency are *Opuntia humifusa* (devil's-tongue), *Daucus carota* (Queen Anne's lace), *Atriplex patula* (spear saltbush), *Bassia hyssopifolia* (fivehorn smotherweed), *Bromus tectorum* (cheatgrass), *Carex silicea* (beach sedge), *Cyperus grayi* (Gray's flatsedge), *Artemisia vulgaris* (common wormwood), *Eragrostis spectabilis* (purple lovegrass), *Heterotheca subaxillaris* (camphorweed), *Lepidium virginicum* (Virginia pepperweed), *Linaria vulgaris* (butter and eggs), *Polygonella articulata* (coastal jointweed), *Rumex acetosella* (common sheep sorrel), and *Verbascum thapsus* (common mullein). Short shrubs can be moderately common and include *Iva frutescens* (Jesuit's bark), *Rhus copallinum* (flameleaf sumac), *Ailanthus altissima* (tree of heaven), *Rosa rugosa* (rugosa rose), *Baccharis halimifolia* (eastern baccharis), and *Juniperus virginiana* (eastern redcedar); tall shrubs and vines such as *Ailanthus altissima* (tree of heaven), *Prunus serotina* (black cherry), *Juniperus virginiana* (eastern redcedar) and *Parthenocissus quinquefolia* (Virginia creeper) are less abundant.
Most Abundant Species:

Stratum	Lifeform	Species
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Ailanthus altissima* (tree of heaven)
Short shrub/sapling	Broad-leaved deciduous shrub	*Iva frutescens* (Jesuit's bark)
Herb (field)	Vine/Liana	*Parthenocissus quinquefolia* (Virginia creeper)
Herb (field)	Graminoid	*Panicum virgatum* (switchgrass)

Characteristic Species: *Iva frutescens* (Jesuit's bark), *Panicum virgatum* (switchgrass), *Spartina patens* (saltmeadow cordgrass).
Other Noteworthy Species: Information not available.
Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
NY	S1S2	=	1	Brackish meadow	Edinger et al. 2002
NJ	S2S3	=	1	*Panicum virgatum-Carex silicea* Herbaceous Vegetation	Breden et al. 2001

Local Range: This association occurs in the Sandy Hook Unit and in the Canarsie Pier section of the Jamaica Bay Unit.

Classification Comments: None.
Other Comments: None.
Local Description Authors: G. J. Edinger and A. L. Feldmann.
Plots: 2am, 61YY, 118YY, 119YY.
Gateway National Recreation Area Inventory Notes: Information not available.

GLOBAL INFORMATION

NVC CLASSIFICATION

Physiognomic Class	Herbaceous Vegetation (V)
Physiognomic Subclass	Perennial graminoid vegetation (V.A.)
Physiognomic Group	Temperate or subpolar grassland (V.A.5.)
Physiognomic Subgroup	Natural/Semi-natural temperate or subpolar grassland (V.A.5.N.)
Formation	Tidal temperate or subpolar grassland (V.A.5.N.n.)
Alliance	*Panicum virgatum* Tidal Herbaceous Alliance (A.1476)
Alliance (English name)	Switchgrass Tidal Herbaceous Alliance
Association	*Panicum virgatum - Spartina patens* Herbaceous Vegetation
Association (English name)	Switchgrass - Saltmeadow Cordgrass Herbaceous Vegetation
Ecological System(s):	Atlantic Coastal Plain Northern Salt Pond Marsh (CES203.892). Northern Atlantic Coastal Plain Tidal Salt Marsh (CES203.519)**.**

GLOBAL DESCRIPTION

Concept Summary: This brackish meadow of the northern Atlantic Coast occurs at the upland border of high salt marshes. It occurs on freely drained, shallow, sandy peat that is moist from upland seepage and brackish from irregular tidal flooding. Vegetation is dominated by *Panicum virgatum* (switchgrass) and occasionally codominated by *Spartina patens* (saltmeadow cordgrass). Common associates can include *Schoenoplectus americanus* (chairmaker's bulrush), *Solidago sempervirens* (seaside goldenrod), *Teucrium canadense* (Canada germander), *Distichlis spicata* (inland saltgrass), *Carex silicea* (beach sedge), and *Juncus* (rush) spp. (*Juncus gerardii* (saltmeadow rush) in the north, *Juncus roemerianus* (needlegrass rush) in the south). Additional species can include *Kosteletzkya virginica* (Virginia saltmarsh mallow), *Hibiscus moscheutos* (crimsoneyed rosemallow), *Amaranthus cannabinus* (tidalmarsh amaranth), and *Typha* (cattail) spp., especially in oligohaline situations. Shrubs may occur sporadically, especially *Baccharis halimifolia* (eastern baccharis), *Morella pensylvanica* (northern bayberry), *Prunus maritima* (beach plum), and *Iva frutescens* (Jesuit's bark). Vegetation can be quite diverse and is a mixture of freshwater and brackish species. This association is best developed in salt marshes with a gradual elevation gradient that lends itself to vegetation zonation. The diagnostic species of this association is *Panicum virgatum* (switchgrass) in brackish settings near upland-marsh borders.
Environmental Description: This association occurs at the upland border of salt marshes on moist, sandy, shallow peat over glacial till. This is the highest elevation within the salt marsh; it is irregularly flooded by tides, high spring tides and storm tides, but is freely drained. It is also subject to salt spray. Soil salinity is low (oligohaline to mesohaline, 0.5-18 ppt). Similar vegetation can occur on anthropogenic dredge spoils where similar environmental conditions are created. Small patches of this association may also occur around coastal salt ponds.
Vegetation Description: This association is a tall grassland occupying brackish meadows at the upland border of high salt marshes. Vegetation is dominated by *Panicum virgatum* (switchgrass) and occasionally codominated by *Spartina patens* (saltmeadow cordgrass). Common associates

include *Schoenoplectus americanus* (chairmaker's bulrush), *Solidago sempervirens* (seaside goldenrod), *Teucrium canadense* (Canada germander), *Distichlis spicata* (inland saltgrass), *Carex silicea* (beach sedge), and *Juncus* (rush) spp. (*Juncus gerardii* (saltmeadow rush) in the north, *Juncus roemerianus* (needlegrass rush) in the south). Shrubs may occur sporadically, especially *Baccharis halimifolia* (eastern baccharis), *Morella pensylvanica* (northern bayberry), *Prunus maritima* (beach plum), and *Iva frutescens* (Jesuit's bark). Vegetation can be quite diverse and is a mixture of freshwater and brackish species. In addition to the common associates, other graminoids can include *Setaria parviflora* (marsh bristlegrass), *Elymus virginicus* (Virginia wildrye), *Panicum amarum* (bitter panicgrass), *Cladium mariscoides* (smooth sawgrass), *Cyperus polystachyos* (manyspike flatsedge), *Cyperus dentatus* (toothed flatsedge), *Schoenoplectus pungens* (common threesquare), and *Fimbristylis castanea* (marsh fimbry), and other forbs can include *Polygala verticillata* (whorled milkwort), *Solidago sempervirens* (seaside goldenrod), *Euthamia caroliniana* (slender goldentop), *Agalinis maritima* (saltmarsh false foxglove), *Artemisia campestris* ssp. *caudata* (field sagewort), *Sabatia stellaris* (rose of Plymouth), *Sabatia dodecandra* (marsh rose gentian), and Asteraceae spp.

Most Abundant Species:

Stratum	Lifeform	Species
Herb (field)	Graminoid	*Panicum virgatum* (switchgrass), *Spartina patens* (saltmeadow cordgrass)

Characteristic Species: *Panicum virgatum* (switchgrass), *Spartina patens* (saltmeadow cordgrass).

Other Noteworthy Species: Information not available.

USFWS Wetland System: Estuarine.

DISTRIBUTION

Range: This association occurs from New Hampshire to Delaware.

States/Provinces: CT, DE:S3?, MA, MD:S4, NJ:S2S3, NY:S1S2, RI, VA.

Federal Lands: NPS (Assateague Island, Cape Cod, Fire Island, Gateway); USFWS (Muskeget Island?, Parker River, Prime Hook).

CONSERVATION STATUS

Rank: GNR (1-Dec-1997)

Reasons: Information not available.

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 2 - Moderate.

Comments: This association is similar in species composition to the herbaceous component of *Iva frutescens / Spartina patens* Shrubland (CEGL006848). This association is less developed in the northern edge of its range (New Hampshire).

Similar Associations:

(Morella cerifera) - Panicum virgatum - Spartina patens Herbaceous Vegetation (CEGL004129).
Baccharis halimifolia - Iva frutescens / Panicum virgatum Shrubland (CEGL006063).
Iva frutescens / Spartina patens Shrubland (CEGL006848).
Schoenoplectus pungens - Eleocharis parvula Herbaceous Vegetation (CEGL006398).
Spartina patens - Festuca rubra - (Spartina pectinata) Herbaceous Vegetation (CEGL006368).

Related Concepts:

Panicum virgatum Tidal Herbaceous Vegetation (Harrison 2001) =
Panicum virgatum Wetland Association (Heckscher et al. 1995) B
Panicum virgatum upland border (Nixon 1982) ?

Brackish Tidal Marsh (Rawinski 1984) ?
Fresh marsh (Hill 1986) B
Freshwater marsh (Fender 1937) B
Mesic shrub community (Higgins et al. 1971) B
Salt Marsh (Rawinski 1984) ?
Salt marsh complex, upland border (Breden 1989) ?

SOURCES

Description Authors: S. L. Neid after D. Hunt.

References: Bowman 2000, Breden 1989, Breden et al. 2001, Clancy 1996, Dowhan and Rozsa 1989, Eastern Ecology Working Group n.d., Edinger et al. 2002, Enser 1999, Fender 1937, Harrison 2001, Harrison 2004, Heckscher et al. 1995, Higgins et al. 1971, Hill 1986, Hunt 2000, Johnson 1985b, Lundgren et al. 2000, Metzler and Barrett 2001, NRCS 2001b, Nixon 1982, Rawinski 1984, Sperduto 2000b, Swain and Kearsley 2001.



Figure E23. Brackish Meadow in Gateway National Recreation Area, Jamaica Bay Unit (Accuracy Assessment Point 61YY, photo no. 1091). 8/2/2006. NAD 1983 / UTM easting 594046, northing 4498116.

COMMON NAME (PARK-SPECIFIC): REED-GRASS TIDAL MARSH

SYNONYMS
NVC English Name: **Common Reed Tidal Herbaceous Vegetation**
NVC Scientific Name: ***Phragmites australis* Tidal Herbaceous Vegetation**
NVC Identifier: **CEGL004187**

LOCAL INFORMATION

Environmental Description: This association is often adjacent to and commonly intermingled with Mid-Atlantic Maritime Salt Shrub (CEGL006848). It occurs in a range of tidal wetland habitats, and substrates range from coarse to fine sand or, less often, mucky peat or mucky fine sandy loam. Soils can be derived from eolian sands or dredge fill (NRCS 2001b).
Vegetation Description: This association is characterized by dense stands of *Phragmites australis* (common reed), which tends to grow in colonies of tall, stout, leafy plants often to the exclusion of all other vascular plant species. Scattered individuals of other species may occur in low abundance and include *Hibiscus moscheutos* (crimsoneyed rosemallow), *Spartina alterniflora* (smooth cordgrass), *Solidago sempervirens* (seaside goldenrod), *Thelypteris palustris* (eastern marsh fern), *Artemisia vulgaris* (common wormwood), *Phytolacca americana* (American pokeweed), *Spartina patens* (saltmeadow cordgrass), *Polygonum punctatum* (dotted smartweed), *Scirpus cyperinus* (woolgrass), *Juncus tenuis* (poverty rush), *Lycopus americanus* (American water horehound), *Schoenoplectus americanus* (chairmaker's bulrush), *Chenopodium album* (lambsquarters), *Cakile edentula* (American searocket), *Atriplex prostrata* (triangle orache), *Ammophila breviligulata* (American beachgrass), and *Erechtites hieraciifolia* (American burnweed). Extremely scattered *Acer rubrum* (red maple) trees may be spread across the community. Sparse tall and short shrubs may also be present, including *Vaccinium corymbosum* (highbush blueberry), *Rhus copallinum* (flameleaf sumac), *Baccharis halimifolia* (eastern baccharis), *Iva frutescens* (Jesuit's bark), *Morella pensylvanica* (northern bayberry), and *Frangula alnus* (glossy buckthorn). Vines of *Toxicodendron radicans* (eastern poison ivy), *Celastrus orbiculata* (Asian bittersweet), and *Smilax rotundifolia* (roundleaf greenbrier) are commonly present in low abundance.
Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Acer rubrum* (red maple)
Tall shrub/sapling	Broad-leaved deciduous shrub	*Vaccinium corymbosum* (highbush blueberry)
Short shrub/sapling	Broad-leaved deciduous shrub	*Iva frutescens* (Jesuit's bark)
Herb (field)	Vine/Liana	*Toxicodendron radicans* (eastern poison ivy)
Herb (field)	Graminoid	*Phragmites australis* (common reed)

Characteristic Species: *Phragmites australis* (common reed)
Other Noteworthy Species: Information not available.
Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
NY	SNA*	=	1	Estuarine reedgrass marsh	Edinger et al. 2002
NJ	.	=	1	*Phragmites australis* Tidal Herbaceous Vegetation	Walz et al. 2007

Local Range: This association occurs in the Sandy Hook Unit, the Great Kills section of the Staten Island Unit, and in all of the sections of the Jamaica Bay Unit.
Classification Comments: None.

Other Comments: None.
Local Description Authors: G. J. Edinger and A. L. Feldmann.
Plots: 0, 1a, 3an, 3l, 3m, 4a, 4j, 9an, 64YY, 65, 79YY, 180, 184, 223, 227, 280.
Gateway National Recreation Area Inventory Notes: Information not available.

GLOBAL INFORMATION

NVC CLASSIFICATION

Physiognomic Class	Herbaceous Vegetation (V)
Physiognomic Subclass	Perennial graminoid vegetation (V.A.)
Physiognomic Group	Temperate or subpolar grassland (V.A.5.)
Physiognomic Subgroup	Natural/Semi-natural temperate or subpolar grassland (V.A.5.N.)
Formation	Tidal temperate or subpolar grassland (V.A.5.N.n.)
Alliance	*Phragmites australis* Tidal Herbaceous Alliance (A.1477)
Alliance (English name)	Common Reed Tidal Herbaceous Alliance
Association	*Phragmites australis* Tidal Herbaceous Vegetation
Association (English name)	Common Reed Tidal Herbaceous Vegetation
Ecological System(s):	Atlantic Coastal Plain Embayed Region Tidal Salt and Brackish Marsh (CES203.260). Central Atlantic Coastal Plain Salt and Brackish Tidal Marsh (CES203.270). Atlantic Coastal Plain Embayed Region Tidal Freshwater Marsh (CES203.259). Northern Atlantic Coastal Plain Tidal Salt Marsh (CES203.519).

GLOBAL DESCRIPTION

Concept Summary: This community is a dense tall grassland indicative of disturbance. It occurs in a range of tidal wetland habitats from fresh to brackish in salinity. It is characterized by dense stands of *Phragmites australis* (common reed), a species which tends to grow in colonies of tall, stout, leafy plants often to the exclusion of all other vascular plant species. Associated species are highly variable, depending on the community that has been invaded. Spreading in large colonies, *Phragmites* (reed) eventually dominates disturbed areas at coverage up to 100%. More typically, though, scattered individuals of other species may occur, such as sparse *Morella cerifera* (wax myrtle) shrubs, *Kosteletzkya virginica* (Virginia saltmarsh mallow), *Calystegia sepium* (hedge false bindweed), *Boehmeria cylindrica* (smallspike false nettle), *Typha angustifolia* (narrowleaf cattail), *Apocynum cannabinum* (Indianhemp), *Rosa palustris* (swamp rose), *Polygonum* (knotweed) sp., and *Mikania scandens* (climbing hempvine). Vines of *Toxicodendron radicans* (eastern poison ivy) are also frequent, but typically occur at low cover. This community has a broad geographic range, including coastal areas of the eastern and southeastern United States and Canada.
Environmental Description: This community is a dense tall grassland indicative of disturbance. It occurs in a range of tidal wetland habitats from fresh to brackish in salinity.
Vegetation Description: This community is a broadly defined reed-grass marsh. It is characterized by dense stands of *Phragmites australis* (common reed), a species which tends to grow in colonies of tall, stout, leafy plants often to the exclusion of all other vascular plant species. Associated species are highly variable, depending on the community that has been invaded. Spreading in large colonies, *Phragmites* (reed) eventually dominates disturbed areas at

coverage up to 100%. More typically, though, scattered individuals of other species may occur, such as sparse *Morella cerifera* (wax myrtle) shrubs, *Kosteletzkya virginica* (Virginia saltmarsh mallow), *Calystegia sepium* (hedge false bindweed), *Boehmeria cylindrica* (smallspike false nettle), *Typha angustifolia* (narrowleaf cattail), *Apocynum cannabinum* (Indianhemp), *Rosa palustris* (swamp rose), *Polygonum* (knotweed) sp., and *Mikania scandens* (climbing hempvine). Vines of *Toxicodendron radicans* (eastern poison ivy) are also frequent but typically occur at low cover.

Most Abundant Species:

Stratum	Lifeform	Species
Herb (field)	Graminoid	*Phragmites australis* (common reed)

Characteristic Species: *Phragmites australis* (common reed).
Other Noteworthy Species: Information not available.
USFWS Wetland System: Estuarine.

DISTRIBUTION

Range: This community has a broad geographic range, including coastal areas of the eastern and southeastern United States and Canada.
States/Provinces: AL, CT, DE, FL, GA, LA, LB?, MA, MD, ME, MS, NC, NF?, NH, NJ, NS?, NY, PA, PE?, QC?, RI, SC, TX, VA.
Federal Lands: NPS (Assateague Island, Boston Harbor Islands, Cape Cod, Colonial, Fire Island, Gateway, George Washington Birthplace); USFWS (Back Bay, Bon Secour, Chesapeake Marshlands).

CONSERVATION STATUS

Rank: GNA (invasive) (22-Nov-1997).
Reasons: Information not available.

CLASSIFICATION INFORMATION

Status: Standard.
Confidence: 1 - Strong.
Comments: Although *Phragmites australis* (common reed) rhizomes have been noted in salt marsh sediments exceeding three thousand years in age (Niering and Warren 1977) and is thus a native component of salt marshes in some areas in North America, the growth of the species in its native condition was likely to have been significantly different than the dense monotypic stands that characterize this community in parts of its range today. The invasive, nonnative strain has been labeled haplotype M (Saltonstall 2002). The presence of the *Phragmites australis* (common reed) community in wetlands today generally indicates human-induced disturbance, either through direct habitat manipulation or through passive introduction of reproductive material to naturally disturbed substrates. Historically, without alteration, these sites would generally be more saline. In New England, *Phragmites* (reed) tends to invade behind artificial/man-made levees where regular salt input is blocked, making the sites more brackish and less saline than prior to levee construction and anthropogenic modification. In cases where *Phragmites australis* (common reed) is a significant component of the vegetation but the vegetation retains sufficient species composition to retain its identity, the site is considered an unhealthy or degraded example of that original community. Where *Phragmites australis* (common reed) cover is so high that native species have been excluded and the original community is no longer recognizable, the occurrence is then treated as an example of *Phragmites australis* (common reed) Tidal Herbaceous Vegetation (CEGL004187).

Similar Associations:
Phragmites australis - (Sagittaria platyphylla, Vigna luteola) Tidal Herbaceous Vegetation (CEGL007891).
Phragmites australis Eastern North America Temperate Semi-natural Herbaceous Vegetation (CEGL004141).

Related Concepts:
Phragmites australis Association (Fleming 1998) ?
Phragmites australis community (Metzler and Barrett 1992) ?
Phragmites australis tidal marsh association (Clancy 1993b) ?
Brackish Tidal Marsh (Rawinski 1984) ?
Salt Marsh Complex (Breden 1989) B

SOURCES

Description Authors: R. E. Zaremba.

