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Natural Resource Stewardship and Science

Vegetation Classification and Mapping of Assateague Island National Seashore

Natural Resource Report NPS/ASIS/NRR—2017/1422



ON THE COVER
Low Salt Marsh, Assateague Island National Seashore, 2009
Photograph by: Sue Gawler

Vegetation Classification and Mapping of Assateague Island National Seashore

Natural Resource Report NPS/ASIS/NRR—2017/1422

Lesley Sneddon[1], John Menke[2], Ashton Berdine[3], Ery Largay[1], and Sue Gawler[1]

[1]NatureServe
c/o University of Massachusetts Boston, Biology Department
100 Morrissey Boulevard
Boston, MA 02125-3393

[2]Aerial Information Systems, Inc.
112 First Street
Redlands, CA 92373

[3]The Nature Conservancy
301 Mountain View Dr.,
Cumberland, MD 21502

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Executive Summary

The NPS Vegetation Mapping Inventory Program was first established in response to the National Park Service's Natural Resources Inventory and Monitoring Guideline issued in 1992. The objective of the NPS Vegetation Mapping InventoryProgram was to develop methods to generate vegetation data in GIS format using a standard hierarchical classification scheme. A pilot study of the NPS Vegetation Mapping Inventory Program was first undertaken at Assateague Island National Seashore (ASIS) beginning in late 1993. This pilot project was in partnership with the U.S. Geological Survey (USGS) and under the original program name called the "USGS-NPS Vegetation mapping Program." Environmental Science Research Institute (ESRI), the prime contractor, subcontracted the mapping firm Aerial Information Systems (AIS) to conduct the photointerpretation of leaf-on color infrared (CIR) stereo aerial photographs commissioned by ESRI. The Nature Conservancy (TNC)[1] was also subcontracted by ESRI to develop the standard vegetation classification to be mapped at the park. The vegetation was to be classified using a standardized framework applied across the United States, known then as the U.S. Standard National Vegetation Classification System. This system drew from a hierarchical framework based on a modification of the UNESCO Vegetation Classification (1973) drafted by regional ecologists at The Nature Conservancy (1994). At the same time, a classification at the proposed Alliance level of this hierarchical framework was being developed in the eastern region of The Nature Conservancy (Sneddon et al. 1994), funded by the U.S. Fish and Wildlife Service Gap Analysis Program. Both of these works provided the foundation upon which the classification of the Assateague Island National Seashore vegetation was built. This, in turn, became an important contribution to the classification that came to be known as the US National Vegetation Classification, first published in 1998 (Grossman et al. 1998).

A sampling scheme was devised by the ESRI-AIS-TNC team, and plot data collection was conducted during the summer of 1994 by ecologists from TNC and from the Maryland Natural Heritage Program. Twenty-four National Vegetation Classification alliances occurring within the park were identified and described in detail. A polygon map of alliances or groups of alliances in the park was created, following the NPS Vegetation Mapping InventoryProgram protocols (The Nature Conservancy and Environmental Systems Research Institute 1994a,b,c). A dichotomous field key was developed for alliances to assist with field recognition and classification. As the project progressed, research on related vegetation allowed for the development of association-level information. A final report of the vegetation classification of ASIS was first delivered to the National Park Service in 1995 (The Nature Conservancy 1995), and the vegetation map and report was submitted to the National Park Service the following year (AIS 1996). Field work to conduct an accuracy assessment of the original map was carried out in 1998. Not surprisingly, accuracy of the map of this pilot project was low, an estimated 44%. The results led to a discussion of the reasons for the low accuracy of the original map. There were many contributing factors to low accuracy, but one main issue was that the vegetation classification was developed concurrently with mapping, as

[1] TNC staff involved in this project migrated to the newly formed NatureServe in 2000. NatureServe then remained active in the project through its completion.

opposed to prior to mapping. As a result, the evolving nature of the classification resulted in a varying understanding of the types by photointerpreters.