References: Bell et al. 2002, Bowman 2000, Breden 1989, Clancy 1993b, Edinger et al. 2002, Fleming 1998, Harrison 2001, Metzler and Barrett 1992, Metzler and Barrett 1996, Metzler and Barrett 2001, NRCS 2001b, Nelson 1986, Niering and Warren 1977, Odum et al. 1984, Rawinski 1984, Saltonstall 2002, Schafale and Weakley 1990, Schotz pers. comm., Southeastern Ecology Working Group n.d., Swain and Kearsley 2001.



Figure E24. Reed-grass Tidal Marsh in Gateway National Recreation Area, Sandy Hook Unit (Accuracy Assessment Point 223, photo no. 1211). 8/23/2006. NAD 1983 / UTM easting 585735, northing 4478751.

COMMON NAME (PARK-SPECIFIC): COASTAL SALT POND MARSH

SYNONYMS

NVC English Name: **Common Threesquare - Dwarf Spikerush Herbaceous Vegetation**
NVC Scientific Name: ***Schoenoplectus pungens - Eleocharis parvula* Herbaceous Vegetation**
NVC Identifier: **CEGL006398**

LOCAL INFORMATION

Environmental Description: This association is separated from the ocean by a beach/dune/maritime shrubland complex. It can be embedded within Northern Tall Maritime Shrubland (CEGL006379) or Reed-grass Tidal Marsh (CEGL004187), with Northern Bayberry Dune Shrubland (CEGL006295), Overwash Dune Grassland (CEGL004097) and Northern Beachgrass Dune occurring seaward. These ponds can draw down to a certain degree exposing mudflats. Substrate is most commonly fine sand originating from marine sediments and eolian deposition in the Hooksan and Jamaica series (NRCS 2001b).

Vegetation Description: The vegetation of this coastal salt pond association is most abundant on mudflats that are exposed when water levels draw down. *Eleocharis parvula* (dwarf spikerush) and *Spartina alterniflora* (smooth cordgrass) are characteristic. Additional species that can be variably present, depending on salinity and local conditions, are *Phragmites australis* (common reed), *Schoenoplectus pungens* (common threesquare), and *Typha angustifolia* (narrowleaf cattail) with *Iva frutescens* (Jesuit's bark) shrubs and, occasionally, *Lemna* (duckweed) sp. floating on the pond's surface.

Most Abundant Species:

Stratum	Lifeform	Species
Short shrub/sapling	Broad-leaved deciduous shrub	*Iva frutescens* (Jesuit's bark)
Herb (field)	Graminoid	*Eleocharis parvula* (dwarf spikerush), *Schoenoplectus americanus* (chairmaker's bulrush)

Characteristic Species: *Eleocharis parvula* (dwarf spikerush), *Iva frutescens* (Jesuit's bark), *Phragmites australis* (common reed), *Schoenoplectus americanus* (chairmaker's bulrush), *Schoenoplectus pungens* (common threesquare), *Typha angustifolia* (narrowleaf cattail).

Other Noteworthy Species: Information not available.

Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
NY	S1S2	=	1	Coastal salt pond	Edinger et al. 2002
NJ	.	=	1	*Schoenoplectus pungens-Eleocharis parvula* Herbaceous Vegetation	Walz et al. 2007

Local Range: This association occurs in the Breezy Point and Floyd Bennett Field sections of the Jamaica Bay Unit.

Classification Comments: None.

Other Comments: None.

Local Description Authors: G. J. Edinger and A. L. Feldmann.

Plots: 2e, ref2.

Gateway National Recreation Area Inventory Notes: Information not available.

GLOBAL INFORMATION

NVC CLASSIFICATION

Physiognomic Class	Herbaceous Vegetation (V)
Physiognomic Subclass	Perennial graminoid vegetation (V.A.)
Physiognomic Group	Temperate or subpolar grassland (V.A.5.)
Physiognomic Subgroup	Natural/Semi-natural temperate or subpolar grassland (V.A.5.N.)
Formation	Tidal temperate or subpolar grassland (V.A.5.N.n.)
Alliance	*Schoenoplectus pungens* Tidal Herbaceous Alliance (A.1478)
Alliance (English name)	Common Threesquare Tidal Herbaceous Alliance
Association	*Schoenoplectus pungens - Eleocharis parvula* Herbaceous Vegetation
Association (English name)	Common Threesquare - Dwarf Spikerush Herbaceous Vegetation
Ecological System(s):	Atlantic Coastal Plain Northern Salt Pond Marsh (CES203.892).

GLOBAL DESCRIPTION

Concept Summary: This association encompasses the brackish marshes of coastal salt ponds of the northeastern Atlantic coast. Coastal salt ponds are ponds separated from the ocean by a barrier beach. They generally form when a lagoon or bay is closed off from regular tidal flooding by a sand spit or other barrier. Salinity depends on the length of time since enclosure of the lake/pond; freshwater input from precipitation and overland flow dilutes the enclosed seawater resulting in meso- to oligohaline conditions. Depending on the distance from the ocean, saltwater input is infrequent and a result of tidal breaches or storm overwash, although there can be some saltwater seepage across the barrier beach. Shorelines usually have gentle slopes that magnify gradients of salinity and saturation. Depending on local water balance, ponds can draw down to a certain degree exposing mud or sand flats. Substrate ranges from sand to mud to peat. Vegetation of coastal salt ponds is highly variable both spatially and temporally given the variable nature of the habitat and processes affecting it. Although not constant, vegetation zonation often occurs along shores of coastal salt ponds along gradients of salinity and flooding or saturation. Dominant species can be variable depending on local conditions but are generally characterized by *Schoenoplectus pungens* (common threesquare), *Eleocharis parvula* (dwarf spikerush), and/or *Spartina patens* (saltmeadow cordgrass), *Spartina pectinata* (prairie cordgrass), or *Panicum virgatum* (switchgrass). Where salinity is less *Typha angustifolia* (narrowleaf cattail) can be common. Mud flat habitat can develop in lower areas that tend to be exposed later in the season with *Eleocharis parvula* (dwarf spikerush), *Eleocharis halophila* (saltmarsh spikerush), *Eleocharis flavescens* (yellow spikerush), *Schoenoplectus maritimus* (cosmopolitan bulrush), *Crassula aquatica* (water pygmyweed), *Spergularia salina* (salt sandspurry), *Cyperus filicinus* (fern flatsedge), or others. In higher zones, vegetation can be similar to high salt marsh habitat; *Panicum virgatum* (switchgrass), *Spartina patens* (saltmeadow cordgrass), or *Spartina pectinata* (prairie cordgrass) can be characteristic, plus *Schoenoplectus smithii* (Smith's bulrush), *Echinochloa walteri* (coast cockspur grass), *Cladium mariscoides* (smooth sawgrass), *Distichlis spicata* (inland saltgrass), or *Chenopodium* (goosefoot) spp. Species found farther south include *Ptilimnium capillaceum* (herbwilliam), *Pluchea odorata* (sweetscent), *Schoenoplectus americanus* (chairmaker's bulrush), *Hibiscus moscheutos* (crimsoneyed rosemallow), plus scattered individuals of *Iva frutescens* (Jesuit's bark) or *Baccharis halimifolia* (eastern baccharis). Ponds often support aquatic plants that are tolerant of brackish/saline conditions, such as *Ruppia maritima* (widgeongrass), *Stuckenia pectinata* (sago pondweed), *Potamogeton*

perfoliatus (claspingleaf pondweed), or *Zannichellia palustris* (horned pondweed), plus some marine algal species. Several associations may be warranted in these highly variable systems; collection of further data will likely support the division of more associations.

Environmental Description: Coastal salt ponds are ponds separated from the ocean by a barrier beach. They generally form when a lagoon or bay is closed off from regular tidal flooding by a sand spit or other barrier. However, some ponds have a permanent, often artificially maintained, inlet/outlet and thus have regular saltwater exchange. Salinity depends on the length of time since enclosure of the lake/pond; freshwater input from precipitation and overland flow dilutes the enclosed seawater resulting in meso- to oligohaline conditions. Depending on the distance from the ocean, saltwater input is infrequent and a result of tidal breaches or storm overwash, although there can be some saltwater seepage across the barrier beach. Shorelines usually have gentle slopes that magnify gradients of salinity and saturation. Depending on local water balance, ponds can draw down to a certain degree exposing mud or sand flats. Substrate ranges from sand to mud to peat. These ponds occur in glaciated areas in moraine or outwash deposits.

Vegetation Description: Vegetation of coastal salt ponds is highly variable both spatially and temporally given the variable nature of the habitat and processes affecting it. Although not constant, vegetation zonation often occurs along shores of coastal salt ponds along gradients of salinity and flooding or saturation. Dominant species can be variable depending on local conditions but are generally characterized by *Schoenoplectus pungens* (common threesquare), *Eleocharis parvula* (dwarf spikerush), and/or *Spartina patens* (saltmeadow cordgrass), *Spartina pectinata* (prairie cordgrass), or *Panicum virgatum* (switchgrass). Where salinity is less *Typha angustifolia* (narrowleaf cattail) can be common. Mud flat habitat can develop in lower areas that tend to be exposed later in the season with *Eleocharis parvula* (dwarf spikerush), *Eleocharis halophila* (saltmarsh spikerush), *Eleocharis flavescens* (yellow spikerush), *Schoenoplectus maritimus* (cosmopolitan bulrush), *Crassula aquatica* (water pygmyweed), *Spergularia salina* (salt sandspurry), or others. In higher zones, vegetation can be similar to high salt marsh habitat; *Panicum virgatum* (switchgrass), *Spartina patens* (saltmeadow cordgrass), or *Spartina pectinata* (prairie cordgrass) can be characteristic, plus *Schoenoplectus smithii* (Smith's bulrush), *Echinochloa walteri* (coast cockspur grass), *Cladium mariscoides* (smooth sawgrass), *Distichlis spicata* (inland saltgrass), and *Chenopodium* (goosefoot) spp. Species found farther south include *Ptilimnium capillaceum* (herbwilliam), *Pluchea odorata* (sweetscent), *Schoenoplectus americanus* (chairmaker's bulrush), *Hibiscus moscheutos* (crimsoneyed rosemallow), plus scattered individuals of *Iva frutescens* (Jesuit's bark) or *Baccharis halimifolia* (eastern baccharis). Ponds often support aquatic plants that are tolerant of brackish/saline conditions, such as *Ruppia maritima* (widgeongrass), *Stuckenia pectinata* (sago pondweed), *Potamogeton perfoliatus* (claspingleaf pondweed), or *Zannichellia palustris* (horned pondweed), plus some marine algal species.

Most Abundant Species:

Stratum	Lifeform	Species
Herb (field)	Graminoid	*Eleocharis parvula* (dwarf spikerush), *Schoenoplectus pungens* (common threesquare), *Spartina patens* (saltmeadow cordgrass)

Characteristic Species: *Eleocharis parvula* (dwarf spikerush), *Schoenoplectus pungens* (common threesquare).

Other Noteworthy Species: Information not available.

USFWS Wetland System: Estuarine.

DISTRIBUTION

Range: Coastal salt ponds occur in a limited geomorphological setting in New Hampshire, Massachusetts, Rhode Island, and Long Island, New York.
States/Provinces: MA, ME, NH:S1, NY:S1S2, RI.
Federal Lands: NPS (Boston Harbor Islands, Cape Cod, Gateway).

CONSERVATION STATUS

Rank: GNR (1-Dec-1997).
Reasons: Information not available.

CLASSIFICATION INFORMATION

Status: Standard.
Confidence: 2 - Moderate.
Comments: This association encompasses a highly variable and shifting vegetation mosaic in a variable and dynamic habitat. Several associations may be warranted; collection of further data will likely support the division of this type into more associations.
Similar Associations:
Panicum virgatum - *Spartina patens* Herbaceous Vegetation (CEGL006150).
Ruppia maritima Acadian/Virginian Zone Temperate Herbaceous Vegetation (CEGL006167).
Schoenoplectus pungens Tidal Herbaceous Vegetation (CEGL004188).
Spartina patens - *Eleocharis parvula* Herbaceous Vegetation (CEGL006342).
Related Concepts:
Coastal Salt Pond (Rawinski 1984) ?
Coastal Salt Pond Marsh (Rawinski 1984) ?

SOURCES

Description Authors: S. L. Neid.
References: Eastern Ecology Working Group n.d., Edinger et al. 2002, Elliman 2003, Gawler 2002, Island Alliance 2001, Karanaukas 2001, Lundgren 1998, Lundgren 2000, NRCS 2001b, Rawinski 1984, Reschke 1990, Sperduto 2000a, Sperduto 2000b, Swain and Kearsley 2000, Swain and Kearsley 2001, Thorne-Miller et al. 1983, Zaremba 1999.



Figure E25. Coastal Salt Pond Marsh in Gateway National Recreation Area, Jamaica Bay Unit (plot GATE.47, NYNHP plot 2e). 7/16/2003. NAD 1983 / UTM easting 590002, northing 4489761.

COMMON NAME (PARK-SPECIFIC): NORTH ATLANTIC LOW SALT MARSH

SYNONYMS

NVC English Name: **Saltmarsh Cordgrass / (Yellow Tang) Acadian/Virginian Zone Herbaceous Vegetation**

NVC Scientific Name: ***Spartina alterniflora / (Ascophyllum nodosum)* Acadian/Virginian Zone Herbaceous Vegetation**

NVC Identifier: **CEGL004192**

LOCAL INFORMATION

Environmental Description: This low salt marsh community occurs in the regularly flooded intertidal zone, approximately from mean high tide to mean sea level; it is diurnally flooded by tides and is classified as polyhaline (18-30 ppt). Low salt marshes occur landward of Intertidal Mudflats Sparse Vegetation (CEGL006614) and subtidal communities and seaward of North Atlantic High Salt Marsh (CEGL006006), North Atlantic Upper Ocean Beach (CEGL004400), and/or Salt Panne (*Salicornia* (pickleweed) Type) CEGL004308). They generally occur on tidally flooded mucky peat, mudflats, and mucky fine sandy loam in the Ipswich, Pawcatuck, and Sandyhook series. Soils are very deep, very poorly drained, and formed in thick organic deposits and sandy sediments with a thin organic layer (NRCS 2001b).

Vegetation Description: This association is characterized and dominated by tall *Spartina alterniflora* (smooth cordgrass), which often forms a nearly monotypic layer. Associates can be *Spartina patens* (saltmeadow cordgrass), *Distichlis spicata* (inland saltgrass), *Salicornia bigelovii* (dwarf saltwort), *Limonium carolinianum* (Carolina sealavender), *Atriplex prostrata* (triangle orache), and *Salicornia maritima* (slender grasswort). *Iva frutescens* (Jesuit's bark) shrubs can occasionally be present in the upper edge of the community. *Ulva lactuca* (sea-lettuce) can form extensive mats at the bases of the grass culms, and ribbed mussels are nearly always present in the substrate.

Most Abundant Species:

Stratum	Lifeform	Species
Herb (field)	Graminoid	*Spartina alterniflora* (smooth cordgrass)
Nonvascular	Alga	*Ulva lactuca* (sea-lettuce)

Characteristic Species: *Limonium carolinianum* (Carolina sealavender), *Salicornia bigelovii* (dwarf saltwort), *Spartina alterniflora* (smooth cordgrass), *Ulva lactuca* (sea-lettuce)

Other Noteworthy Species: Information not available.

Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
NY	S3S4	=	1	Low salt marsh	Edinger et al. 2002
NJ	S5	=	1	*Spartina alterniflora/(Ascophyllum nodosum)* Acadian/Virginian Zone Herbaceous Vegetation	Breden et al. 2001

Local Range: This association occurs in the Sandy Hook Unit; the Great Kills section of the Staten Island Unit; and the Fort Tilden, Floyd Bennett Field, Canarsie Pier, Jamaica Bay Wildlife Refuge, and Spring Creek sections of the Jamaica Bay Unit.

Classification Comments: None.

Other Comments: None.

Local Description Authors: G. J. Edinger and A. L. Feldmann.

Plots: 1f, 2h, 5f, 6f, 44YY, 47XX, 56YY, 57YY, 110YY, 116XX, 130, 136YY, 156YY, 157, 166, 179, 189, 219, 220, 247, 250, 251, 252, 258.
Gateway National Recreation Area Inventory Notes: Information not available.

GLOBAL INFORMATION

NVC CLASSIFICATION

Physiognomic Class	Herbaceous Vegetation (V)
Physiognomic Subclass	Perennial graminoid vegetation (V.A.)
Physiognomic Group	Temperate or subpolar grassland (V.A.5.)
Physiognomic Subgroup	Natural/Semi-natural temperate or subpolar grassland (V.A.5.N.)
Formation	Tidal temperate or subpolar grassland (V.A.5.N.n.)
Alliance	*Spartina alterniflora* Tidal Herbaceous Alliance (A.1471)
Alliance (English name)	Saltmarsh Cordgrass Tidal Herbaceous Alliance
Association	*Spartina alterniflora / (Ascophyllum nodosum)* Acadian/Virginian Zone Herbaceous Vegetation
Association (English name)	Saltmarsh Cordgrass / (Yellow Tang) Acadian/Virginian Zone Herbaceous Vegetation
Ecological System(s):	Atlantic Coastal Plain Embayed Region Tidal Salt and Brackish Marsh (CES203.260). Acadian Coastal Salt Marsh (CES201.578). Northern Atlantic Coastal Plain Tidal Salt Marsh (CES203.519).

GLOBAL DESCRIPTION

Concept Summary: This tall grassland dominated by *Spartina alterniflora* (smooth cordgrass) forms the low salt marsh of the north and mid-Atlantic coast. It is diurnally flooded by tides, occurring in the intertidal zone between mean high tide and mean sea level in protected inlets behind barrier beaches or in the seaward reaches of drowned river valleys. It forms a coarse peat over sandy substrate. The low salt marsh occurs elevationally between high marsh that occurs landward and subtidal communities that occur seaward. *Spartina alterniflora* (smooth cordgrass) is limited to the low marsh zone by interspecific competition and by moderate salinity; it can withstand longer submergence than other salt marsh grasses but still requires periodic exposure of the substrate. *Spartina alterniflora* (smooth cordgrass) forms nearly monotypic stands with little variation across the geographic range of the community. Tall form *Spartina alterniflora* (smooth cordgrass) occurs adjacent to salt water and colonizes unvegetated flats. This association also grades into short form *Spartina alterniflora* (smooth cordgrass) landward. Associated species occur in low abundance and commonly include *Limonium carolinianum* (Carolina sealavender), *Salicornia virginica* (Virginia glasswort), *Salicornia bigelovii* (dwarf saltwort), *Spergularia maritima* (media sandspurry), *Spergularia canadensis* (Canadian sandspurry), and *Suaeda maritima* (herbaceous seepweed). Brown algae can form extensive mats at the bases of the grass culms, especially *Ascophyllum nodosum*, *Fucus vesiculosus*, *Enteromorpha* spp., and *Ulva* (sea-lettuce) spp. Macroalgae associates may be sparse or absent at the southern edge of the range. This community occurs from Nova Scotia to Cape Hatteras, North Carolina. Low marshes at the northern edge of the geographic range are far less extensive in size than those farther south due to differences in geomorphology and time since last glaciation.

Environmental Description: This low salt marsh community occurs in the regularly flooded intertidal zone, approximately from mean high tide to mean sea level; it is diurnally flooded by tides and classified as polyhaline (18-30 ppt). This low marsh occurs in areas sheltered from direct wave action, such as behind barrier beaches, as pocket marshes at the heads of bays, or in the outer reaches of estuaries. Low salt marshes occur landward of intertidal flats and subtidal communities and seaward of high salt marsh communities. Low salt marshes dominated by *Spartina alterniflora* (smooth cordgrass) generally occur on mucky silt to silty coarse fibrous peat, often with high organic matter content. However, peat in the low marsh is generally less dense than farther landward (Bertness 1988). Peat depth ranges from a few feet, if the community formed over a mudflat, to 80 feet in drowned river valleys at the mouths of estuaries.
Vegetation Description: This community is a tall grassland dominated by *Spartina alterniflora* (smooth cordgrass) occurring in regularly flooded intertidal zones. *Spartina alterniflora* (smooth cordgrass) dominates this physically stressful zone due to limited competition and its ability to tolerate salinity and flooding. It also requires moderately high levels of iron (7-15 ppm) (Adams 1963). *Spartina alterniflora* (smooth cordgrass) is strongly dominant, forming a nearly monotypic tallgrass layer. There is little variation in vascular plant composition across the range. Tall-form *Spartina alterniflora* (smooth cordgrass) occurs adjacent to saltwater and colonizes unvegetated flats. This association also grades into short-form *Spartina alterniflora* (smooth cordgrass) landward where tidal range is more restricted. Common associates, occurring in low abundance, include *Limonium carolinianum* (Carolina sealavender), *Salicornia virginica* (Virginia glasswort), *Salicornia bigelovii* (dwarf saltwort), *Spergularia maritima* (media sandspurry), *Spergularia canadensis* (Canadian sandspurry), and *Suaeda maritima* (herbaceous seepweed). *Distichlis spicata* (inland saltgrass), *Agalinis maritima* (saltmarsh false foxglove), *Symphyotrichum tenuifolium* (perennial saltmarsh aster), and *Spartina patens* (saltmeadow cordgrass) can also sporadically occur, but are more common in the high salt marsh. Brown algae can form extensive mats at the bases of the grass culms, especially *Ascophyllum nodosum*, *Fucus vesiculosus*, and *Ulva* (sea-lettuce) spp. *Enteromorpha* spp. can occur early in the growing season. Macroalgae associates may be sparse or absent at the southern edge of the range. Microscopic algae, especially diatoms, can be abundant on the marsh surface (Teal 1986).
Most Abundant Species:

Stratum	Lifeform	Species
Herb (field)	Graminoid	*Spartina alterniflora* (smooth cordgrass)

Characteristic Species: *Spartina alterniflora* (smooth cordgrass).
Other Noteworthy Species: Information not available.
USFWS Wetland System: Estuarine.

DISTRIBUTION
Range: This association occurs along the Atlantic coastline from Nova Scotia and New Brunswick south to Cape Hatteras, North Carolina.
States/Provinces: CT, DE:S5, MA, MD:S5, ME, NB, NC, NH, NJ:S5, NS, NY:S3S4, RI, VA.
Federal Lands: NPS (Acadia, Assateague Island, Boston Harbor Islands, Cape Cod, Fire Island, Gateway, Sagamore Hill); USFWS (Back Bay?, Chesapeake Marshlands, Monomoy, Moosehorn?, Muskeget Island, Parker River, Prime Hook).

CONSERVATION STATUS
Rank: G5 (1-Dec-1997).
Reasons: Information not available.

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 1 - Strong.

Comments: The northern limit of this type occurs where there is a slower accumulation of silt and corresponding absence of algal species (Chapman 1937). The southern limit corresponds with the southern limit of the Virginian province of the American Atlantic Temperate Region, a transitional area harboring animal species of both southern and northern affinities (Gosner 1979, Cowardin 1979). Southern occurrences, where *Ascophyllum nodosum* (yellow tang) may be sparse or absent, are placed within this type because of the associated characteristic faunal assemblage, including *Uca pugnax* (Atlantic marsh fiddler), *Littorina saxatilis* (rough periwinkle), *Littorina obtusata* (smooth periwinkle), and *Brachidontes demissus* (ribbed mussel). Analogous low salt marsh associations in other geographic areas include *Spartina alterniflora* (smooth cordgrass) Carolinian Zone Herbaceous Vegetation (CEGL004191) and *Spartina alterniflora - Juncus roemerianus - Distichlis spicata* Louisianian Zone Salt Tidal Herbaceous Vegetation (CEGL004190) for the Atlantic Coast of the southeastern U.S. (Cape Hatteras, North Carolina, to Florida) and the Gulf Coast (Florida to Texas), respectively [see Cowardin (1979) for regional boundaries]. *Spartina alterniflora - Lilaeopsis chinensis* Herbaceous Vegetation (CEGL004193) is a *Spartina alterniflora* (smooth cordgrass)-dominated association occurring in the mid-tidal range of tidal rivers that have a minimum tidal range of one meter.

Similar Associations:

Spartina alterniflora - Juncus roemerianus - Distichlis spicata Louisianian Zone Salt Tidal Herbaceous Vegetation (CEGL004190).
S*partina alterniflora - Lilaeopsis chinensis* Herbaceous Vegetation (CEGL004193).
Spartina alterniflora Carolinian Zone Herbaceous Vegetation (CEGL004191).

Related Concepts:

Spartina alterniflora Tidal Herbaceous Vegetation (Harrison 2001) =
Spartina alterniflora community (Metzler and Barrett 1992) ?
Spartina alterniflora salt marsh (Clancy 1993b) ?
Cordgrass saltmarsh community (MENHP 1991) ?
Low salt marsh (Reschke 1990) ?
Low salt marsh (Enser 1993) ?
Low salt marsh community (Sperduto 1994) ?
Salt Marsh (Rawinski 1984) ?
Salt Marsh (Virginian Subtype) (Schafale 2000) ?
Salt marsh (Higgins et al. 1971) B
Salt marsh community (Hill 1986) B
Salt marsh complex, low marsh (Breden 1989) ?

SOURCES

Description Authors: S. L. Neid.

References: Adams 1963, Bell et al. 2002, Bertness 1988, Bowman 2000, Breden 1989, Breden et al. 2001, Chapman 1937, Clancy 1993b, Clancy 1996, Cowardin et al. 1979, Eastern Ecology Working Group n.d., Edinger et al. 2002, Enser 1993, Enser 1999, Fleming et al. 2001, Gawler 2001, Gawler 2002, Gosner 1979, Harrison 2001, Harrison 2004, Higgins et al. 1971, Hill 1986, MENHP 1991, Metzler and Barrett 1992, Metzler and Barrett 2001, Moul 1973, NRCS 2001b, Rawinski 1984, Reschke 1990, Schafale 2000, Schafale 2003b, Schafale and Weakley 1990, Soil Conservation Service 1987, Sperduto 1994, Sperduto 2000a, Sperduto 2000b, Stalter 1979, Swain and Kearsley 2001, Teal 1986.



Figure E26. North Atlantic Low Salt Marsh in Gateway National Recreation Area, Jamaica Bay Unit (Accuracy Assessment Point 156YY, photo no. 1350). 9/22/2006. NAD 1983 / UTM easting 597194, northing 4497277.

COMMON NAME (PARK-SPECIFIC): NORTH ATLANTIC HIGH SALT MARSH

SYNONYMS

NVC English Name: **Saltmeadow Cordgrass - Saltgrass - (Black-grass) Herbaceous Vegetation**

NVC Scientific Name: ***Spartina patens - Distichlis spicata - (Juncus gerardii)*** **Herbaceous Vegetation**

NVC Identifier: **CEGL006006**

LOCAL INFORMATION

Environmental Description: This association is often adjacent to North Atlantic Low Salt Marsh (CEGL004192). It occupies the irregularly flooded zone extending from mean high tide landward to the limit of spring tides. Substrate is tidally flooded mucky peat, mucky fine sandy loam, loamy sand, and coarse sand in the Matunuck, Sandyhook, Bigapple, Breeze, Ipswich, and Jamaica series.

Vegetation Description: This association is characterized by co-dominance of *Spartina patens* (saltmeadow cordgrass) and *Distichlis spicata* (inland saltgrass), which can form extensive meadows or linear features at the upper edge of low salt marsh. *Spartina alterniflora* (smooth cordgrass) (short form), *Limonium carolinianum* (Carolina sealavender), *Suaeda maritima* (herbaceous seepweed), *Salicornia bigelovii* (dwarf saltwort), *Juncus gerardii* (saltmeadow rush), *Solidago sempervirens* (seaside goldenrod), and *Salicornia maritima* (slender grasswort) are common associates. Both *Phragmites australis* (common reed) and *Ammophila breviligulata* (American beachgrass) can colonize the community from the edges; they are not characteristic species of this type. Similarly, *Iva frutescens* (Jesuit's bark) shrubs can be present in low abundance, primarily near the community's edge.

Most Abundant Species:

Stratum	Lifeform	Species
Short shrub/sapling	Broad-leaved deciduous shrub	*Iva frutescens* (Jesuit's bark)
Herb (field)	Forb	*Limonium carolinianum* (Carolina sealavender)
Herb (field)	Graminoid	*Distichlis spicata* (inland saltgrass), *Spartina alterniflora* (smooth cordgrass), *Spartina patens* (saltmeadow cordgrass)

Characteristic Species: *Distichlis spicata* (inland saltgrass), *Limonium carolinianum* (Carolina sealavender), *Spartina alterniflora* (smooth cordgrass), *Spartina patens* (saltmeadow cordgrass).

Other Noteworthy Species: Information not available.

Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
NY	S3S4	=	1	High salt marsh	Edinger et al. 2002
NJ	S5	=	1	*Spartina patens-Distichlis spicata-Plantago maritima* Herbaceous Vegetation	Breden et al. 2001

Local Range: This association occurs in the Sandy Hook Unit and in the Breezy Point, Fort Tilden, Floyd Bennett Field, Canarsie Pier, and Jamaica Bay Wildlife Refuge sections of the Jamaica Bay Unit.

Classification Comments: None.

Other Comments: None.

Local Description Authors: G. J. Edinger and A. L. Feldmann.

Plots: 1j, 2f, 2g, 2m, 3e, 3s, 4h, 12n, 90XX, 91, 97YY, 105YY, 113YY, 119XX, 120XX, 121XX, 122XX, 124XX, 132XX, 138, 161YY, 162XX, ref1, ref2, ref5.
Gateway National Recreation Area Inventory Notes: Information not available.

GLOBAL INFORMATION

NVC CLASSIFICATION

Physiognomic Class	Herbaceous Vegetation (V)
Physiognomic Subclass	Perennial graminoid vegetation (V.A.)
Physiognomic Group	Temperate or subpolar grassland (V.A.5.)
Physiognomic Subgroup	Natural/Semi-natural temperate or subpolar grassland (V.A.5.N.)
Formation	Tidal temperate or subpolar grassland (V.A.5.N.n.)
Alliance	*Spartina patens - (Distichlis spicata)* Tidal Herbaceous Alliance (A.1481)
Alliance (English name)	Saltmeadow Cordgrass - (Saltgrass) Tidal Herbaceous Alliance
Association	*Spartina patens - Distichlis spicata - (Juncus gerardii)* Herbaceous Vegetation
Association (English name)	Saltmeadow Cordgrass - Saltgrass - (Black-grass) Herbaceous Vegetation
Ecological System(s):	Atlantic Coastal Plain Northern Salt Pond Marsh (CES203.892). Northern Atlantic Coastal Plain Tidal Salt Marsh (CES203.519). Acadian Coastal Salt Marsh (CES201.578).

GLOBAL DESCRIPTION

Concept Summary: This high salt marsh vegetation dominated by *Spartina patens* (saltmeadow cordgrass) or codominated by *Distichlis spicata* (inland saltgrass) forms distinct "cowlicked" meadows above low salt marsh communities. This high marsh association generally occurs behind barrier beaches along the north Atlantic coast from the Canadian maritime provinces south to New Jersey. It occupies the irregularly flooded zone extending from mean high tide landward to the limit of spring tides. The substrate is peat overlying sand, silt, or bedrock. Vegetation of this marsh community occurs in mosaics of patches generally dominated by a single graminoid species, *Spartina patens* (saltmeadow cordgrass), *Distichlis spicata* (inland saltgrass), or *Juncus gerardii* (saltmeadow rush). Other characteristic associates that occur in low abundance include *Symphyotrichum tenuifolium* (perennial saltmarsh aster), *Limonium carolinianum* (Carolina sealavender), *Solidago sempervirens* (seaside goldenrod), *Symphyotrichum subulatum* (eastern annual saltmarsh aster), *Polygonum ramosissimum* (bushy knotweed), *Argentina anserina* (silverweed cinquefoil), *Atriplex patula* (spear saltbush), *Lythrum lineare* (wand lythrum), and *Panicum virgatum* (switchgrass). Salt pannes are often a prominent feature within this association.
Environmental Description: This high salt marsh association generally occurs behind barrier beaches, but also in the outer reaches of estuaries, occupying the zone extending from mean high tide landward approximately to the limit of spring tides. They are often adjacent to low salt marshes dominated by *Spartina alterniflora* (smooth cordgrass) (tall form), which are regularly flooded by diurnal tides. *Spartina patens* (saltmeadow cordgrass)-dominated high marshes form very dense peat with high organic matter content. Peat forms over sand, silt or bedrock.
Vegetation Description: Vegetation of this marsh community occurs in mosaics of patches generally dominated by a single graminoid species, *Spartina patens* (saltmeadow cordgrass),

Distichlis spicata (inland saltgrass), or *Juncus gerardii* (saltmeadow rush). Other characteristic associates that occur in low abundance include *Symphyotrichum tenuifolium* (perennial saltmarsh aster), *Limonium carolinianum* (Carolina sealavender), *Solidago sempervirens* (seaside goldenrod), *Symphyotrichum subulatum* (eastern annual saltmarsh aster), *Polygonum ramosissimum* (bushy knotweed), *Argentina anserina* (silverweed cinquefoil), *Atriplex patula* (spear saltbush), *Lythrum lineare* (wand lythrum), and *Panicum virgatum* (switchgrass).

Most Abundant Species:

Stratum	Lifeform	Species
Herb (field)	Graminoid	*Distichlis spicata* (inland saltgrass), *Juncus gerardii* (saltmeadow rush), *Spartina patens* (saltmeadow cordgrass)

Characteristic Species: *Distichlis spicata* (inland saltgrass), *Juncus gerardii* (saltmeadow rush), *Spartina patens* (saltmeadow cordgrass).

Other Noteworthy Species: Information not available.

USFWS Wetland System: Estuarine.

DISTRIBUTION

Range: This high salt marsh association occurs from the Canadian maritime provinces south to Delaware.

States/Provinces: CT, DE, MA, MD, ME, NH, NJ:S5, NY:S3S4, RI.

Federal Lands: NPS (Acadia, Boston Harbor Islands, Cape Cod, Fire Island, Gateway, Sagamore Hill); USFWS (Moosehorn, Muskeget Island?, Parker River?, Prime Hook).

CONSERVATION STATUS

Rank: G5 (1-Dec-1997).

Reasons: Information not available.

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 2 - Moderate.

Comments: This community is differentiated from *Spartina patens - Distichlis spicata - (Juncus roemerianus)* Herbaceous Vegetation (CEGL004197) to the south by the importance of *Juncus gerardii* (saltmeadow rush), *Plantago maritima* (goose tongue), and *Triglochin maritima* (seaside arrowgrass) and absence or relatively infrequent occurrence of species of southern distribution such as *Borrichia frutescens* (bushy seaside tansy), *Kosteletzkya virginica* (Virginia saltmarsh mallow), *Fimbristylis castanea* (marsh fimbry), and *Lythrum lineare* (wand lythrum).

Similar Associations:

Spartina patens - Agrostis stolonifera Herbaceous Vegetation (CEGL006365).
Spartina patens - Distichlis spicata - (Juncus roemerianus) Herbaceous Vegetation (CEGL004197).

Related Concepts:

Spartina patens - Distichlis spicata Herbaceous Vegetation (Harrison 2001) I
Salt Marsh (Rawinski 1984) ?
Salt marsh complex, high marsh (Breden 1989) ?

SOURCES

Description Authors: S. L. Neid.

References: Bell et al. 2002, Bertness et al. 1992, Breden 1989, Breden et al. 2001, Coulling pers. comm., Dowhan and Rozsa 1989, Eastern Ecology Working Group n.d., Edinger et al. 2002, Enser 1999, Fleming 2001, Gawler 2001, Gawler 2002, Harrison 2001, Hill 1923, Metzler and Barrett 2001, Nixon 1982, Rawinski 1984, Reschke 1990, Soil Conservation Service 1987, Sperduto 2000a, Sperduto 2000b, Swain and Kearsley 2001.



Figure E27. North Atlantic High Salt Marsh in Gateway National Recreation Area, Jamaica Bay Unit (Accuracy Assessment Point 90XX, photo no. 1163). 8/16/2006. NAD 1983 / UTM easting 599138, northing 4497645.

COMMON NAME (PARK-SPECIFIC): NORTH ATLANTIC COAST BACKDUNE GRASSLAND

SYNONYMS

NVC English Name: **(Northern Bayberry) / Seaside Bluestem - Seabeach Three-awn Shrub Herbaceous Vegetation**

NVC Scientific Name: ***(Morella pensylvanica) / Schizachyrium littorale - Aristida tuberculosa* Shrub Herbaceous Vegetation**

NVC Identifier: **CEGL006161**

LOCAL INFORMATION

Environmental Description: This community occurs in a natural setting on deep stabilized sands of old interdunes and backdunes. It can also occur in disturbed settings following clearing of maritime shrubland and other backdune communities or on sandy dredge spoil. Substrate can be fine sand, coarse sand, gravelly fine sand, or, less commonly, loamy sand in the Gravesend-Oldmill, Bigapple, Hooksan, Fortress, and Breeze series (NRCS 2001b). Soils are derived from various natural and non-natural sediments, including household landfills capped with sand, sandy dredge fill, eolian and marine sediments, and sandy fill mixed with demolished construction debris (NRCS 2001b).

Vegetation Description: The vegetation of this association is variable and depends on landscape setting and land-use history. It is dominated by *Corynephorus canescens* (gray clubawn grass) in more disturbed settings and by *Schizachyrium scoparium* (little bluestem) in its more natural expression. Associates include *Pityopsis falcata* (sickleleaf silkgrass), *Heterotheca subaxillaris* (camphorweed), *Panicum virgatum* (switchgrass), *Ammophila breviligulata* (American beachgrass), *Centaurea biebersteinii* (spotted knapweed), *Artemisia campestris* (field sagewort), *Conyza canadensis* (Canadian horseweed), *Solidago sempervirens* (seaside goldenrod), *Lechea maritima* (beach pinweed), *Opuntia humifusa* (devil's-tongue), *Polygonella articulata* (coastal jointweed), *Artemisia vulgaris* (common wormwood), *Cyperus grayi* (Gray's flatsedge), *Artemisia campestris* (field sagewort), and many others that occur in a mosaic with shifting dominance. Shrubs and stunted trees may be scattered throughout and include *Rhus copallinum* (flameleaf sumac), *Hudsonia tomentosa* (woolly beachheather), *Prunus maritima* (beach plum), *Morella pensylvanica* (northern bayberry), *Prunus serotina* (black cherry), *Rosa rugosa* (rugosa rose), *Ailanthus altissima* (tree of heaven), *Juniperus virginiana* (eastern redcedar), and *Rubus flagellaris* (northern dewberry). Vines, such as *Celastrus orbiculata* (Asian bittersweet), *Parthenocissus quinquefolia* (Virginia creeper), *Toxicodendron radicans* (eastern poison ivy), *Lonicera japonica* (Japanese honeysuckle), and *Smilax rotundifolia* (roundleaf greenbrier), can be present at low abundance. The vine layer (0.5 m) has 4.7% cover and *Rubus flagellaris* (northern dewberry) and *Strophostyles helvula* (trailing fuzzybean) as the most abundant species.