The NPS Vegetation Mapping Inventory Program (VMI) and mapping methods have both evolved greatly in the intervening years. In 2002, Chris Lea of the National Park Service's Biological Resources Management Division requested that NatureServe re-interpret the original vegetation map. NatureServe re-labeled the original polygons with the corrected association names, using the 1998 accuracy assessment points to inform this second photo-interpretation effort. The Northeastern Region of the National Park Service eventually established a standard set of deliverables and a standard report format for all vegetation classification and mapping projects in the northeastern parks. In 2004, the National Park Service requested that NatureServe compile all existing products of the original ASIS vegetation mapping project, incorporating edits to the original vegetation map, and also incorporating the results of recently acquired LIDAR data and resulting analysis (Nayeghandi 2003). In 2006, the National Park Service requested a new accuracy assessment of the original map following the above described changes. With the guidance of Chris Lea, plans were made for a new accuracy assessment, and upon completion of map edits, the accuracy assessment was designed, then implemented, in summer of 2009. The resulting accuracy ranged from 57% (all associations, simple correct or incorrect) to 75% when the second field choices were also taken into consideration.

A great deal has been learned from this pilot project and from many other projects over the life of the USGS-NPS Vegetation Mapping Program, now known as the NPS Vegetation Mapping Inventory Program. In addition, there have been technological advances in GPS, GIS, development of metadata, PLOTS database, and other areas. The VMI has matured markedly during this time, bringing a far more robust vegetation classification to ASIS.

Keywords: association, vegetation classification, vegetation mapping, Assateague Island National Seashore, National Vegetation Classification

Acknowledgments

The vegetation mapping of Assateague Island National Seashore was launched in 1994 as the first pilot of the USGS-NPS Vegetation Mapping Program, and has evolved as a project as the NPS Vegetation Mapping Inventory Program matured. As a result, a great number of people have been involved over the years, many of whom have moved to new jobs. It is our hope that we have not neglected to list anyone who should be acknowledged, but if this is the case, please know that your contributions have been greatly appreciated. The authors gratefully acknowledge Beth Johnson and her colleagues of the National Park Service for their funding of this project, and for Beth's guidance during its many phases. Denny Grossman of The Nature Conservancy was intrumental in helping this project get underway. We also thank the many people for their time and assistance with this project; Rose Railley of the Assateague Island National Seashore (ASIS) spent a considerable amount of time in the field collecting plot data. Mark Duffy and Elaine Furbish, also of ASIS, provided guidance, access, facilities, and a four-wheel-drive vehicle. Elaine also provided us with guidance in the field and collected several plots. Joe Vierra of Environmental Systems Research Institute (ESRI) provided training in use of the GPS, as well as a loan of the GPS during Ashton's field work. We thank Debbie Johnson of Aerial Information Systems (AIS) for her guidance and expertise. Many others at ESRI and AIS were also involved in photointerpretation and mapping. Chris Lea of NPS designed the first accuracy assessment, which was conducted by James Melonas and Stacey Weller and analyzed by Frank Hudson. Mike Story of the USGS (and later, NPS) provided much guidance over all. Dennis Skidds provided considerable patience and help in the preparation of spatial metadata as well as review of this report. This has been a truly collaborative effort by a number of individuals.The contributions of all of are greatly appreciated.

We are very sad to note the recent passing of our dedicated and accomplished colleague and co-author, Sue Gawler, to ALS. Sue spent weeks in the field with Ery Largay collecting many accuracy assessment points amidst the heat, humidity, and ferocious insects, all with good humor and kindness, before her diagnosis in 2010. Her expertise, friendship, and warmth will be greatly missed.

Introduction

General Background

One of the goals of the National Park Service's Inventory and Monitoring Program is to provide current and accurate information for effective, long-term management of the natural resources held in trust (National Park Service 2003a,b). The Inventory and Monitoring 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 (National Park Service 2003a).

To ensure that vegetation mapping is standardized across the National Park Service (NPS), the NPS Vegetation Mapping Inventory Program was established in 1994 (at the time in partnership with the USGS). The Program developed a protocol for creating vegetation maps in national parks (The Nature Conservancy and Environmental Systems Research Institute 1994a,b,c), using a standardized vegetation classification applied across the United States, known now as the US National Vegetation Classification (USNVC). The USNVC was developed by ecologists of the Natural Heritage Program network many other partners, and NatureServe (initially by 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 USNVC 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 and many other partners. The classification is housed in the Biotics database and is updated regularly (NatureServe 2014). The upper levels of the USNVC were adopted as a standard by the Federal Geographic Data Committee to support the production of uniform statistics on vegetation at the national level (Federal Geographic Data Committee 1996). The hierarchy was subsequently revised, and the FGDC adopted all levels of the new hierarchy in 2008 (FGDC 2008). The NPS Vegetation Mapping Inventory Program adopted the alliance level, and where possible, the association level, as the mapping unit for national parks.