Most Abundant Species:

Stratum	Lifeform	Species
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Rhus copallinum* (flameleaf sumac)
Tall shrub/sapling	Broad-leaved deciduous shrub	*Prunus serotina* (black cherry)
Herb (field)	Vine/Liana	*Celastrus orbiculata* (Asian bittersweet), *Parthenocissus quinquefolia* (Virginia creeper), *Toxicodendron radicans* (eastern poison ivy)
Herb (field)	Forb	*Heterotheca subaxillaris* (camphorweed),

Herb (field)	Graminoid	*Pityopsis falcata* (sickleleaf silkgrass) *Corynephorus canescens* (gray clubawn grass), *Schizachyrium scoparium* (little bluestem)

Characteristic Species: *Corynephorus canescens* (gray clubawn grass), *Heterotheca subaxillaris* (camphorweed), *Hudsonia tomentosa* (woolly beachheather), *Morella pensylvanica* (northern bayberry), *Pityopsis falcata* (sickleleaf silkgrass), *Prunus maritima* (beach plum), *Schizachyrium scoparium* (little bluestem).
Other Noteworthy Species: Information not available.
Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
NY	S3*	B	2	Maritime dunes	Edinger et al. 2002
NJ	.	=	1	*(Morella pensylvanica)/Schizachyrium littorale-Aristida tuberculosa* Shrub Herbaceous Vegetation	Walz et al. 2007

Local Range: This association occurs in the Great Kills section of the Staten Island Unit, in the Sandy Hook Unit, and in all of the sections of the Jamaica Bay Unit.
Classification Comments: There are two expressions of this type at Gateway: native (stable dune) and nonnative (*Corynephorus*-dominated "dune old field"). It can come in after clearing maritime shrublands or after other forms of disturbance. Good examples of stabilized old dune (a natural expression of this type) can be seen in the western half of Fort Tilden. The association can be found in a mosaic with and in a similar landscape setting as Northern Beach Heather Dune Shrubland (CEGL006143), which has similar associated species.
Other Comments: None.
Local Description Authors: G. J. Edinger and A. L. Feldmann.
Plots: 1v, 1w, 1y, 2u, 4ah, 4k, 4o, 4y, 5ad, 5n, 8ad, 8YY, 10YY, 18XX, 19YY, 23YY, 55XX, 84, 87, 89YY, 95, 98YY, 100YY, 101YY, 102, 102a, 104XX, 114YY, 115, 117YY, 118XX, 141YY, 142YY, 145YY, 147, 148XX, 285, ref, ref2, ref2, ref7.
Gateway National Recreation Area Inventory Notes: Information not available.

GLOBAL INFORMATION

NVC CLASSIFICATION

Physiognomic Class	Herbaceous Vegetation (V)
Physiognomic Subclass	Perennial graminoid vegetation (V.A.)
Physiognomic Group	Temperate or subpolar grassland with a sparse shrub layer (V.A.7.)
Physiognomic Subgroup	Natural/Semi-natural temperate or subpolar grassland with a sparse shrub layer (V.A.7.N.)
Formation	Medium-tall temperate or subpolar grassland with a sparse cold-deciduous shrub layer (V.A.7.N.g.)
Alliance	*Schizachyrium littorale* Shrub Herbaceous Alliance (A.1533)
Alliance (English name)	Seaside Bluestem Shrub Herbaceous Alliance
Association	*(Morella pensylvanica) / Schizachyrium littorale - Aristida tuberculosa* Shrub Herbaceous Vegetation
Association (English name)	(Northern Bayberry) / Seaside Bluestem - Seabeach Three-awn Shrub Herbaceous Vegetation
Ecological System(s):	Information not available.

GLOBAL DESCRIPTION

Concept Summary: This association comprises diverse grasslands of stabilized interdunes and backdunes along the north Atlantic coast. It occurs on deep stabilized sands within the influence of offshore winds and salt spray. The vegetation is variable but generally dominated by bunch grasses and forbs. Common species include *Aristida tuberculosa* (seaside threeawn), *Schizachyrium littorale* (shore little bluestem), *Artemisia campestris* ssp. *caudata* (field sagewort), *Lechea maritima* (beach pinweed), *Toxicodendron radicans* (eastern poison ivy), *Cenchrus tribuloides* (sanddune sandbur), *Polygonella articulata* (coastal jointweed), *Solidago sempervirens* (seaside goldenrod), *Liatris scariosa var. novae-angliae* (New England blazing star), *Eragrostis spectabilis* (purple lovegrass), *Opuntia humifusa* (devil's-tongue), *Spartina patens* (saltmeadow cordgrass), *Cirsium horridulum* (yellow thistle), *Pityopsis falcata* (sickleleaf silkgrass), *Lathyrus japonicus* (beach pea), *Cyperus grayi* (Gray's flatsedge), *Carex silicea* (beach sedge), *Oenothera parviflora* (northern evening-primrose), *Triplasis purpurea* (purple sandgrass), *Trichostema dichotomum* (forked bluecurls), and others. On Cape Cod, *Deschampsia flexuosa* (wavy hairgrass) is characteristic. *Hudsonia tomentosa* (woolly beachheather) and *Ammophila breviligulata* (American beachgrass) may occur with very low cover. Shrubs and stunted trees may be scattered throughout, including *Morella pensylvanica* (northern bayberry), *Prunus maritima* (beach plum), *Pinus rigida* (pitch pine), and *Juniperus virginiana* (eastern redcedar).

Environmental Description: This community occurs on deep stabilized sands of old leveled interdunes and backdunes. It usually occurs within the influence of offshore winds and salt spray.

Vegetation Description: This grassland is dominated by bunch grasses and forbs that occur in a mosaic with variable dominance. Common species include *Aristida tuberculosa* (seaside threeawn), *Schizachyrium littorale* (shore little bluestem), *Artemisia campestris* ssp. *caudata* (field sagewort), *Lechea maritima* (beach pinweed), *Toxicodendron radicans* (eastern poison ivy), *Cenchrus tribuloides* (sanddune sandbur), *Polygonella articulata* (coastal jointweed), *Solidago sempervirens* (seaside goldenrod), *Liatris scariosa var. novae-angliae* (New England blazing star), *Eragrostis spectabilis* (purple lovegrass), *Opuntia humifusa* (devil's-tongue), *Spartina patens* (saltmeadow cordgrass), *Cirsium horridulum* (yellow thistle), *Pityopsis falcata* (sickleleaf silkgrass), *Lathyrus japonicus* (beach pea), *Cyperus grayi* (Gray's flatsedge), *Carex silicea* (beach sedge), *Oenothera parviflora* (northern evening-primrose), *Triplasis purpurea* (purple sandgrass), *Trichostema dichotomum* (forked bluecurls), and others. On Cape Cod, *Deschampsia flexuosa* (wavy hairgrass) is characteristic. *Hudsonia tomentosa* (woolly beachheather) and *Ammophila breviligulata* (American beachgrass) may occur with very low cover. Shrubs and stunted trees may be scattered throughout, including *Morella pensylvanica* (northern bayberry), *Prunus maritima* (beach plum), *Pinus rigida* (pitch pine), and *Juniperus virginiana* (eastern redcedar).

Most Abundant Species:

Stratum	Lifeform	Species
Herb (field)	Forb	*Artemisia campestris* ssp. *caudata* (field sagewort)
Herb (field)	Graminoid	*Aristida tuberculosa* (seaside threeawn), *Schizachyrium littorale* (shore little bluestem)

Characteristic Species: *Aristida tuberculosa* (seaside threeawn), *Schizachyrium littorale* (shore little bluestem)

Other Noteworthy Species:

Species	GRank	Type	Note
Liatris scariosa var. novae-angliae (New England blazing star)	G5?T3	plant	

USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: This community occurs along the north Atlantic coast from New York to Massachusetts and possibly to Maine.
States/Provinces: CT, MA, ME?, NJ, NY.
Federal Lands: NPS (Cape Cod, Gateway); USFWS (Parker River).

CONSERVATION STATUS

Rank: GNR (6-May-2002).
Reasons: Information not available.

CLASSIFICATION INFORMATION

Status: Standard.
Confidence: 2 - Moderate.
Comments: Information not available.
Similar Associations:
Morella (pensylvanica, cerifera) / Schizachyrium littorale - Eupatorium hyssopifolium Shrub Herbaceous Vegetation (CEGL004240).
Related Concepts:
Interdune (McDonnell 1979) ?

SOURCES

Description Authors: S. L. Neid.
References: Eastern Ecology Working Group n.d., Edinger et al. 2002, Gwilliam unpubl. data 1998, McDonnell 1979, Metzler and Barrett 2001, NRCS 2001b, Reschke 1990, Swain and Kearsley 2000.



Figure E28. North Atlantic Coast Backdune Grassland in Gateway National Recreation Area, Jamaica Bay Unit (Accuracy Assessment Point Ref2, photo no. 1283b). 9/13/2006. NAD 1983 / UTM easting 592487, northing 4490118.

COMMON NAME (PARK-SPECIFIC): JAPANESE KNOTWEED GRAVELBAR

SYNONYMS

NVC English Name: **Japanese Knotweed Temporarily Flooded Herbaceous Vegetation**
NVC Scientific Name: ***Polygonum cuspidatum* Temporarily Flooded Herbaceous Vegetation**
NVC Identifier: **CEGL008472**

LOCAL INFORMATION

Environmental Description: This association occurs in disturbed areas that are temporarily flooded. Sediments are Greenbelt loam, formed in loamy fill, and Bigapple coarse sand, formed in sandy dredge fill (NRCS 2001b).
Vegetation Description: This association consists primarily of a monospecific stand of *Polygonum cuspidatum* (Japanese knotweed). *Artemisia vulgaris* (common wormwood) and *Ampelopsis brevipedunculata* (Amur peppervine) are occasional associates.
Most Abundant Species:

Stratum	Lifeform	Species
Herb (field)	Vine/Liana	*Ampelopsis brevipedunculata* (Amur peppervine)
Herb (field)	Forb	*Polygonum cuspidatum* (Japanese knotweed)

Characteristic Species: *Polygonum cuspidatum* (Japanese knotweed).
Other Noteworthy Species: Information not available.
Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
NY	S5*	B	1	Shallow emergent marsh	Edinger et al. 2002
NJ	.	=	1	*Polygonum cuspidatum* Temporarily Flooded Herbaceous Vegetation	Walz et al. 2007

Local Range: This association is found in the Sandy Hook Unit and in the Fort Wadsworth section of the Staten Island Unit.
Classification Comments: None.
Other Comments: None.
Local Description Authors: G. J. Edinger and A. L. Feldmann.
Plots: 81, 168YY.
Gateway National Recreation Area Inventory Notes: Information not available.

GLOBAL INFORMATION

NVC CLASSIFICATION

Physiognomic Class	Herbaceous Vegetation (V)
Physiognomic Subclass	Perennial forb vegetation (V.B.)
Physiognomic Group	Temperate or subpolar perennial forb vegetation (V.B.2.)
Physiognomic Subgroup	Natural/Semi-natural temperate or subpolar perennial forb vegetation (V.B.2.N.)
Formation	Temporarily flooded temperate perennial forb vegetation (V.B.2.N.d.)
Alliance	*Polygonum cuspidatum* Temporarily Flooded Herbaceous Alliance (A.2005)

Alliance (English name)	Japanese Knotweed Temporarily Flooded Herbaceous Alliance
Association	*Polygonum cuspidatum* Temporarily Flooded Herbaceous Vegetation
Association (English name)	Japanese Knotweed Temporarily Flooded Herbaceous Vegetation
Ecological System(s):	Information not available.

GLOBAL DESCRIPTION

Concept Summary: Examples of this vegetation type are significant (monocultural) stands of the exotic forb *Polygonum cuspidatum* (Japanese knotweed), which are found in temporarily flooded habitats such as scour bars. These disturbed habitats flood very frequently and have lots of light and rocky or sandy soil. Stands of this vegetation may be dense and shrubby, or somewhat more open. Species diversity is low, as the patches of *Polygonum* (knotweed) shade out other plant species. This vegetation ranges across the Southeast north at least to Pennsylvania and New Jersey. In North Carolina, this vegetation is found on scour bars and low rocky banks of the Nolichucky and French Broad rivers. In Kentucky, *Polygonum cuspidatum* (Japanese knotweed) is found primarily along disturbed riverbanks and bars mostly in the Cumberland Plateau and Cumberland Mountains where it can form pure, dense stands.

Environmental Description: Stands of this type are found in temporarily flooded habitats such as scour bars. These disturbed areas flood very frequently and have lots of light and rocky or sandy soil. In North Carolina, it is found on scour bars and low rocky banks of the Nolichucky and French Broad rivers (B. Brown pers. comm. 2001). In Kentucky, *Polygonum cuspidatum* (Japanese knotweed) is found primarily along disturbed riverbanks and bars mostly in the Cumberland Plateau and Cumberland Mountains where it can form pure, dense stands (M. Evans pers. comm. 2001).

Vegetation Description: These are primarily monospecific stands of *Polygonum cuspidatum* (Japanese knotweed) with few other plant species. Some disturbance-oriented forbs may be present, such as *Impatiens* (touch-me-not) spp., *Phalaris arundinacea* (reed canarygrass), *Leersia virginica* (whitegrass), *Polygonum hydropiper* (marshpepper knotweed), *Polygonum hydropiperoides* (swamp smartweed), *Polygonum persicaria* (spotted ladysthumb), and *Boehmeria cylindrica* (smallspike false nettle), along with seedlings of some woody plants (e.g., *Platanus occidentalis* (American sycamore), *Salix nigra* (black willow)). The invasive exotic herbs *Alliaria petiolata* (garlic mustard) and *Microstegium vimineum* (Nepalese browntop) may be present.

Most Abundant Species:

Stratum	Lifeform	Species
Herb (field)	Forb	*Polygonum cuspidatum* (Japanese knotweed)

Characteristic Species: *Polygonum cuspidatum* (Japanese knotweed).

Other Noteworthy Species: Information not available.

USFWS Wetland System: Palustrine.

DISTRIBUTION

Range: This vegetation is potentially found anywhere in the southeastern and mid-Atlantic United States where the exotic rhizomatous forb *Polygonum cuspidatum* (Japanese knotweed) has formed significant (monocultural) stands. This includes at least Alabama, Georgia, Kentucky, Maryland, New Jersey, North Carolina, Pennsylvania, South Carolina, Tennessee, and Virginia.

States/Provinces: AL, GA, KY, NC, NJ, NY, PA, SC, TN, VA.

Federal Lands: NPS (Allegheny Portage Railroad, Delaware Water Gap, Gateway, Upper Delaware); USFS (Cherokee?, Daniel Boone).

CONSERVATION STATUS
Rank: GNA (invasive) (31-May-2001).
Reasons: This vegetation is composed of and dominated by a species which is not native to North America.

CLASSIFICATION INFORMATION
Status: Standard.
Confidence: 1 - Strong
Comments: This species has also been treated as *Reynoutria japonica*.
Similar Associations: Information not available.
Related Concepts: Information not available.

SOURCES
Description Authors: M. Pyne, mod. S. C. Gawler.
References: Brown pers. comm., M. Evans pers. comm., NRCS 2001b, Schafale pers. comm., Schotz pers. comm., Southeastern Ecology Working Group n.d., TDNH unpubl. data, TNC and WPC 2004, WPC and TNC 2002.



Figure E29. Japanese Knotweed Gravelbar in Gateway National Recreation Area, Sandy Hook Unit (Accuracy Assessment Point 168YY, photo no. 1387). 9/28/2006. NAD 1983 / UTM easting 585437, northing 4476562.

COMMON NAME (PARK-SPECIFIC): MIXED FORB MARSH

SYNONYMS

NVC English Name: **Nodding Beggarticks - Swamp Verbena - Smartweed species Herbaceous Vegetation**

NVC Scientific Name: ***Bidens cernua - Verbena hastata - Polygonum* spp. Herbaceous Vegetation**

NVC Identifier: **CEGL006446**

LOCAL INFORMATION

Environmental Description: The hydrology of this marsh is closely linked to that of East Pond, whose water levels are artificially maintained. The marsh is completely surrounded by Early-Successional Woodland/Forest (CEGL006303) with dense associated *Phragmites australis* (common reed). Substrate is frequently ponded Jamaica gravelly sand (NRCS 2001b).

Vegetation Description: This marsh association is dominated by *Eupatorium maculatum* (spotted joepyeweed) (FNA Editorial Committee 2006) with a mix of herbs that include *Schoenoplectus americanus* (chairmaker's bulrush), *Carex vulpinoidea* (fox sedge), *Eupatorium perfoliatum* (common boneset), *Poa trivialis* (rough bluegrass), *Asclepias incarnata* (swamp milkweed), *Spartina patens* (saltmeadow cordgrass), *Onoclea sensibilis* (sensitive fern), *Lycopus uniflorus* (northern bugleweed), *Juncus gerardii* (saltmeadow rush), *Solidago rugosa* (wrinkleleaf goldenrod), *Cyperus strigosus* (strawcolored flatsedge), *Verbena hastata* (swamp verbena), and *Panicum virgatum* (switchgrass). Extremely scattered low-shrub species, including *Baccharis halimifolia* (eastern baccharis), *Rubus flagellaris* (northern dewberry), and *Rubus allegheniensis* (Allegheny blackberry), can occur at low frequency and abundance. *Toxicodendron radicans* (eastern poison ivy) is a common vine associate.

Most Abundant Species:

Stratum	Lifeform	Species
Herb (field)	Vine/Liana	*Toxicodendron radicans* (eastern poison ivy)
Herb (field)	Forb	*Eupatorium maculatum* (spotted joepyeweed)

Characteristic Species: *Carex vulpinoidea* (fox sedge), *Eupatorium maculatum* (spotted joepyeweed), *Eupatorium perfoliatum* (common boneset), *Poa trivialis* (rough bluegrass), *Schoenoplectus americanus* (chairmaker's bulrush), *Toxicodendron radicans* (eastern poison ivy).

Other Noteworthy Species: Information not available.

Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
NY	S5*	B	1	Shallow emergent marsh	Edinger et al. 2002
NJ	.	=	1	*Bidens cernua-Verbena hastata-Polygonum* spp. Herbaceous Vegetation [Provisional]	Walz et al. 2007

Local Range: This association occurs adjacent to East Pond in the Jamaica Bay Wildlife Refuge section of the Jamaica Bay Unit.

Classification Comments: None.

Other Comments: None.

Local Description Authors: G. J. Edinger and A. L. Feldmann.

Plots: ref2.

Gateway National Recreation Area Inventory Notes: Information not available.

GLOBAL INFORMATION

NVC CLASSIFICATION

Physiognomic Class	Herbaceous Vegetation (V)
Physiognomic Subclass	Perennial forb vegetation (V.B.)
Physiognomic Group	Temperate or subpolar perennial forb vegetation (V.B.2.)
Physiognomic Subgroup	Natural/Semi-natural temperate or subpolar perennial forb vegetation (V.B.2.N.)
Formation	Semipermanently flooded temperate perennial forb vegetation (V.B.2.N.e.)
Alliance	*Pontederia cordata - Peltandra virginica* Semipermanently Flooded Herbaceous Alliance (A.1669)
Alliance (English name)	Pickerelweed - Green Arrow-arum Semipermanently Flooded Herbaceous Alliance
Association	*Bidens cernua - Verbena hastata - Polygonum* spp. Herbaceous Vegetation
Association (English name)	Nodding Beggarticks - Swamp Verbena - Smartweed species Herbaceous Vegetation
Ecological System(s):	Laurentian-Acadian Freshwater Marsh (CES201.594).

GLOBAL DESCRIPTION

Concept Summary: This variable wetland type occurs in depressions, drainages, and basins that contain ponded water throughout the year. In general, water flow out of the sites is restricted, either due to naturally occurring depressions or from beaver activity, roads, or berms. The vegetation is dominated by species that are tolerant of standing water, and species composition is extremely variable among sites. Common species may include *Eleocharis acicularis* (needle spikerush), *Verbena hastata* (swamp verbena), *Bidens cernua* (nodding beggarticks), *Eupatorium maculatum* (spotted joepyeweed), *Leersia oryzoides* (rice cutgrass), *Polygonum hydropiper* (marshpepper knotweed), *Polygonum sagittatum* (arrowleaf tearthumb), *Equisetum arvense* (field horsetail), *Symphyotrichum novae-angliae* (New England aster), *Schoenoplectus americanus* (chairmaker's bulrush), *Carex stipata* (owlfruit sedge), *Carex vulpinoidea* (fox sedge), *Eupatorium perfoliatum* (common boneset), *Poa trivialis* (rough bluegrass), *Ludwigia palustris* (marsh seedbox), and/ or *Toxicodendron radicans* (eastern poison ivy).

Environmental Description: This variable wetland type occurs in depressions, drainages, and basins that contain ponded water throughout the year. Water flow out of the sites is typically restricted, either due to naturally occurring depressions or from beaver activity, roads, or berms. The vegetation is often restricted to the edges of the basins, with open water remaining in the center. These wetlands typically occur on very poorly drained soils such as mucky silt loam, shallow mucky peat, and, less occasionally, on ponded gravelly sand.

Vegetation Description: This herbaceous-dominated association contains standing water for most or all of the year and is often associated with impounded drainages, ponded areas near streams, or saturated areas surrounding drainages. The vegetation is dominated by species that are tolerant of standing water, and species composition is extremely variable among sites. Common species include *Eleocharis acicularis* (needle spikerush), *Verbena hastata* (swamp verbena), *Bidens cernua* (nodding beggartick), *Eupatorium maculatum* (spotted joepyeweed), *Leersia oryzoides* (rice cutgrass), *Polygonum hydropiper* (marshpepper knotweed), *Polygonum*

sagittatum (arrowleaf tearthumb), *Equisetum arvense* (field horsetail), *Symphyotrichum novae-angliae* (New England aster), *Schoenoplectus americanus* (chairmaker's bulrush), *Carex stipata* (owlfruit sedge), *Carex vulpinoidea* (fox sedge), *Eupatorium perfoliatum* (common boneset), *Poa trivialis* (rough bluegrass), *Ludwigia palustris* (marsh seedbox), and/ or *Toxicodendron radicans* (eastern poison ivy).

Most Abundant Species:

Stratum	Lifeform	Species
Herb (field)	Forb	*Bidens cernua* (nodding beggartick), *Polygonum hydropiper* (marshpepper knotweed), *Verbena hastata* (swamp verbena)

Characteristic Species: *Bidens cernua* (nodding beggartick), *Eupatorium maculatum* (spotted joepyeweed), *Polygonum hydropiper* (marshpepper knotweed), *Toxicodendron radicans* (eastern poison ivy), *Verbena hastata* (swamp verbena).

Other Noteworthy Species: Information not available.

USFWS Wetland System: Palustrine.

DISTRIBUTION

Range: This community is described from Pennsylvania and New Jersey and probably ranges northward.

States/Provinces: CT?, MA?, NJ, NY, PA, RI?, VT?

Federal Lands: NPS (Delaware Water Gap, Gateway, Saratoga, Upper Delaware).

CONSERVATION STATUS

Rank: GNR (7-Feb-2006).

Reasons: Better data on this community are needed in order to assign a conservation rank to it.

CLASSIFICATION INFORMATION

Status: Nonstandard.

Confidence: 3 - Weak.

Comments: Information not available.

Similar Associations: Information not available.

Related Concepts: Information not available.

SOURCES

Description Authors: S. C. Gawler, mod. E. Largay.

References: Eastern Ecology Working Group n.d., FNA Editorial Committee 2006c, Fike 1999, NRCS 2001b, NRCS 2004.



Figure E30. Mixed Forb Marsh in Gateway National Recreation Area, Jamaica Bay Unit (Accuracy Assessment Point Ref2, photo no. 1167). 8/17/2006. NAD 1983 / UTM easting 599596, northing 4497299.

COMMON NAME (PARK-SPECIFIC): SALT PANNE (SALICORNIA TYPE)

SYNONYMS

NVC English Name: **(Virginia Glasswort, Dwarf Glasswort, Sea Saltwort) - Saltmarsh Cordgrass Herbaceous Vegetation**

NVC Scientific Name: ***Salicornia (virginica, bigelovii, maritima) - Spartina alterniflora* Herbaceous Vegetation**

NVC Identifier: **CEGL004308**

LOCAL INFORMATION

Environmental Description: This association consists of shallow, hypersaline depressions often within or at the margins of North Atlantic Low Salt Marsh (CEGL004192), North Atlantic High Salt Marsh (CEGL006006), or North Atlantic Upper Ocean Beach (CEGL004400). Sediments are frequently flooded, poorly drained mucky fine sandy loam, mucky peat, gravelly coarse sand, and fine sand. Soils were formed in sandy dredge fill, eolian and marine sediments, and deep sandy sediments in the Sandyhook, Matunuck, Hooksan, Bigapple, and Jamaica series (NRCS 2001b).

Vegetation Description: This association consists of shallow, hypersaline depressions often within low salt marsh or at its upper margin. Dominant species are *Salicornia maritima* (slender grasswort), *Salicornia bigelovii* (dwarf saltwort), and *Suaeda maritima* (herbaceous seepweed) with *Spartina alterniflora* (smooth cordgrass) (short form), *Limonium carolinianum* (Carolina sealavender), *Spergularia salina* (salt sandspurry), *Spartina patens* (saltmeadow cordgrass) and *Distichlis spicata* (inland saltgrass). *Ulva lactuca* (sea-lettuce) is often matted on the surface, and occasionally individual *Iva frutescens* (Jesuit's bark) shrubs will colonize from the edge.

Most Abundant Species:

Stratum	Lifeform	Species
Short shrub/sapling	Broad-leaved deciduous shrub	*Iva frutescens* (Jesuit's bark)
Herb (field)	Forb	*Salicornia bigelovii* (dwarf saltwort), *Salicornia maritima* (slender grasswort), *Suaeda maritima* (herbaceous seepweed)
Herb (field)	Graminoid	*Spartina alterniflora* (smooth cordgrass)

Characteristic Species: *Limonium carolinianum* (Carolina sealavender), *Salicornia bigelovii* (dwarf saltwort), *Salicornia maritima* (slender grasswort), *Spartina alterniflora* (smooth cordgrass), *Suaeda maritima* (herbaceous seepweed)

Other Noteworthy Species: Information not available.

Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
NY	S3*	B	1	Salt panne	Edinger et al. 2002
NJ	S3S4	=	1	*Sarcocornia perennis-Salicornia* spp.-*Spartina alterniflora* Dwarf-shrubland	Breden et al. 2001

Local Range: This association occurs in the Sandy Hook Unit and in the Floyd Bennett Field, Canarsie Pier, Jamaica Bay Wildlife Refuge, Breezy Point, and Fort Tilden subsections of the Jamaica Bay Unit.

Classification Comments: None.

Other Comments: None.

Local Description Authors: G. J. Edinger and A. L. Feldmann.

Plots: 2p, 3aa, 7f, 11n, ref1.

Gateway National Recreation Area Inventory Notes: Information not available.

GLOBAL INFORMATION

NVC CLASSIFICATION

Physiognomic Class	Herbaceous Vegetation (V)
Physiognomic Subclass	Perennial forb vegetation (V.B.)
Physiognomic Group	Temperate or subpolar perennial forb vegetation (V.B.2.)
Physiognomic Subgroup	Natural/Semi-natural temperate or subpolar perennial forb vegetation (V.B.2.N.)
Formation	Tidal temperate perennial forb vegetation (V.B.2.N.g.)
Alliance	*Sarcocornia perennis - (Distichlis spicata, Salicornia* spp.) Tidal Herbaceous Alliance (A.1704)
Alliance (English name)	Woody Glasswort - (Saltgrass, Saltwort species) Tidal Herbaceous Alliance
Association	*Salicornia (virginica, bigelovii, maritima) - Spartina alterniflora* Herbaceous Vegetation
Association (English name)	(Virginia Glasswort, Dwarf Glasswort, Sea Saltwort) - Saltmarsh Cordgrass Herbaceous Vegetation
Ecological System(s):	Atlantic Coastal Plain Embayed Region Tidal Salt and Brackish Marsh (CES203.260). Northern Atlantic Coastal Plain Tidal Salt Marsh (CES203.519). Central Atlantic Coastal Plain Salt and Brackish Tidal Marsh (CES203.270). Acadian Coastal Salt Marsh (CES201.578).

GLOBAL DESCRIPTION

Concept Summary: This association represents tidally flooded hypersaline flats or very shallow depressions (pannes) dominated by halophytic herbs, including *Salicornia virginica* (Virginia glasswort), *Salicornia bigelovii* (dwarf saltwort), *Salicornia maritima* (slender grasswort), and stunted *Spartina alterniflora* (smooth cordgrass), that occur in salt marshes of the Atlantic Coast. Vegetation of this association tends to develop in shallow depressions within high or salt marshes where drainage is poor. The depressions are regularly to irregularly flooded by high tides, but as the water evaporates during low tide, the salinity concentration increases forming "salt pannes." Formation of the pannes may result from ice-scouring, rafting flotsam, peat compaction, mosquito ditch levees, or erosion of tidal creek banks, which create small, sparsely vegetated to unvegetated impoundments. Bare peat and/or mucky soils are prevalent (up to 85% bare soils). Total vegetative cover is variable in pannes, from near total absence of vascular plants to a dense cover of *Salicornia virginica* (Virginia glasswort), *Salicornia bigelovii* (dwarf saltwort), *Salicornia maritima* (slender grasswort), *Sarcocornia perennis* (chickenclaws), or *Spartina alterniflora* (smooth cordgrass) (short form). Common associates include *Limonium carolinianum* (Carolina sealavender), *Plantago maritima var. juncoides* (goose tongue), *Triglochin maritima* (seaside arrowgrass), *Spartina patens* (saltmeadow cordgrass), *Suaeda maritima* (herbaceous seepweed), and *Atriplex* (saltbush) spp. Algal mats are characteristically present, visible even in densely vegetated pannes. Blue-green algae are an important component of these mats, in some cases contributing significantly more biomass to the community than do

vascular species. Diagnostic species include *Salicornia bigelovii* (dwarf saltwort) and *Salicornia virginica* (Virginia glasswort).

Environmental Description: Vegetation of this association tends to develop in shallow depressions in salt marshes where drainage is poor. They tend to occur more frequently on the high marsh but occur within low marsh as well. Pannes form in depressions that range from 2-30 cm lower than the elevation of the marsh. The depressions are regularly to irregularly flooded by tides, and as the water evaporates during low tide, the salinity concentration increases forming "salt pannes." Substrate is soft, silty muck or peat of variable density.

Vegetation Description: This association includes tidally flooded hypersaline flats or very shallow depressions (pannes) dominated by halophytic herbs. Total vegetative cover is quite variable in pannes, from near total absence of vascular plants to a dense cover of *Salicornia virginica* (Virginia glasswort), *Salicornia bigelovii* (dwarf saltwort), *Salicornia maritima* (slender grasswort), *Sarcocornia perennis* (chickenclaws), or *Spartina alterniflora* (smooth cordgrass) (short form). Common associates include *Limonium carolinianum* (Carolina sealavender), *Plantago maritima var. juncoides* (goose tongue), *Triglochin maritima* (seaside arrowgrass), *Spartina patens* (saltmeadow cordgrass), *Suaeda maritima* (herbaceous seepweed), and *Atriplex* (saltbush) spp. Algal mats are characteristically present, visible even in densely vegetated pannes. Blue-green algae are an important component of these mats, in some cases contributing significantly more biomass to the community than do vascular species. The following algae were noted to occur in association with *Spartina alterniflora* (smooth cordgrass) in the littoral zone of a Massachusetts salt marsh: *Oscillatoria subuliformis, Oscillatoria amphibia, Lyngbea* spp., *Microcoleus chthonoplastes, Nodularia harveyana, Hydrocoleum lyngbyaceum*, and *Symploca* spp. (Webber 1967).

Most Abundant Species:

Stratum	Lifeform	Species
Herb (field)	Semi-shrub	*Salicornia virginica* (Virginia glasswort), *Sarcocornia perennis* (chickenclaws)
Herb (field)	Forb	*Salicornia bigelovii* (dwarf saltwort)
Herb (field)	Graminoid	*Spartina alterniflora* (smooth cordgrass)

Characteristic Species: *Salicornia bigelovii* (dwarf saltwort), *Salicornia virginica* (Virginia glasswort), *Sarcocornia perennis* (chickenclaws).

Other Noteworthy Species: Information not available.

USFWS Wetland System: Estuarine.

DISTRIBUTION

Range: This association occurs along the Mid- and North Atlantic Coast from the Canadian maritime provinces south to North Carolina.

States/Provinces: CT, DE:S3, MA, MD, ME, NB, NC, NH, NJ:S3S4, NS, NY, RI, SC?, VA.

Federal Lands: NPS (Assateague Island, Boston Harbor Islands, Cape Cod, Fire Island, Gateway); USFWS (Parker River, Prime Hook).

CONSERVATION STATUS

Rank: G5 (1-Dec-1997).

Reasons: Information not available.

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 2 - Moderate.

Comments: This community occurs in coastal salt marshes from Nova Scotia to the Carolinas, north of the range of *Batis maritima* (turtleweed). Salt pannes can potentially be classified based on morphology, salinity gradients, or substrate (Godfrey et al. 1978), which may elucidate further variation.

Similar Associations:

Batis maritima - Sarcocornia perennis Dwarf-shrubland (CEGL003956).
Sarcocornia perennis - (Batis maritima, Distichlis spicata) Dwarf-shrubland (CEGL002278).
Spartina alterniflora - Distichlis spicata Tidal Herbaceous Vegetation [Provisional] (CEGL006586).

Related Concepts:

Salicornia - Bassia salt flat (Harvill 1965) =
Salicornia europaea - Spartina alterniflora community (Metzler and Barrett 1992) =
Salicornia tidal flat (Clovis 1968) =
Salicornietum ambiguae (Conard 1935) =
Sarcocornia perennis - (Distichlis spicata, Spartina alterniflora) Dwarf-shrubland (Bartgis 1986) =
Spartina alterniflora / Salicornia europaea community (Clancy 1993b) =
Pan (Nichols 1920) =
Panne (Good 1965) =
Panne marsh (Baumann 1978b) =
Pans (Hill 1986) =
Pans (Higgins et al. 1971) =
Salt Flat (Schafale 2000) =
Salt Marsh (Rawinski 1984) ?
Salt marsh complex, pannes (Breden 1989) =
Salt pan (Klotz 1986) =
Salt panne (Clancy 1993b) =
Salt panne (Reschke 1990) =
Salt panne (Miller and Egler 1950) =
Stunted *Spartina alterniflora* community (Miller and Egler 1950) =

SOURCES

Description Authors: S. L. Neid.

References: Bartgis 1986, Baumann 1978b, Bell et al. 2002, Berdine 1998, Bertness et al. 1992, Bowman 2000, Breden 1989, Breden et al. 2001, Clancy 1993b, Clancy 1996, Clovis 1968, Conard 1935, Dowhan and Rozsa 1989, Eastern Ecology Working Group n.d., Edinger et al. 2002, Enser 1999, Fleming 2001, Fleming et al. 2001, Gawler 2001, Gawler 2002, Godfrey et al. 1978, Good 1965, Harrison 2004, Harvill 1965, Higgins et al. 1971, Hill 1986, Klotz 1986, Metzler and Barrett 1992, Metzler and Barrett 2001, Miller and Egler 1950, NRCS 2001b, Nichols 1920, Niering and Warren 1980, Peet et al. unpubl. data 2002, Rawinski 1984, Redfield 1972, Reschke 1990, Schafale 2000, Schafale and Weakley 1990, Sperduto 2000b, Swain and Kearsley 2001, VDNH 2003, Webber 1967.



Figure E31a. Salt Panne (Salicornia Type) in Gateway National Recreation Area, Jamaica Bay Unit (plot GATE.132, NYNHP plot 7f). 7/17/2003. NAD 1983 / UTM easting 598110, northing 4494376.



Figure E31b. Salt Panne (Salicornia Type) in Gateway National Recreation Area, Jamaica Bay Unit (Accuracy Assessment Point Ref1, photo no. 1164). 8/16/2006. NAD 1983 / UTM easting 599086, northing 4497603.

COMMON NAME (PARK-SPECIFIC): NORTH ATLANTIC UPPER OCEAN BEACH

SYNONYMS
NVC English Name: **Sea-rocket - Northern Seaside Spurge Sparse Vegetation**
NVC Scientific Name: ***Cakile edentula* ssp. *edentula* - *Chamaesyce polygonifolia* Sparse Vegetation**
NVC Identifier: **CEGL004400**

LOCAL INFORMATION

Environmental Description: This association occurs on unstable sands just above mean high tide on beaches and foredunes washed over by spring and storm tides and impacted by wind erosion.

Vegetation Description: This maritime beach association is sparsely vegetated and characterized by *Cakile edentula* (American searocket). Typical associated but infrequent species are *Salsola kali* (Russian thistle), *Chamaesyce polygonifolia* (seaside sandmat), *Xanthium strumarium* (rough cockleburr), *Atriplex patula* (spear saltbush), *Cycloloma atriplicifolium* (winged pigweed), *Suaeda maritima* (herbaceous seepweed), *Polygonella articulata* (coastal jointweed), *Triplasis purpurea* (purple sandgrass), and *Chenopodium album* (lambsquarters). Species from the surrounding maritime dunes, such as *Ammophila breviligulata* (American beachgrass), *Solidago sempervirens* (seaside goldenrod), *Spartina patens* (saltmeadow cordgrass), and *Heterotheca subaxillaris* (camphorweed), can occur sporadically in the upper reaches of this community, and *Spartina alterniflora* (smooth cordgrass) can colonize infrequently from adjacent low salt marsh. The marine alga *Ulva lactuca* (sea-lettuce), as well as horseshoe crab carapaces, driftwood, and other wrack, is regularly deposited. Three state-listed plants, two of which are also globally listed, occur in this community at Gateway: *Amaranthus pumilus* (seaside amaranth), *Polygonum glaucum* (seaside knotweed), and *Cenchrus tribuloides* (sanddune sandbur). The beaches at Gateway provide nesting habitat for the globally rare piping plover (*Charadrius melodus)* and the state-listed common tern (*Sterna hirundo*) and black skimmer (*Rynchops niger*).

Most Abundant Species:

Stratum	Lifeform	Species
Herb (field)	Forb	*Cakile edentula* (American searocket), *Chamaesyce polygonifolia* (seaside sandmat), *Salsola kali* (Russian thistle)

Characteristic Species: *Cakile edentula* (American searocket), *Chamaesyce polygonifolia* (seaside sandmat), *Salsola kali* (Russian thistle).

Other Noteworthy Species:

Species	GRank	Type	Note
Amaranthus pumilus (seaside amaranth)	G2	plant	State endangered plant (NY)
Cenchrus tribuloides (sanddune sandbur)	-	plant	State threatened plant (NY)
Charadrius melodus (piping plover)	G3	animal	State endangered animal (NY), US LE, US LT
Polygonum glaucum (seaside knotweed)	G3	plant	State rare plant (NY)

Rynchops niger (black skimmer)	-	animal	State special concern animal (NY)
Sterna hirundo (common tern)	-	animal	State threatened animal (NY)

Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
NY	S5*	B	1	Maritime beach	Edinger et al. 2002
NJ	S1S2	=	1	*Cakile edentula* ssp. *edentula-Chamaesyce polygonifolia* Sparse Vegetation	Breden et al. 2001

Local Range: This association is distributed across all sections of the park; it occurs in the Sandy Hook Unit, the Staten Island Unit, and the Jamaica Bay Unit.
Classification Comments: This association is characterized by a sand substrate located above the limit of mean high tide. The tidal portion of the beach, usually composed of gravel and sand, was classified as Marine intertidal sand/gravel beach (Edinger et al. 2002) and mapped as the Anderson II type "72. Beaches."
Other Comments: None.
Local Description Authors: G. J. Edinger and A. L. Feldmann.
Plots: 1ai, 2k, 3af, 9YY, 10n, 29YY, 30, 32YY, 45YY, 58XX, 63YY, 72YY, 96, 131, 181, 190, 248YY, ref, ref1.
Gateway National Recreation Area Inventory Notes: Information not available.