The goal of the vegetation mapping effort at the Assateague Island National Seashore 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 alliances, and descriptions of the vegetation alliances in the park. A subset of the alliance level of this hierarchical framework was concurrently being developed in the eastern region of The Nature Conservancy (Sneddon et al. 1994), funded by the U.S. Fish and Wildlife Service Gap Analysis Program. This work provided the basis for the classification of the Assateague Island National Seashore vegetation.

US National Vegetation Classification

At the beginning of this project, USNVC hierarchy was divided into two floristic levels at the bottom, and five physiognomic levels. The seven levels of the USNVC hierarchy included, from

broadest to narrowest, Formation Class, Formation Subclass, Formation Group, Formation Subgroup, Formation, Alliance, and Association. The hierarchy was revised in 2008, largely retaining physiognomy as one of the major organizers, but incorporating broad climatic and regional environmental factors that arranged vegetation into more ecologically related units. The two lower units, Alliance and Association, were retained, although alliance concepts underwent substantial revision.

The basic unit of vegetation classification in the USNVC was, and 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. Several associations that share one or more dominant or characteristic species are grouped to form an alliance. Alliances are generally more wide-ranging geographically than associations, having broader species composition reflecting the geographic range.

Associations are described to include species composition, vegetation structure, environmental setting, range and other information. Associations are also assigned global conservation status ranks that indicate their relative risk of extirpation (Grossman et al 1998). Baseline information on association composition and associated threats is critical to developing desired conditions and park management goals relating to native associations, non-native plant and insect species, and effects of browse and other disturbances. Vegetation maps also assist park managers in the siting of trails and buildings so as to miminize negative impacts to native vegetation. The identification and description of associations provides habitat information important to understanding associated organisms, including animals, protozoans, bacteria, and fungi. This “coarse filter” approach provides a framework for management and conservation of not only the dominant species of an association, but also the vertebrates, invertebrates, nonvascular plants, and other biologic members that depend on it.

Park-Specific Information

Assateague Island is a federally-owned barrier island along the coast of Maryland and Virginia. Assateague Island National Seashore is the jurisdiction of the National Park Service and encompasses northern half of the island (Maryland portion). The State of Maryland manages approximately 680 acres within the National Seashore as Assateague State park. The Virginia portion of the island is Chincoteague National Wildlife Refuge, owned and managed by the U.S. Fish and Wildlife Service. The following history of Assateague Island is drawn from a detailed report by Mackintosh (1982). As a barrier island exposed to storms and other natural disturbances, the configuration of Assateague Island is naturally prone to change. A major alteration in the island’s form took place in 1933 when a major storm breached land near the northern end and formed Ocean City Inlet. Formation of the inlet effectively cut off the island from the development occurring at Ocean City. After the 1933 storm, local residents capitalized on the fortuitous formation of the inlet and worked to keep it open for navigation by constructing jetties projecting into the ocean. Jetties prevented the inlet from silting in, but also prevented natural processes that would have continued to build the northern end of the island. Interruption of the natural process has resulted in a continuing reduction of the northern end, while the unaltered drift has contributed to accretion on the southern end. Early public use of Assateague was intermittent and modest, and the island was occupied only by four small coast guard stations until 1934 when the National Park Service and Department of

Interior began a survey of lands on the Atlantic and Gulf coasts. Assateague was identified in this survey as one of twelve sites to be considered as national seashore recreation areas.