GLOBAL INFORMATION

NVC CLASSIFICATION

Physiognomic Class	Sparse Vegetation (VII)
Physiognomic Subclass	Unconsolidated material sparse vegetation (VII.C.)
Physiognomic Group	Sparsely vegetated sand flats (VII.C.2.)
Physiognomic Subgroup	Natural/Semi-natural sparsely vegetated sand flats (VII.C.2.N.)
Formation	Sand flats (VII.C.2.N.a.)
Alliance	*Cakile edentula* Sparsely Vegetated Alliance (A.1861)
Alliance (English name)	Sea-rocket Sparsely Vegetated Alliance
Association	*Cakile edentula* ssp. *edentula* - *Chamaesyce polygonifolia* Sparse Vegetation
Association (English name)	Sea-rocket - Northern Seaside Spurge Sparse Vegetation
Ecological System(s):	Northern Atlantic Coastal Plain Sandy Beach (CES203.301). Central Atlantic Coastal Plain Sandy Beach (CES203.064)**.**

GLOBAL DESCRIPTION

Concept Summary: This is a sparsely vegetated upper beach community occurring on unstable sands and often gravels and cobbles just above mean high tide on maritime beaches and foredunes along the middle and northern Atlantic coast. This association occurs at the wrack line; there is regular deposition of wave-deposited flotsam. They are irregularly flooded by spring or storm tides. Vegetation cover is variable, depending on the amount of exposure to wave and wind action, but is generally sparse and characterized by annuals and biennials. Species composition can change dramatically from year to year but frequently includes *Cakile edentula* ssp. *edentula* (American searocket), as well as *Salsola kali* ssp. *kali* (Russian thistle), *Chamaesyce polygonifolia* (seaside sandmat), *Honckenya peploides* (seaside sandplant),

Cenchrus tribuloides (sanddune sandbur), *Amaranthus retroflexus* (redroot amaranth), *Chenopodium album* (lambsquarters), *Erechtites hieraciifolia* (American burnweed), *Xanthium strumarium* (rough cockleburr), and *Atriplex cristata* (crested saltbush). Globally rare species such as *Polygonum glaucum* (seaside knotweed) and *Amaranthus pumilus* (seaside amaranth) occur in this habitat. Sparse *Ammophila breviligulata* (American beachgrass) can occur sporadically as a common associate, colonizing from the adjacent beachgrass community. Diagnostic species are *Cakile edentula* ssp. *edentula* (American searocket), *Salsola kali* ssp. *kali* (Russian thistle), *Atriplex cristata* (crested saltbush), and *Chamaesyce polygonifolia* (seaside sandmat). This community occurs in maritime coastal areas from southern Maine to Cape Hatteras, North Carolina.

Environmental Description: This association occurs on unstable sands and often gravels and cobbles just above mean high tide on beaches and foredunes washed over by spring and storm tides and impacted by wind erosion.

Vegetation Description: This is a sparsely vegetated association characterized by annuals and biennials. Species composition is variable, but frequently includes *Cakile edentula* ssp. *edentula* (American searocket), *Honckenya peploides* (seaside sandplant), *Salsola kali* (Russian thistle), *Atriplex patula* (spear saltbush), *Cenchrus tribuloides* (sanddune sandbur), *Chamaesyce polygonifolia* (seaside sandmat), *Atriplex cristata* (crested saltbush), *Xanthium strumarium* (rough cockleburr), and *Chenopodium* (goosefoot) spp. Globally rare species such as *Polygonum glaucum* (seaside knotweed) and *Amaranthus pumilus* (seaside amaranth) occur in this habitat. *Ammophila breviligulata* (American beachgrass) can occur sporadically, colonizing from the adjacent beachgrass community. Additional infrequent species can include *Chenopodium rubrum* (red goosefoot), *Chenopodium album* (lambsquarters), *Chenopodium berlandieri var. macrocalycium* (pitseed goosefoot), *Cyperus filicinus* (fern flatsedge), *Triplasis purpurea* (purple sandgrass), and *Sesuvium maritimum* (slender seapurslane). Bare substrate can comprise greater than 95% cover in this association.

Most Abundant Species:

Stratum	Lifeform	Species
Herb (field)	Forb	*Atriplex cristata* (crested saltbush), *Cakile edentula* ssp. *edentula* (American searocket), *Chamaesyce polygonifolia* (seaside sandmat), *Salsola kali* ssp. *kali* (Russian thistle)

Characteristic Species: *Atriplex cristata* (crested saltbush), *Cakile edentula* ssp. *edentula* (American searocket), *Chamaesyce polygonifolia* (seaside sandmat), *Salsola kali* ssp. *kali* (Russian thistle).

Other Noteworthy Species:

Species	GRank	Type	Note
Amaranthus pumilus (seaside amaranth)	G2	plant	
Polygonum glaucum (seaside knotweed)	G3	plant	

USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: This association ranges from southern Maine to North Carolina.

States/Provinces: CT, DE, MA:S3, MD, ME, NC, NH, NJ:S1S2, NY:S5, RI, VA.

Federal Lands: NPS (Assateague Island, Boston Harbor Islands, Cape Cod, Fire Island, Gateway, Sagamore Hill); USFWS (Back Bay, Chesapeake Marshlands, Monomoy, Muskeget Island, Parker River).

CONSERVATION STATUS
Rank: G4G5 (1-Dec-1997).
Reasons: Information not available.

CLASSIFICATION INFORMATION
Status: Standard.
Confidence: 2 - Moderate.
Comments: This community is common on maritime dunes of the Northeast but is vulnerable to development and shifting wave action due to jetties. J. Harrison (pers. comm. 2006): "In the Chesapeake Marshlands, in Maryland, a small patch of this vegetation was observed on South Marsh Island [see Observation Point CM-15]. Please note many of the associated "maritime" species are not present in the refuge. Although not as well-developed in estuarine environments, consider expanding concept to include narrow sandy shorelines on bay islands."
Similar Associations:
Cakile edentula Great Lakes Shore Sparse Vegetation (CEGL005162).
Cakile edentula ssp. *edentula* - *Mertensia maritima* Sparse Vegetation (CEGL006106).
Cakile edentula ssp. *harperi* Sparse Vegetation (CEGL004401).
Related Concepts:
Cakile edentula - *Chenopodium album* community (Metzler and Barrett 1992) =
Cakile edentula ssp. *edentula* - *Salsola caroliniana* Sparse Vegetation (Bartgis 1986) =
Cakiletum edentula (Conard 1935) =
Beach (Fender 1937) =
Beach (McDonnell 1979) =
Beach (Higgins et al. 1971) =
Beach community (Johnson 1985b) ?
Beach community (Hill 1986) =
Beach community (Baumann 1978b) =
Beach strand community (MENHP 1991) =
Beach vegetation (Moul 1973) =
Coastal beach strand (Sperduto 1994) =
Coastal beach strand community (Rawinski 1984) ?
Dune and swale community (Stalter 1990) B
Dune community (Jenkins 1974) =
Dune-strand area (Clovis 1968) =
Embryo dune (Klotz 1986) =
Marine intertidal gravel/sand beach community (Breden 1989) =
Marine sandy beach (Clancy 1993b) =
Maritime beach (Reschke 1990) =
Middle beach (Nichols 1920) =
Middle beach (Shreve et al. 1910) =
Pioneer beach community (Boule 1979) =
Sea-strand vegetation, beach formation (Harshberger 1900) =

SOURCES
Description Authors: S. L. Neid.
References: Bartgis 1986, Baumann 1978b, Berdine 1998, Boule 1979, Bowman 2000, Breden 1989, Breden et al. 2001, Clancy 1993b, Clovis 1968, Conard 1935, Dowhan and Rozsa 1989, Eastern Ecology Working Group n.d., Edinger et al. 2002, Enser 1999, Fender 1937, Fleming et al. 2001, Gawler 2001, Gawler 2002, Godfrey et al. 1978, Harrison 2004, Harshberger 1900, Higgins et al. 1971, Hill 1986, J. Harrison pers. comm., Jenkins 1974, Johnson 1985b, Klotz 1986, MENHP 1991, McDonnell 1979, Metzler and Barrett 1992, Metzler and Barrett 2001, Moul 1973, Nichols 1920, Rawinski 1984, Reschke 1990, Schafale and Weakley 1990, Shreve et

al. 1910, Sperduto 1994, Sperduto 2000a, Sperduto 2000b, Stalter 1990, Swain and Kearsley 2001.



Figure E32. North Atlantic Upper Ocean Beach in Gateway National Recreation Area, Jamaica Bay Unit (plot GATE.17, NYNHP plot 1ai). 10/5/2004. NAD 1983 / UTM easting 590066, northing 4490115.

COMMON NAME (PARK-SPECIFIC): NORTH ATLANTIC COAST ESTUARINE INTERTIDAL MUDFLATS

SYNONYMS
NVC English Name: **Intertidal Mudflats Sparse Vegetation**
NVC Scientific Name: **Intertidal Mudflats Sparse Vegetation**
NVC Identifier: **CEGL006614**

LOCAL INFORMATION

Environmental Description: This association occurs on saline mudflats located between the highest high tide and the lowest low tide. It is completely exposed at low tide and is tidally flooded twice daily. The substrate consists of silt and mud that is rich in organic matter and poorly drained at low tide. It is subject to moderate fluctuations in salinity and moisture and is washed by low-energy waves.
Vegetation Description: This association is characterized by almost completely unvegetated saline, silty mudflats. *Spartina alterniflora* (smooth cordgrass) can occur sporadically, colonizing from adjacent low salt marsh communities. The marine alga *Ulva lactuca* (sea-lettuce) can cover 40% or more of the exposed substrate.
Most Abundant Species:

Stratum	Lifeform	Species
Nonvascular	Alga	*Ulva lactuca* (sea-lettuce)

Characteristic Species: *Ulva lactuca* (sea-lettuce)
Other Noteworthy Species: Information not available.
Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
NY	S4	=	1	Marine intertidal mudflats	Edinger et al. 2002
NJ	.	=	1	Intertidal mudflats sparse vegetation	Walz et al. 2007

Local Range: This community occurs in the Great Kills section of the Staten Island Unit and the Floyd Bennett Field and Jamaica Bay Wildlife Refuge sections of the Jamaica Bay Unit.
Classification Comments: This type is defined by its silty mud substrate. Associations in a similar setting with a firm sand substrate are classified as marine intertidal gravel/sand beach (Anderson Level II Class: 72. Beaches) (Anderson et al. 1976).
Other Comments: None.
Local Description Authors: G. J. Edinger and A. L. Feldmann.
Plots: 4m, 116YY, 128, 129, 253.
Gateway National Recreation Area Inventory Notes: Information not available.

GLOBAL INFORMATION

NVC CLASSIFICATION

Physiognomic Class	Sparse Vegetation (VII)
Physiognomic Subclass	Unconsolidated material sparse vegetation (VII.C.)
Physiognomic Group	Sparsely vegetated soil flats (VII.C.4.)
Physiognomic Subgroup	Natural/Semi-natural sparsely vegetated soil flats (VII.C.4.N.)
Formation	Tidal mudflats (VII.C.4.N.d.)
Alliance	Estuarine Tidal Mudflat Sparsely Vegetated Alliance (A.3010)
Alliance (English name)	Estuarine Tidal Mudflat Sparsely Vegetated Alliance

Association	Intertidal Mudflats Sparse Vegetation
Association (English name)	Intertidal Mudflats Sparse Vegetation
Ecological System(s):	Information not available.

GLOBAL DESCRIPTION

Concept Summary: This is a saline (>18.0 ppt) intertidal mudflat community that typically lacks vegetation. *Ulva lactuca* (sea-lettuce) may be present or prominent. The substrate consists of silt or sand that is rich in organic matter and poorly drained at low tide. These saline intertidal mudflats extend along the North Atlantic Coast from Maine to New York.

Environmental Description: This association occurs on saline mudflats located between the highest high tide and the lowest low tide along the North Atlantic Coast. Salinity levels are greater than 18.0 parts per thousand of ocean-derived salts. They are completely exposed at low tide and are tidally flooded twice daily. The substrate consists of silt or sand that is poorly drained at low tide and rich in organic matter. These areas are subject to moderated fluctuations in salinity and moisture and are washed by low-energy waves. The substrate may be covered with algae.

Vegetation Description: This association typically does not have vegetation. However, some examples have dense cover of the green algae *Ulva lactuca* (sea-lettuce).

Most Abundant Species:

Stratum	Lifeform	Species
Floating aquatic	Alga	*Ulva lactuca* (sea-lettuce)

Characteristic Species: *Ulva lactuca* (sea-lettuce).

Other Noteworthy Species: Information not available.

USFWS Wetland System: Estuarine.

DISTRIBUTION

Range: These intertidal mudflats extend along the Atlantic Coast from Maine to New York and possibly New Jersey.

States/Provinces: CT, MA, ME, NH, NY:S4, RI.

Federal Lands: NPS (Boston Harbor Islands, Cape Cod, Gateway).

CONSERVATION STATUS

Rank: G5 (23-Mar-2007).

Reasons: This is a very common intertidal maritime community along the Atlantic Coast.

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 3 - Weak.

Comments: This type is likely covered by the marine classification; however, this mudflat community occurs in coastal vegetation mapping projects, and it seems appropriate to classify it under sparse vegetation for the time being, until the marine classification can be applied to vegetation mapping projects.

Similar Associations:

Sagittaria subulata - Limosella australis Tidal Herbaceous Vegetation (CEGL004473)--is a brackish intertidal mudflat association with salinity levels ranging from 0.5-18.0 and lacks the macroalgae component of CEGL006614.

Related Concepts: Information not available.

SOURCES

Description Authors: E. Largay and G. Edinger.

References: Anderson et al. 1976, Bell et al. 2002, Eastern Ecology Working Group n.d., Edinger et al. 2002, Enser and Lundgren 2005, MNAP 1991, Metzler and Barrett 2004, Swain and Kearsley 2001, Welsh 1980, Whitlatch 1982.



Figure E33. North Atlantic Coast Estuarine Intertidal Mudflats in Gateway National Recreation Area, Jamaica Bay Unit (Accuracy Assessment Point 128, photo no. 1359). 9/22/2006. NAD 1983 / UTM easting 598811, northing 4495952.

COMMON NAME (PARK-SPECIFIC): JAPANESE SEDGE MARITIME DUNES

SYNONYMS
NVC English Name: **Japanese Sedge Herbaceous Vegetation**
NVC Scientific Name: ***Carex kobomugi* Herbaceous Vegetation**
NVC Identifier: **CEGL006615**

LOCAL INFORMATION

Environmental Description: This association occurs on coastal sand dunes with sandy, unstable, droughty substrates 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 occurs on foredunes that receive the force of wind and salt spray, but it is generally beyond the influence of most storm tides.
Vegetation Description: This association is characterized by dominance of the nonnative *Carex kobomugi* (Japanese sedge) in association with (and outcompeting) typical maritime dune species, including *Artemisia campestris* (field sagewort), *Ammophila breviligulata* (American beachgrass), and *Solidago sempervirens* (seaside goldenrod). Additional associated herbaceous species, present at low abundance, can be *Lepidium virginicum* (Virginia pepperweed), *Artemisia campestris* (field sagewort), *Schizachyrium scoparium* (little bluestem), *Lathyrus japonicus* (beach pea), *Conyza canadensis* (Canadian horseweed), *Helianthus annuus* (common sunflower), *Opuntia humifusa* (devil's-tongue), *Oenothera biennis* (common evening-primrose), *Verbascum thapsus* (common mullein), *Eragrostis spectabilis* (purple lovegrass), *Panicum virgatum* (switchgrass), *Spartina patens* (saltmeadow cordgrass), *Xanthium strumarium* (rough cockleburr), and *Panicum amarum* (bitter panicgrass). Sparse, scattered short shrubs (1 m tall) include *Morella pensylvanica* (northern bayberry), *Prunus maritima* (beach plum), and *Rhus copallinum* (flameleaf sumac), and *Toxicodendron radicans* (eastern poison ivy) is also occasionally present.
Most Abundant Species:

Stratum	Lifeform	Species
Short shrub/sapling	Broad-leaved deciduous shrub	*Morella pensylvanica* (northern bayberry)
Herb (field)	Graminoid	*Carex kobomugi* (Japanese sedge)

Characteristic Species: *Ammophila breviligulata* (American beachgrass), *Artemisia campestris* (field sagewort), *Carex kobomugi* (Japanese sedge), *Solidago sempervirens* (seaside goldenrod)
Other Noteworthy Species: Information not available.
Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
NY	.	.	.	N/A	.
NJ	.	=	1	*Carex kobomugi* Herbaceous Vegetation	Walz et al. 2007

Local Range: This association is limited to the Sandy Hook Unit, New Jersey.
Classification Comments: None.
Other Comments: None.
Local Description Authors: G. J. Edinger and A. L. Feldmann.
Plots: 5al, 12an, 123XX, 124YY, 125XX, 126.
Gateway National Recreation Area Inventory Notes: Information not available.

GLOBAL INFORMATION

NVC CLASSIFICATION

Physiognomic Class	Herbaceous Vegetation (V)
Physiognomic Subclass	Perennial graminoid vegetation (V.A.)
Physiognomic Group	Temperate or subpolar grassland (V.A.5.)
Physiognomic Subgroup	Natural/Semi-natural temperate or subpolar grassland (V.A.5.N.)
Formation	Short sod temperate or subpolar grassland (V.A.5.N.e.)
Alliance	Park Specific - no Alliance assigned
Alliance (English name)	Park Specific-no Alliance assigned
Association	*Carex kobomugi* Herbaceous Vegetation
Association (English name)	Japanese Sedge Herbaceous Vegetation
Ecological System(s):	Information not available.

GLOBAL DESCRIPTION

Concept Summary: This semi-natural community is dominated by the nonnative sedge *Carex kobomugi* (Japanese sedge) that invades and overtakes coastal sand dunes dominated by *Ammophila breviligulata* (American beachgrass) and/or *Panicum amarum var. amarum* (bitter panicgrass). It is reported along the central New Jersey coast and at First Landing/Seashore State Park in Virginia.

Environmental Description: This association occurs on coastal sand dunes with sandy, unstable, droughty substrates 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 it is beyond the influence of most storm tides.

Vegetation Description: *Carex kobomugi* (Japanese sedge), a nonnative invasive sedge that spreads by rhizome growth, dominates the vegetation. This sedge overtakes maritime dune grasslands dominated by *Ammophila breviligulata* (American beachgrass) or *Panicum amarum var. amarum* (bitter panicgrass). Associated species in New Jersey include *Solidago sempervirens* (seaside goldenrod), *Artemisia campestris* (field sagewort), and scattered shrubs such as *Prunus maritima* (beach plum) and/or *Morella pensylvanica* (northern bayberry).

Most Abundant Species: Information not available.

Characteristic Species: Information not available.

Other Noteworthy Species: Information not available.

USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: Relatively large (>0.5 ha) occurrences of this invasive association are reported in coastal sand dunes in central New Jersey, and one mappable occurrence is reported in Virginia. *Carex kobomugi* (Japanese sedge) is also reported to the north and south along the Atlantic Coast in Massachusetts, Rhode Island, Delaware, Maryland, Virginia and North Carolina.

States/Provinces: NC, NJ, VA.

Federal Lands: NPS (Cape Hatteras, Gateway).

CONSERVATION STATUS

Rank: GNA (invasive) (15-Mar-2007).

Reasons: Nonnative invasive association not of conservation concern.

CLASSIFICATION INFORMATION

Status: Nonstandard.

Confidence: 3 - Weak.

Comments: Information not available.

Similar Associations:

Ammophila breviligulata - Panicum amarum var. *amarum* Herbaceous Vegetation (CEGL004043)--is the community *Carex kobomugi* successfully invades and overtakes in New Jersey.

Related Concepts: Information not available.

SOURCES

Description Authors: E. Largay.

References: Eastern Ecology Working Group n.d., Martin 1959a, Small 1954, Stalter 1980, Wootton et al. 2005.



Figure E34. Japanese Sedge Maritime Dunes in Gateway National Recreation Area, Sandy Hook Unit (Accuracy Assessment Point 125XX, photo no. 1183). 8/22/2006. NAD 1983 / UTM easting 584373, northing 4480954.

COMMON NAME (PARK-SPECIFIC): HARDWOOD PLANTATION

SYNONYMS
NVC English Name: **Willow Oak - London Planetree Plantation**
NVC Scientific Name: ***Quercus phellos* - *Platanus hybrida* Plantation**
NVC Identifier: **CEGL006613**

LOCAL INFORMATION

Environmental Description: This modified vegetation type has developed over outwash sand and gravel that is possibly mixed with fill material (NRCS 2001b). It is adjacent to a reed-grass marsh and a pond whose water levels are artificially maintained; it is likely that soil moisture is extremely variable throughout the year.

Vegetation Description: The somewhat open canopy (80% closure) of this hardwood plantation is strongly dominated by even-aged *Quercus phellos* (willow oak) with associated *Platanus hybrida* (London planetree) and *Acer rubrum* (red maple). *Frangula alnus* (glossy buckthorn) is abundant in both the tall- and short-shrub layers; scattered short *Ilex opaca* (American holly) saplings are also present. The woody vine *Parthenocissus quinquefolia* (Virginia creeper) is moderately common (with about 25% cover), and cover of *Juncus tenuis* (poverty rush) can be high in fairly open patches. The invasive exotic species *Microstegium vimineum* (Nepalese browntop) can be present at low abundance.

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Quercus phellos* (willow oak)
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Frangula alnus* (glossy buckthorn)
Herb (field)	Vine/Liana	*Parthenocissus quinquefolia* (Virginia creeper)
Herb (field)	Graminoid	*Juncus tenuis* (poverty rush)

Characteristic Species: *Frangula alnus* (glossy buckthorn), *Juncus tenuis* (poverty rush), *Parthenocissus quinquefolia* (Virginia creeper), *Platanus hybrida* (London planetree), *Quercus phellos* (willow oak).

Other Noteworthy Species: Information not available.

Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
NY	SNR*	B	1	Hardwood plantation	Edinger et al. 2002
NJ	.	.	.	N/A	.

Local Range: This association occurs in the Jamaica Bay Wildlife Refuge section of the Jamaica Bay Unit.

Classification Comments: None.

Other Comments: None.

Local Description Authors: G. J. Edinger and A. L. Feldmann.

Plots: 199.

Gateway National Recreation Area Inventory Notes: Information not available.

GLOBAL INFORMATION

NVC CLASSIFICATION

Physiognomic Class	Forest (I)
Physiognomic Subclass	Deciduous forest (I.B.)
Physiognomic Group	Cold-deciduous forest (I.B.2.)
Physiognomic Subgroup	Planted/Cultivated cold-deciduous forest (I.B.2.C.)
Formation	Planted/cultivated cold-deciduous forest (I.B.2.C.x)
Alliance	Park Specific-no Alliance assigned
Alliance (English name)	Park Specific-no Alliance assigned
Association	*Quercus phellos - Platanus hybrida* Plantation
Association (English name)	Willow Oak - London Planetree Plantation
Ecological System(s):	Information not available.

GLOBAL DESCRIPTION

Concept Summary: Information not available.
Environmental Description: Information not available.
Vegetation Description: Information not available.
Most Abundant Species: Information not available.
Characteristic Species: Information not available.
Other Noteworthy Species: Information not available.
USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: This plantation is only reported in Gateway National Recreation Area on the Coastal Plain of New York.
States/Provinces: NY.
Federal Lands: NPS (Gateway).

CONSERVATION STATUS

Rank: GNA (modified/managed) (23-Mar-2007).
Reasons: Plantations are not of conservation concern.

CLASSIFICATION INFORMATION

Status: Nonstandard.
Confidence: 3 - Weak.
Comments: Information not available.
Similar Associations: Information not available.
Related Concepts: Information not available.

SOURCES

Description Authors: E. Largay
References: Eastern Ecology Working Group n.d., NRCS 2001b.



Figure E35. Hardwood Plantation in Gateway National Recreation Area, Jamaica Bay Unit (Accuracy Assessment Point 199, photo no. 1166). 8/17/2006. NAD 1983 / UTM easting 599327, northing 4496913.

References for Gateway National Recreation Area Classification

Adams, D. A. 1963. Factors influencing vascular plant zonation in North Carolina salt marshes. Ecology 44:445-456.

Anderson, J. R., E. E. Hardy, J. T. Roach, and R. E. Witmer. 1976. A land use and land cover classification system for use with remote sensor data. USDI, Geological Survey Professional Paper No. 964. Washington, DC. 26 pp.

Anderson, L.E. 1990. A checklist of Sphagnum in North America north of Mexico. The Bryologist 93: 500-501.

Anderson, L.E., H.A. Crum, and W.R. Buck. 1990. List of mosses of North America north of Mexico. The Bryologist 93: 448-499.

Art, H. W. 1976. Ecological studies of the Sunken Forest, Fire Island National Seashore, New York. National Park Service Scientific Monograph Series No. 7, Publication No. NPS 123. 237 pp.

Art, H. W. 1987. Patterns of community dynamics in the Sunken Forest: 1967 to 1985 and 1985 to 1986. National Park Service, North Atlantic Regional Office. 66 pp.

Art, H. W. 1992. The impacts of Hurricane Gloria on deer and trails, the Sunken Forest, Fire Island National Seashore, Fire Island, NY. National Park Service, North Atlantic region, Boston, MA 168 pp.

Barry, J. F. 1980. Natural vegetation of South Carolina. University of South Carolina Press, Columbia. 214 pp.

Bartgis, R. 1986. Natural community descriptions. Unpublished draft. Maryland Natural Heritage Program, Maryland Department of Natural Resources, Annapolis.

Baumann, C. 1978b. The effects of overwash on the vegetation of a Virginia barrier island. M.A. thesis. College of William and Mary, Williamsburg, VA. 104 pp.

Bell, R., M. Chandler, R. Buchsbaum, and C. Roman. 2002. Inventory of intertidal habitats: Boston Harbor Islands, a National Park area. Technical Report NPS/NERBOST/NRTR-2004/1. USDI National Park Service, Northeast Region, Boston, MA. 13 pp.

Bellis, V. J. 1992. Floristic continuity among the maritime forests of the Atlantic Coast of the United States. Pages 21-29 in: C. A. Cole and F. K. Turner, editors. Barrier island ecology of the mid-Atlantic Coast: A symposium. Technical Report NPS/SERCAHA/NRTR-93/04.

Berdine, M. A. 1998. Maryland vegetation classification. Maryland Department of Natural Resources, Annapolis, MD.

Bertness, M. D. 1988. Peat accumulation and the success of marsh plants. Ecology 69:703-713.

Bertness, M. D., L. Gough, and S. W. Shumway. 1992. Salt tolerances and the distribution of fugitive salt marsh plants. Ecology 73(5):1842-1851.

Boule, M. E. 1979. The vegetation of Fisherman Island, Virginia. Castanea 44:98-108.

Bowman, P. 2000. Draft classification for Delaware. Unpublished draft. Delaware Natural Heritage Program.

Breden, T. F. 1989. A preliminary natural community classification for New Jersey. Pages 157-191 in: E. F. Karlin, editor. New Jersey's rare and endangered plants and animals. Institute for Environmental Studies, Ramapo College, Mahwah, NJ. 280 pp.

Breden, T. F., Y. R. Alger, K. S. Walz, and A. G. Windisch. 2001. Classification of vegetation communities of New Jersey: Second iteration. Association for Biodiversity Information and New Jersey Natural Heritage Program, Office of Natural Lands Management, Division of Parks and Forestry, New Jersey Department of Environmental Protection, Trenton.

Brown, B. Personal communication. University of North Carolina.

Burk, C. J. 1968. A floristic comparison of lower Cape Cod, Massachusetts and the North Carolina Outer Banks. Rhodora 70:215-227.

Byers, E. A., J. P. Vanderhorst, and B. P. Streets. 2007. Classification and conservation assessment of high elevation wetland communities in the Allegheny Mountains of West Virginia. West Virginia Natural Heritage Program, West Virginia Division of Natural Resources, Elkins.

Cain, S. A., and W. T. Penfound. 1938. *Aceretum rubri*: The red maple swamp forest of central Long Island. The American Midland Naturalist 19:390-416.

Chapman, V. J. 1937. A note on the salt marshes of Nova Scotia. Rhodora 39:53-57.

Chrysler, M. A. 1930. The origin and development of the vegetation of Sandy Hook. Bulletin of the Torrey Botanical Club 57:163-176.

Clampitt, C. A. 1991. The upland plant communities of Seashore State Park, Virginia Beach, Virginia. Virginia Journal of Science 42:419-435.

Clancy, K. 1993a. Selected rare and historical vascular plants of Delaware. Bartonia 57:75-92.

Clancy, K. 1993b. A preliminary classification of the natural communities of Delaware. Unpublished draft, Delaware Natural Heritage Inventory, Division of Parks and Recreation, Dover. 30 pp.

Clancy, K. 1996. Natural communities of Delaware. Unpublished review draft. Delaware Natural Heritage Program, Division of Fish and Wildlife, Delaware Division of Natural Resources and Environmental Control, Smyrna, DE. 52 pp.

Clark, J. S. 1986. Vegetation and land-use history of the William Floyd Estate, Fire Island National Seashore, Long Island, New York. USDI, National Park Service, North Atlantic Region, Office of Scientific Studies. 126 pp.

Clovis, J. F. 1968. The vegetation of Smith Island, Virginia. Castanea 33:115-121.

Conard, H. S. 1935. The plant associations of central Long Island. The American Midland Naturalist 16:433-516.

Coulling, P. P. 2002. A preliminary classification of tidal marsh, shrub swamp, and hardwood swamp vegetation and assorted non-tidal, chiefly non-maritime, herbaceous wetland communities of the Virginia Coastal Plain. October 2002. Virginia Department of Conservation and Recreation, Division of Natural Heritage. Natural Heritage Technical Report 02-18. 30 pp.

Coulling, Phil. Personal communication. Vegetation Ecologist. Department of Conservation & Recreation, 217 Governor St., Richmond, VA 23219.

Cowardin, L. M., V. Carter, F. C. Golet, and E. T. LaRoe. 1979. Classification of wetlands and deepwater habitats of the United States. U.S. Fish and Wildlife Service, Biological Service Program. FWS/OBS-79/31. Washington, DC. 103 pp.

Daiber, F. C., L. L. Thornton, K. A. Bolster, T. G. Campbell, O. W. Crichton, G. L. Esposito, D. R. Jones, and J. M. Tyrawski. 1976. An atlas of Delaware's wetlands and estuarine resources. College of Marine Studies, University of Delaware, Newark. 528 pp.

Dowhan, J. J., and R. Rozsa. 1989. Flora of Fire Island, Suffolk Country, New York. Bulletin of the Torrey Botanical Club 116:265-282.

Dunlop, D. A., and G. E. Crow. 1985. The vegetation and flora of the Seabrook Dunes with special reference to rare plants. Rhodora 87:471-486.

Eastern Ecology Working Group of NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Terrestrial Vegetation. NatureServe, Boston, MA.

Edinger, G. J., D. J. Evans, S. Gebauer, T. G. Howard, D. M. Hunt, and A. M. Olivero, editors. 2002. Ecological communities of New York state. Second edition. A revised and expanded edition of Carol Reschke's ecological communities of New York state. (Draft for review). New York Natural Heritage Program, New York State Department of Environmental Conservation, Albany, NY.

Egan, R.S. 1987. A fifth checklist of the lichen-forming, lichenicolous and allied fungi of the continental United States and Canada. The Bryologist 90: 77-173.

Egan, R.S. 1989. Changes to the "Fifth checklist of the lichen-forming, lichenicolous and allied fungi of the continental United States and Canada, edition I. The Bryologist 92: 68-72.

Egan, R.S. 1990. Changes to the "Fifth checklist of the lichen-forming, lichenicolous and allied fungi of the continental United States and Canada," edition II. The Bryologist 93: 211-219.

Egan, R.S. 1991. Changes to the "Fifth checklist of the lichen-forming, lichenicolous and allied fungi of the continental United States and Canada," edition III. The Bryologist 94: 396-400.

Egler, F. E. 1962. Ferns and flowering plants of Seashore State Park, Cape Henry, Virginia. New York State College of Forestry, Syracuse, NY. 60 pp.

Ehrenfeld, J. G. 1977. Vegetation of Morristown National Historical Park: Ecological analysis and management alternatives. Final Report. USDI National Park Service Contract No. 1600-7-0004. 166 pp.

Elliman, T. 2003. Boston Harbor Islands plant communities. Report submitted to Massachusetts Natural Heritage & Endangered Species Program, Massachusetts Division of Fisheries & Wildlife, Westborough.

Enser, R. 1993. Natural community classification for Rhode Island (draft). Rhode Island Natural Heritage Program. Providence, RI.

Enser, R. 1999. Natural communities of Rhode Island. Unpublished draft, December 1999. 22 pp.

Enser, R., and J. A. Lundgren. 2005. Natural communities of Rhode Island. Review draft. Rhode Island Natural Heritage Program, Department of Environmental Management and The Nature Conservancy of Rhode Island. Providence, RI.

Esslinger, T.L., and R.S. Egan. 1995. A sixth checklist of the lichen-forming, lichenicolous, and allied fungi of the continental United States and Canada. The Bryologist 98: 467-549.

Evans, Marc. Personal communication. Ecologist. Kentucky Natural Heritage Program, Kentucky State Nature Preserves Commission, Frankfort.

FNA Editorial Committee [Flora of North America Editorial Committee], editor. 2006c. Flora of North America, north of Mexico. Volume 21. Magnoliophyta: Asteridae, part 8: Asteraceae, part 3. Oxford University Press, New York. 616 pp.

Fender, F. S. 1937. The flora of Seven Mile Beach, New Jersey. Bartonia 19:23-41.

Fike, J. 1999. Terrestrial and palustrine plant communities of Pennsylvania. Pennsylvania Natural Diversity Inventory. Pennsylvania Department of Conservation and Recreation. Bureau of Forestry. Harrisburg, PA. 86 pp.

Fleming, G. P. 1998. Virginia natural community framework, version January 30, 1998. Unpublished document. Virginia Department of Conservation and Recreation, Division of Natural Heritage, Richmond. 6 pp.

Fleming, G. P. 2001. Community types of Coastal Plain calcareous ravines in Virginia. Preliminary analysis and classification. Virginia Department of Conservation and Recreation, Division of Natural Heritage, Richmond, VA. 4 pp.

Fleming, G. P., P. P. Coulling, D. P. Walton, K. M. McCoy, and M. R. Parrish. 2001. The natural communities of Virginia: Classification of ecological community groups. First approximation. Natural Heritage Technical Report 01-1. Virginia Department of Conservation and Recreation, Division of Natural Heritage, Richmond, VA. Unpublished report. January 2001. 76 pp.

Fleming, Gary P. Personal communication. Ecologist, Virginia Department of Conservation and Recreation, Division of Natural Heritage, Richmond, VA.

Gawler, S. C. 2001. Natural landscapes of Maine: Natural community profiles. Open (non-forested) types. Final review draft, July 2001. Maine Natural Areas Program. Department of Conservation. Augusta, ME.

Gawler, S. C. 2002. Natural landscapes of Maine: A guide to vegetated natural communities and ecosystems. Maine Natural Areas Program, Department of Conservation, Augusta, ME. [in press]

Godfrey, P. J., M. Benedict, and M. Soukup. 1978. A guide to the ecology of Cape Cod National Seashore (Mary 1978 draft). National Park Service Cooperative Research Unit, Institute for Man and Environment, University of Massachusetts, Amherst, MA .

Golet, F. C., A. J. K. Calhoun, W. R. DeRagon, D. J. Lowry, and A. J. Gold. 1993. Ecology of red maple swamps in the glaciated Northeast: A community profile. USDI Fish & Wildlife Service, Washington, DC. 151 pp.

Good, R. E. 1965. Salt marsh vegetation, Cape May, New Jersey. Bulletin of the New Jersey Academy of Science 10:1-11.

Gosner, K. L. 1979. A field guide to the Atlantic seashore: Invertebrates and seaweeds of the Atlantic coast from the Bay of Fundy to Cape Hatteras. Houghton Mifflin, Boston, MA.

Greller, A. M. 1977. A classification of mature forests on Long Island, New York. Bulletin of the Torrey Botanical Club 104:376-382.

Gwilliam, Evan. 1998. Unpublished data. USDI National Park Service, Cape Cod National Seashore, MA.

Harrison, J. W. 2001. Herbaceous tidal wetland communities of Maryland's eastern shore: Identification, assessment and monitoring. Report submitted to the U.S. EPA (Clean Water Act 1998 State Wetlands Protection Development Grant Program). Biodiversity

Program, Maryland Department of Natural Resources, Wildlife and Heritage Division. 30 June 2001. [U.S. EPA Reference Wetland Natural communities of Maryland's Herbaceous Tidal Wetlands Grant #CD993724].

Harrison, J. W., and P. Stango, III. 2003. Shrubland tidal wetland communities of Maryland's Eastern Shore: Identification, assessment and monitoring. Maryland Natural Heritage Program, Maryland Department of Natural Resources, Annapolis. 118 pp.

Harrison, J. W., compiler. 2004. Classification of vegetation communities of Maryland: First iteration. A subset of the International Classification of Ecological Communities: Terrestrial Vegetation of the United States, NatureServe. Maryland Natural Heritage Program, Maryland Department of Natural Resources, Annapolis. 243 pp.

Harrison, Jason W. Personal communication. State Community Ecologist, Maryland Wildlife and Heritage Division, Department of Natural Resources, Tawes State Office Building, E-1, Annapolis, MD 21401.

Harshberger, J. W. 1900. An ecological study of the New Jersey strand flora. Proceedings of the Academy of Natural Science Philadelphia 52:623-671.

Harvill, A. M., Jr. 1965. The vegetation of Parramore Island, Virginia. Castanea 30:226-228.

Heckscher, C. M., W. A. McAvoy, and K. Clancy. 1995. Biological assessment of the Milford Neck Preserve. Division of Fish and Wildlife, Department of Natural Resources and Environmental Control, Delaware Natural Heritage Program, Smyrna, DE. 29 pp.

Higgins, E. A. T., R. D. Rappleye, and R. G. Brown. 1971. The flora and ecology of Assateague Island. University of Maryland Experiment Station Bulletin A-172. 70 pp.

Hill, A. F. 1923. The vegetation of the Penobscot Bay region, Maine. Proceedings of the Portland Society of Natural History 3:307-438.

Hill, S. R. 1986. An annotated checklist of the vascular flora of Assateague Island (Maryland and Virginia). Castanea 5:265-305.

House, H. D. 1917. The vegetation of the eastern end of Oneida Lake. New York State Museum Bulletin #197. Albany, NY. pp. 61-71.

Hunt, D. 1997b. Classification of brackish interdunal swales. Unpublished materials. New York Natural Heritage Program, Latham, NY.

Hunt, D. M. 2000. Element global ranking form: Brackish Meadow. New York Natural Heritage Program, February 25, 2000.

Island Alliance. 2001. Boston Harbor Islands: Grape Island facts. [www.bostonislands.org/grap_factsheet.asp]

Jenkins, D. 1974. Natural areas of the Chesapeake Bay region: Ecological priorities. Smithsonian Institute, Ecology Program, Center for Natural Areas Ecology.

Johnson, A. F. 1981b. Plant communities of the Napeague Dunes. Bulletin of the Torrey Botanical Club 108:76-84.