Over the next several decades, numerous complex and often difficult negotiations ensued within the federal government, with other federal and state agencies, and the general public. The U.S. Fish and Wildlife established Chincoteague National Wildlife Refuge in 1943, but little progress occurred for the National Seashore. Public opposition to the park was often strident, rooted in a fear of lost tax income. The park was championed by, among others, Representative Otis Bland of Virginia, but with Bland's death in 1948, there was little activity for over ten years. However, a growing interest in private development led to the purchase of 15 miles of the island north of Virginia in 1950. The land was platted, plans for a road (dubbed “Baltimore Avenue”) were drawn up, and a major sales campaign followed. The opening of the Chesapeake Bay Bridge all but ensured commercial development of the island. However, a major storm in 1962 effectively halted those plans when large dunes were blown out by winds and water, demonstrating that future development would be ill-considered. Secretary of Interior Stewart Udall then took up the cause for federal acquisition of the island the following year. Legislation authorizing the creation of Assateague Island National Seashore was enacted in January 1965 with President Johnson’s signature.

Although Baltimore Avenue was thwarted by the 1962 storm, the idea of a road running the length of the island was kept alive by many, as was a growing interest in concession stands, motels, and restaurants. Plans for both were eventually incorporated into a master plan approved by the Department of Interior in 1967. A series of political delay tactics prevailed against development proponents, however, until the mounting pressure from environmental organizations and a gradual evolution of public support took hold. By 1976, legislation was enacted that repealed the mandates for concession stands, stores, and restaurants. A sand-clay road was eventually built on the island, and with approval of the watchdog Committee to Preserve Assateague, it was angled to obscure sight lines and to minimize speed. The main road runs primarily through the interdunal areas and is accessible only by four wheel drive vehicles south of the Life of the Dunes nature trail. Dune crossing markers denote areas accessible to the beach or mark roads that travel across the island to the back bay areas. North of Assateague State Park, travel is restricted to National Park vehicles usually along the immediate beach; no roads exist in this area.

Project Area

Location and Regional Setting

Assateague Island is a barrier island that spans the entire length of Chincoteague Bay in the south and Sinepuxent Bay in the north, encompassing both the northern portions of Virginia and southern Maryland. Assateague Island is bound on the east by the Atlantic Ocean and on the west by Chincoteague and Sinepuxent Bay. Outlets to the sea include the Ocean City inlet to the north and the Chincoteague inlet between Tom's Cove Hook and Wallops Island to the south. North of the Ocean City inlet, the remainder of the barrier island chain in Maryland is highly altered, comprising residential and commercial development. Assateague Island is approximately 50 miles long and varies in width from one-half mile in the north to two miles in the middle and southern parts of the island. A two-mile stretch of the island within the National Seashore comprising approximately 680 acres is owned and administered by the Maryland Department of Natural Resources as Assateague State Park. The study area for mapping the vegetation is the National Seashore and State Park area north of the Virginia/Maryland state line (Figure 1).