Johnson, A. F. 1985b. A guide to the plant communities of the Napeague Dunes, Long Island, New York. Mad Printers, Mattituck, NY. 58 pp. plus plates.

Karanaukas, M. 2001. A survey of the aquatic invertebrates of the Boston Harbor Islands. Report to the Island Alliance, National Park Service, and the Massachusetts Natural Heritage and Endangered Species Program.

Keever, C. 1979. Mechanisms of plant succession on old fields of Lancaster County, Pennsylvania. Bulletin of the Torrey Botanical Club 106(4):299-308.

Klemas, V., F. C. Daiber, D. S. Bartlett, O. W. Crichton, and A. O. Fornes. 1973. Coastal vegetation of Delaware. University of Delaware, College of Marine Studies. 27 pp.

Klotz, L. H. 1986. The vascular flora of Wallops Island and Wallops Mainland, Virginia. Castanea 51:306-326.

Lea, C. 2002b. Vegetation classification of Assateague Island National Seashore, Addendum (version 2) - March 1, 2002. Unpublished draft. National Park Service. 31 pp.

Lundgren, J. 2000. Lower New England - Northern Piedmont Ecoregion Forest Classification. The Nature Conservancy, Conservation Science, Boston, MA. 72 pp.

Lundgren, J. A. 1998. Natural communities of coastal Massachusetts: Inventory and assessment. Massachusetts Department of Fisheries and Wildlife Natural Heritage and Endangered Species Program, Boston, MA.

Lundgren, J., B. Hammond, J. Stone, and L. Sneddon. 2000. Vegetation classification and mapping of Nantucket Island, Massachusetts. Final Draft. The Nature Conservancy, March 2000. 59 pp.

MENHP [Maine Natural Heritage Program]. 1991. Natural landscapes of Maine: A classification of ecosystems and natural communities. Unpublished document. Office of Comprehensive Planning, Maine Natural Heritage Program, Augusta. 77 pp.

MNAP [Maine Natural Areas Program]. 1991. Natural landscapes of Maine: Classification of ecosystems and natural communities. Maine Natural Areas Program, Maine Department of Conservation, Natural Resources Information and Mapping Center. Augusta, ME.

Martin, N. D. 1959a. An analysis of forest succession in Algonquin Park, Ontario. Ecological Monographs 29(3):187-218.

Martin, W. E. 1959b. The vegetation of Island Beach State Park, New Jersey. Ecological Monographs 29:1-46.

McDonnell, M. J. 1979. The flora of Plum Island, Essex County, Massachusetts. University of New Hampshire, Agricultural Experiment Station. Station Bulletin No. 513. Durham, NH. 110 pp.

Metzler, K. J., and J. Barrett. 1992. Connecticut community classification. Unpublished draft. Connecticut Department of Environmental Protection, Natural Resources Center, Natural Diversity Database, Hartford.

Metzler, K. J., and J. P. Barrett. 2001. Vegetation classification for Connecticut. Draft 5/21/2001. Connecticut Department of Environmental Protection, Natural Resources Center, Natural Diversity Database, Hartford.

Metzler, K. J., and J. P. Barrett. 2004. Vegetation classification for Connecticut. Draft. State Geological and Natural History Survey of Connecticut, Department of Environmental Protection, Hartford, CT.

Metzler, K., and J. Barrett. 1996. Vegetation classification for Connecticut organized into the modified UNESCO hierarchy. Unpublished review draft. Connecticut Natural Diversity Database. Hartford, CT. 48 pp.

Miller, W. R., and F. E. Egler. 1950. Vegetation of the Wequetequock-Pawcatuck tidal-marshes, Connecticut. Ecological Monographs 20:143-172.

Moul, E. T. 1969. Flora of Monomoy Island, Massachusetts. Rhodora 71:18-28.

Moul, E. T. 1973. Marine flora and fauna of the northeastern United States: Higher plants of the marine fringe. USDC National Oceanographic and Atmospheric Administration. Technical Report NMFS CIRC-384. Seattle, WA. 61 pp.

NAP [Northern Appalachian-Boreal Forest Working Group]. 1998. Northern Appalachian-Boreal Working group discussions. The Nature Conservancy, Boston, MA.

NRCS [Natural Resources Conservation Service]. 2001b. Soil survey of Gateway National Recreation Area, New York and New Jersey. USDA Natural Resources Conservation Service and USDI National Park Service, Gateway National Recreation Area in partnership with Cornell University Agricultural Experiment Station and New York City Soil and Water Conservation District.

Nelson, B. W., and L. K. Fink. 1980. Geological and botanical features of sand beach in Maine. Bulletin No. 14. Maine Sea Grant Publications. 163 pp.

Nelson, J. B. 1986. The natural communities of South Carolina: Initial classification and description. South Carolina Wildlife and Marine Resources Department, Division of Wildlife and Freshwater Fisheries, Columbia, SC. 55 pp.

Newbold, A., J. Evert, and J. Holt. 1988. Rare plant and general flora survey of the White Clay Creek Park, Newcastle County, Delaware. 40 pp.

Nichols, G. E. 1920. The vegetation of Connecticut: III. The associations of depositing areas along the seacoast. Bulletin of the Torrey Botanical Club 47:511-548.

Niering, W. A., R. H. Goodwin, and S. Taylor. 1970. Prescribed burning in southern New England. Introduction to long-range studies. Proceedings of the Tall Timbers Fire Ecology Conference 10:267-286.

Niering, W. A., and R. S. Warren. 1977. Our dynamic tidal marshes: Vegetation changes as revealed by peat analysis. The Connecticut Arboretum Bulletin 22.

Niering, W. A., and R. S. Warren. 1980. Vegetation patterns and processes in New England salt marshes. Bioscience 30:301-307.

Nixon, S. W. 1982. The ecology of New England high salt marshes: A community profile. USDI Fish & Wildlife Service. FWS/OBS-81/55. 70 pp.

Odum, W. E., T. J. Smith, III, J. K. Hoover, and C. C. McIvor. 1984. The ecology of tidal freshwater marshes of the United States east coast: A community profile. USDI Fish & Wildlife Service. FWS/OBS-83/17. 176 pp.

Overlease, W. R. 1987. 150 years of vegetation change in Chester County, Pennsylvania. Bartonia 53:1-12.

Peet, R. K., T. R. Wentworth, M. P. Schafale, and A.S. Weakley. 2002. Unpublished data of the North Carolina Vegetation Survey. University of North Carolina, Chapel Hill.

Perles, S. J., G. S. Podniesinski, E. A. Zimmerman, W. A. Millinor, and L. A. Sneddon. 2005a. Vegetation classification and mapping at Fort Necessity National Battlefield. Technical Report NPS/NER/NRTR--2006/038. National Park Service. Philadelphia, PA.

Perles, S. J., G. S. Podniesinski, E. A. Zimmerman, W. A. Millinor, and L. A. Sneddon. 2005b. Vegetation classification and mapping at Friendship Hill National Historic Site. Technical Report NPS/NER/NRTR--2006/041. National Park Service. Philadelphia, PA.

Perles, S. J., G. S. Podniesinski, W. A. Millinor, and L. A. Sneddon. 2005c. Vegetation classification and mapping at Gettysburg National Military Park and Eisenhower National Historic Park. Draft Technical Report NPS/NER/NRTR--2006/058. National Park Service. Philadelphia, PA.

Podniesinski, G. S., S. J. Perles, W. A. Millinor, and L. A. Sneddon. 2006. Vegetation classification and mapping at Delaware Water Gap National Recreation Area. Technical Report NPS/NER/NRTR--2007/076. National Park Service. Philadelphia, PA.

Rawinski, T. 1984. Natural community description abstract - southern New England calcareous seepage swamp. Unpublished report. The Nature Conservancy, Boston, MA. 6 pp.

Redfield, A. C. 1972. Development of a New England salt marsh. Ecological Monographs 42(2):201-237.

Reschke, C. 1990. Ecological communities of New York State. New York Natural Heritage Program. New York State Department of Environmental Conservation. Latham, NY. 96 pp.

Robichaud, B., and M. F. Buell. 1973. Vegetation of New Jersey. Rutgers University Press, New Brunswick, NJ. 340 pp.

Saltonstall, K. 2002. Cryptic invasion by a nonnative genotype of the common reed, *Phragmites australis*, into North America. Proceedings of the National Academy of Science 99:2445-2449.

Schafale, M. 2000. Fourth approximation guide. Coastal Plain. January 2000 draft. North Carolina Natural Heritage Program, Raleigh.

Schafale, M. 2003b. Fourth approximation guide. Coastal Plain communities. March 2003 draft. North Carolina Natural Heritage Program, Raleigh.

Schafale, M. P., and A. S. Weakley. 1990. Classification of the natural communities of North Carolina. Third approximation. North Carolina Department of Environment, Health, and Natural Resources, Division of Parks and Recreation, Natural Heritage Program, Raleigh. 325 pp.

Schafale, Mike P. Personal communication. Ecologist, North Carolina Department of Environment, Health, and Natural Resources, Division of Parks and Recreation, Natural Heritage Program, Raleigh.

Schotz, Al. Personal communication. Community Ecologist. Alabama Natural Heritage Program. Huntingdon College, Massey Hall, 1500 East Fairview Avenue, Montgomery, AL 36106-2148.

Shreve, F., M. A. Chrysler, F. H. Blodgett, and F. W. Besley. 1910. The plant life of Maryland. Maryland Weather Service. Special Publication, Volume III. Johns Hopkins Press. Baltimore, MD.

Sirkin, L. A. 1972. Origin and history of Maple Bog in the Sunken Forest, Fire Island, New York. Bulletin of the Torrey Botanical Club 99:131-135.

Small, J. A. 1954. Carex kobomugi at Island Beach, New Jersey. Ecology 35:289-291.

Sneddon, L. A., K. J. Metzler, and M. Anderson. 1995. A classification and description of natural community alliances and selected community elements of the Delaware Estuary. In: L. E. Dove and R. M. Nyman, editors. Living resources of the Delaware Estuary. The Delaware Estuary Program. 530 pp. plus appendices.

Sneddon, L., and J. Lundgren. 2001. Vegetation classification of Fire Island National Seashore and William Floyd Estate. Final Draft. TNC/ABI Vegetation Mapping Program. 87 pp.

Southeastern Ecology Working Group of NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Terrestrial Vegetation. NatureServe, Durham, NC.

Sperduto, D. 1994. A classification of the natural communities of New Hampshire. April 1994 approximation. Unpublished document. New Hampshire Natural Heritage Inventory, Department of Resources and Economic Development, Concord, NH. 45 pp. plus appendices.

Sperduto, D. D. 1997a. The natural communities of New Hampshire: A guide and classification. The New Hampshire Natural Heritage Inventory, Concord, NH. 126 pp.

Sperduto, D. D. 1997b. A preliminary classification of natural communities in the New Hampshire Coastal Lowlands Ecoregion. NH Natural Heritage Inventory / The Nature Conservancy, Division of Forests and Lands, Department of Resources and Economic Development, Concord, NH.

Sperduto, D. D. 2000a. Natural communities of New Hampshire: A guide and classification. Near final unformatted draft without pictures and illustrations; includes upland classification. New Hampshire Natural Heritage Inventory, DRED Division of Forests and Lands, Concord, NH. 127 pp.

Sperduto, D. D. 2000b. A classification of wetland natural communities in New Hampshire. New Hampshire Natural Heritage Inventory, Department of Resources and Economic Development, Division of Forests and Lands. Concord, NH. 156 pp.

Sperduto, D. D., W. F. Nichols, K. F. Crowley, and D. A. Bechtel. 2000b. Black gum (*Nyssa sylvatica* Marsh) in New Hampshire. New Hampshire Natural Heritage Inventory, Concord, NH. 51 pp. plus appendices.

Sperduto, D. D., and W. F. Nichols. 2004. Natural communities of New Hampshire: A guide and classification. New Hampshire Natural Heritage Inventory, DRED Division of Forests and Lands, Concord. 242 pp.

Stalter, R. 1979. The major plant communities of the Fire Island National Seashore. Pages 177-181 in: R. M. Linn, editor. Proceedings of the first conference on Scientific Research in the National Parks. USDI National Park Service, Washington, DC.

Stalter, R. 1980. Carex kobomugi Ohwi at Sandy Hook, New Jersey. Bulletin of the Torrey Botanical Club 107:431-432.

Stalter, R. 1990. The vascular flora of Assateague Island, Virginia. Bulletin of the Torrey Botanical Club 117:48-56.

Stalter, R., and E. E. Lamont. 1990. The vascular flora of Assateague Island, Virginia. Bulletin of the Torrey Botanical Club 117:48-56.

Stotler, R., and B. Crandall-Stotler. 1977. A checklist of liverworts and hornworts of North America. The Bryologist 80:405-428.

Svenson, H. K. 1970. A linden (*Tilia*) forest on Cape Cod (with extended notes on *Tilia neglecta, Bromus pubescens*, and *Ribes hirtellum*). Rhodora 72:339-350.

Swain, P. C., and J. B. Kearsley. 2000. Classification of natural communities of Massachusetts. July 2000 draft. Natural Heritage and Endangered Species Program, Massachusetts Division of Fisheries and Wildlife. Westborough, MA.

Swain, P. C., and J. B. Kearsley. 2001. Classification of natural communities of Massachusetts. September 2001 draft. Natural Heritage and Endangered Species Program, Massachusetts Division of Fisheries and Wildlife. Westborough, MA.

TDNH [Tennessee Division of Natural Heritage] Unpublished data. Tennessee Division of Natural Heritage, 14th Floor, L&C Tower, 401 Church Street, Nashville, TN 37243-0447. 615-532-0431

TNC [The Nature Conservancy]. 1995c. NBS/NPS Vegetation Mapping Program: Vegetation classification of Assateague Island National Seashore. Unpublished report. The Nature Conservancy, Eastern Regional Office, Boston, MA.

TNC [The Nature Conservancy]. 1995d. Unpublished data collected from Block Island, Rhode Island. The Nature Conservancy, Eastern Heritage Task Force, Boston, MA.

TNC and WPC [The Nature Conservancy and Western Pennsylvania Conservancy]. 2004. Classification, assessment, and protection of non-forested floodplain wetlands of the Susquehanna drainage. Pennsylvania Natural Heritage Program, Harrisburg, PA. 128 pp.

Teal, J. M. 1986. The ecology of regularly flooded salt marshes of New England: A community profile. Department of Interior, U.S. Fish and Wildlife Service, Washington, DC. Biological Report 85(7.4). 61 pp.

Thompson, E. 1996. Natural communities of Vermont uplands and wetland. Nongame and Natural Heritage Program, Department of Fish and Wildlife in cooperation with The Nature Conservancy, Vermont chapter. 34 pp.

Thompson, E. H., and E. R. Sorenson. 2000. Wetland, woodland, wildland: A guide to the natural communities of Vermont. The Nature Conservancy and the Vermont Department of Fish and Wildlife. University Press of New England, Hanover, NH. 456 pp.

Thorne-Miller, B., M. M. Harlin, G. B. Thursby, M. M. Brady-Campbell, and B. A. Dworetsky. 1983. Variations in the distribution and biomass of submerged macrophytes in five coastal lagoons in Rhode Island, USA. Botanica Marina 26:231-242.

Tiner, R. W., Jr. 1984. Wetlands of the United States: Current status and recent trends. USDI Fish and Wildlife Service, National Wetlands Inventory 59 pp.

Tiner, R. W., Jr. 1985a. Wetlands of Delaware. Cooperative publication of USDI Fish & Wildlife Service, National Wetlands Inventory, Newton Corner, MA, and Delaware Department of Natural Resources and Environmental Control, Dover, DE. 77 pp.

Tiner, R. W., Jr. 1985b. Wetlands of New Jersey. USDI Fish & Wildlife Service, National Wetlands Inventory, Newton Corner, MA. 117 pp.

Travis, R. W., and P. J. Godfrey. 1976. Interactions of plant communities and oceanic overwash on the manipulated barrier islands of Cape Hatteras National Seashore, North Carolina. Pages 777-780 in: Proceedings of the First Conference on Scientific Research in the National Parks, Volume II.

United States Department of Agriculture, National Resources Conservation Service (USDA NRCS). 2004. The PLANTS Database, Version 3.5 (http://plants.usda.gov). Data compiled from various sources by Mark W. Skinner. National Plant Data Center. Baton Rouge, LA.

VDNH [Virginia Division of Natural Heritage]. 2003. The natural communities of Virginia: Hierarchical classification of community types. Unpublished document, working list of November 2003. Virginia Department of Conservation and Recreation, Division of Natural Heritage, Ecology Group, Richmond.

Van Luven, D. 1990. Cape Cod Critical Habitats Atlas. Association for the Preservation of Cape Cod. Orleans, MA.

Vogelmann, H. W. 1976. An unusual black gum swamp in Maine. Rhodora 78:326-327.

WPC and TNC [Western Pennsylvania Conservancy and The Nature Conservancy]. 2002. Classification, assessment, and protection of forest floodplain wetlands of the Susquehanna drainage. Pennsylvania Natural Heritage Program, Harrisburg, PA. 160 pp.

Walbridge, M. R. 1982. Vegetation patterning and community distribution in four high-elevation headwater wetlands in West Virginia. M.S. thesis, West Virginia University, Morgantown.

Webber, E. E. 1967. Bluegreen algae from a Massachusetts salt marsh. Bulletin of the Torrey Botanical Club 94:99-106.

Welsh, B. L. 1980. Comparative nutrient dynamics of a marsh-mudflat ecosystem. Estuarine Coastal and Marine Science 10:143-164.

Whitlatch, R. B. 1982. The ecology of New England tidal flats: A community profile. USDI, U.S. Fish and Wildlife Service, Biological Services Program, Washington, DC. FWS/OBS-81/01. 125 pp.

Windisch, A. G. 1995c. Natural community inventory of Mashipacong Bogs site, New Jersey. New Jersey Natural Heritage Program, Office of Natural Lands Management, Division of Parks and Forestry. Trenton, NJ.

Wootton, L., S. Halsey, K. Bevaart, A. McGough, J. Ondreika, and P. Patel. 2005. When invasive species have benefits as well as costs: Managing Carex kobomugi (Asiatic sand sedge) in New Jersey's Coastal Dunes. Biological Invasions 7:1017-27.

Zaremba, R. E. 1989. A comparison of maritime heathlands of holocene deposits to related communities in Massachusetts and New York. Draft report for The Nature Conservancy, Albany, NY.

Zaremba, R. E. 1999. Memorandum: Basic notes on coastal salt ponds. Written summer 1999 for M. Jordan, Long Island Chapter, The Nature Conservancy.

Zaremba, R. E., and S. P. Leatherman. 1984. Overwash processes and foredune ecology, Nauset Spit, Massachusetts. Miscellaneous Paper EL-84-8. Prepared by Massachusetts Audubon Society and University of Massachusetts under cooperative agreement between USDI National Park Service, North Atlantic Region, Boston, MA, and the U.S. Army Corps of Engineering Research Center. Published by U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS. 232 pp.

Zebryk, T. 1990. Vegetation and site characteristics of a *Nyssa*-dominated wetland in central Massachusetts. Unpublished report. Draft 3.

As the nation's primary conservation agency, the Department of the Interior has responsibility for most of our nationally owned public land and natural resources. This includes fostering sound use of our land and water resources; protecting our fish, wildlife, and biological diversity; preserving the environmental and cultural values of our national parks and historical places; and providing for the enjoyment of life through outdoor recreation. The department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all our people by encouraging stewardship and citizen participation in their care. The department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

NPS D-452 March 2008

National Park Service
U.S. Department of the Interior

Northeast Region
Philadelphia, Pennsylvania



NPS Northeast Region
Inventory and Monitoring Coordinator
105 Coastal Institute in Kingston
University of Rhode Island
Kingston, RI 02881

http://www.nps.gov/nero/science/

EXPERIENCE YOUR AMERICA ™