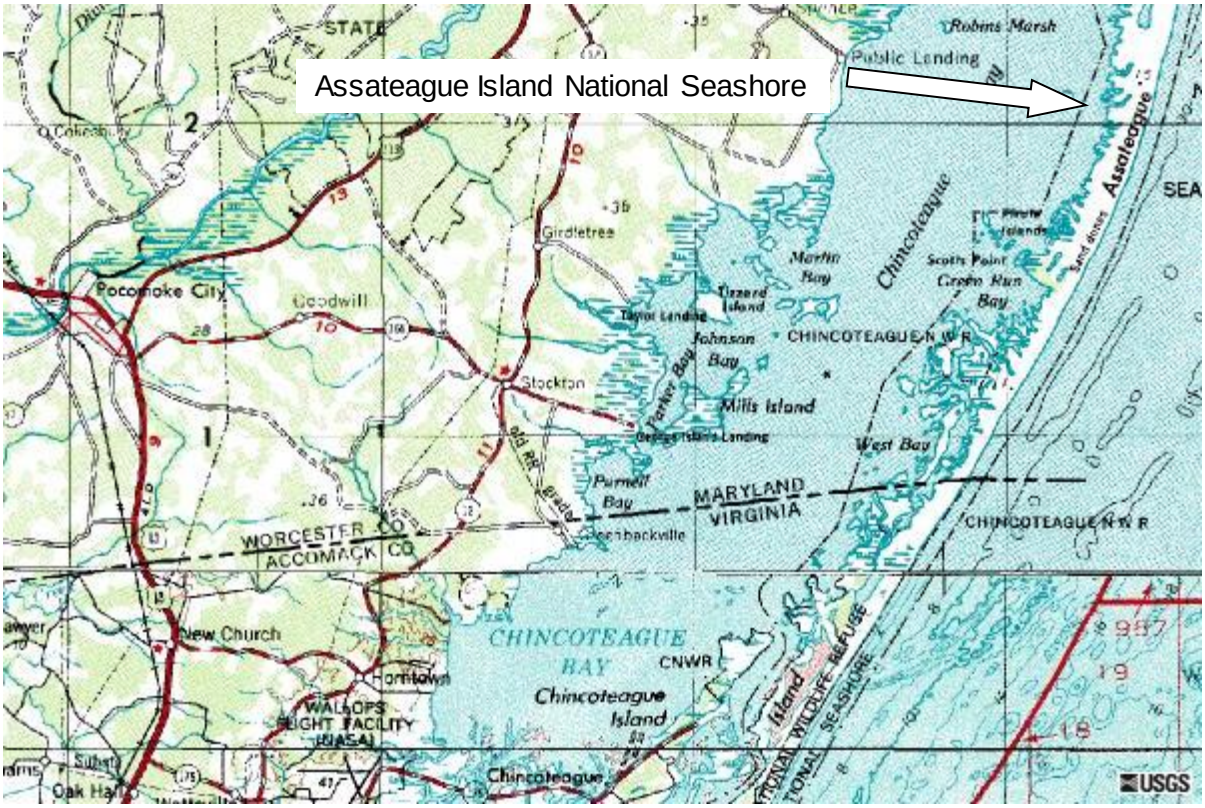


Figure 1. Location of Assateague Island National Seashore.

Park Environmental Attributes

Assateague Island is one of a series of barrier islands ranging from Long Island, New York south to the Gulf of Mexico. It comprises beaches, dunes, maritime shrublands and forests, salt marshes, and subaquatic vegetation. The climate is temperate, with annual rainfall of 44.7 inches, summer

temperatures averaging 83^0 F (high) and 67^0 F (low), and winter temperatures averaging 45^0 F (high) and 28^0 F (low) (www.worldwideclimate.com). The maximum elevation of Assateague Island is 12 feet. The island is influenced by a twice-daily tidal regime. Winter storms and periodic hurricanes cause overwash and occasional island breaches in this dynamic environment.

Barrier islands are generally relatively narrow stretches of sand oriented parallel to the mainland, separated by a lagoon. They are of geologically recent origin, formed by the deposition of sand by ocean currents following the retreat of the glaciers approximately 12,000 years before present. Barrier island formation is generally a result of eustatic sea level rise[2] that caused either drowning of a dune system, forming a lagoon separating the highest dunes from the mainland, or spit detachment, in which the island is formed by headland erosion and sediment transport. The spit is then breached by a major storm causing separation from the mainland (Morang et al. 2002).

[2] Eustatic sea level rise is a result of holocene glacial melting and is unrelated to current climate change

Methods

Note: Nomenclature follows the PLANTS 3.5 Database developed by the Natural Resource Conservation Service in cooperation with the Biota of North America Program (United States Department of Agriculture, National Resources Conservation Service 2004).

Planning and Scoping – Methods, 1994

Assateague Island National Seashore holds the distinction of being the first park to undergo vegetation mapping by the USGS – NPS Vegetation Mapping Program. As such, it was regarded as a pilot project during which mapping and classification methods would be developed. Several discussions took place among staff of the United States Geological Survey (USGS), National Park Service (NPS), and The Nature Conservancy (TNC) regarding methodology for data collection, classification and mapping, as well as setting a timetable for the project. The first field visit to Assateague Island National Seashore was a reconnaissance that occurred in November 1993. A second field visit was conducted in June 1994, and involved staff from TNC, Aerial Information Systems, Inc. (AIS), Environmental Systems Research Institute (ESRI), and Assateague Island National Seashore. AIS was subcontracted by ESRI, the prime contractor, to conduct the photointerpretation for the program. TNC was subcontracted by ESRI to conduct the field sampling effort and to support the development of the then-nascent National Vegetation Classification.

Preliminary Data Collection and Review of Existing Information – Methods, 1994

Leaf-on color infra-red diapositive photos, 1:12,000 scale, were examined in the office to determine the variation in signature types. In the field, different signatures were located and notes on vegetation type were made. Mapping methods were discussed, including the use of multiple acetate overlays to denote vegetation density, cover, and identification. Very little association-level information existed in the USNVC, so a preliminary list of potential alliances was used to identify vegetation in the field. In addition, two publications presenting descriptions of plant communities and flora of the island (Higgins et al. 1971 and Hill 1986) provided a good baseline from which to assemble a list of potential alliances.

Aerial Photography Acquisition and Processing – Methods, 1994

Aerial photography was flown and processed by Photo Science Inc., of Gaithersburg, Maryland. In April 1993, stereo color-infrared aerial photos were collected in five flight lines, producing 215 9x9" diapositives. An additional inland series of 32 photos was also flown on the western shore of Sinepuxent Bay across from the park, but these were not used in this project. The original diapositive film is archived at the USGS Earth Resources Observation and Science (EROS) Center[3].

Field Data Collection and Classification - Methods, 1994

The sample area consisted of the entire mainland area (Maryland portion) of Assateague Island with few sites being inaccessible to sampling. Polygons were selected for sampling based on

[3] 47914 252nd Street, Sioux Falls, SD 57192. Available for order at http://earthexplorer.usgs.gov

environmental factors (primarily beach, foredunes, interdunes, back dunes and salt marsh) as well as vegetation structure (forests, woodlands, shrublands, dwarf-shrublands, herbaceous, and sparse vegetation). Due to the low relief across the island, sufficiently detailed aspect and slope data were not yet available for stratifying the samples[4]. In addition, samples were selected to be geographically dispersed to capture the variability of each of the vegetation types. The draft list of alliances was referenced during reconnaisance to identify sampling locations of all alliances that were encountered.

Field Survey

Sample plots were subjectively located within polygons so as to include representative expressions of the stand, following the methods of Mueller-Dombois and Ellenberg (1974). The number of sample plots per vegetation type varied with the total coverage, number of polygons, and variability of each type. All vegetation data were collected following NatureServe's accepted natural heritage sampling protocols (Sneddon 1991), with 20-m x 20-m plots in forests and woodlands and 5-m x 5-m plots in herbaceous vegetation. Appendix B includes a sample of the field form. An ad hoc field coding system was employed, using the aerial photo number, the field worker's initials, and sequential numbers indicating the number of plots taken on that photo. The vegetation was visually divided into up to eight strata: emergent trees (variable height), tree canopy (variable height), tree subcanopy (>5m in height), tall shrub (2-5m), short shrub (<2m), herbaceous, non-vascular, and vines. 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. In addition to floristic information, the following environmental variables were recorded at each plot: slope, aspect, topographic position, and hydrologic regime. Surface soils, where readily visible, were described by stoniness, average soil texture, and soil drainage. 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. The vegetation profile and topographic position were sketched in cross-section to represent the location and setting of the plot. Photos were taken of most vegetation types[5]. The location of 100 of the plots was recorded with a PLGR global positioning system (GPS) unit. The original GPS locations were not differentially corrected, and were later lost. Fourteen plots have neither GPS locations nor mylar overlays, so no location information exists for these plots. However, for the remaining 100 plots, the field ecologists marked their positions on carefully registered mylar overlays on the diapositive aerial photos while in the field. Positions were estimated by locating landscape features on the photos that could be identified on the ground, such as trail crossings, isolated trees, sandy openings, and the like. The mylar overlays were not scanned, but the locations could be easily recognized on the digital aerial photos at high resolution, and a shapefile was created by manually digitizing these locations.

[4] LIDAR mapping of Assateague began in 1995.

[5] The collection of slides is incomplete, and location information is lacking.

A total of 114 plots was taken across Assateague Island National Seashore (Figures 2-14), averaging approximately 5 plots per vegetation type. (Note that plot numbers in these figures refer to the PLOTS database code rather than the plot code assigned in the field.)

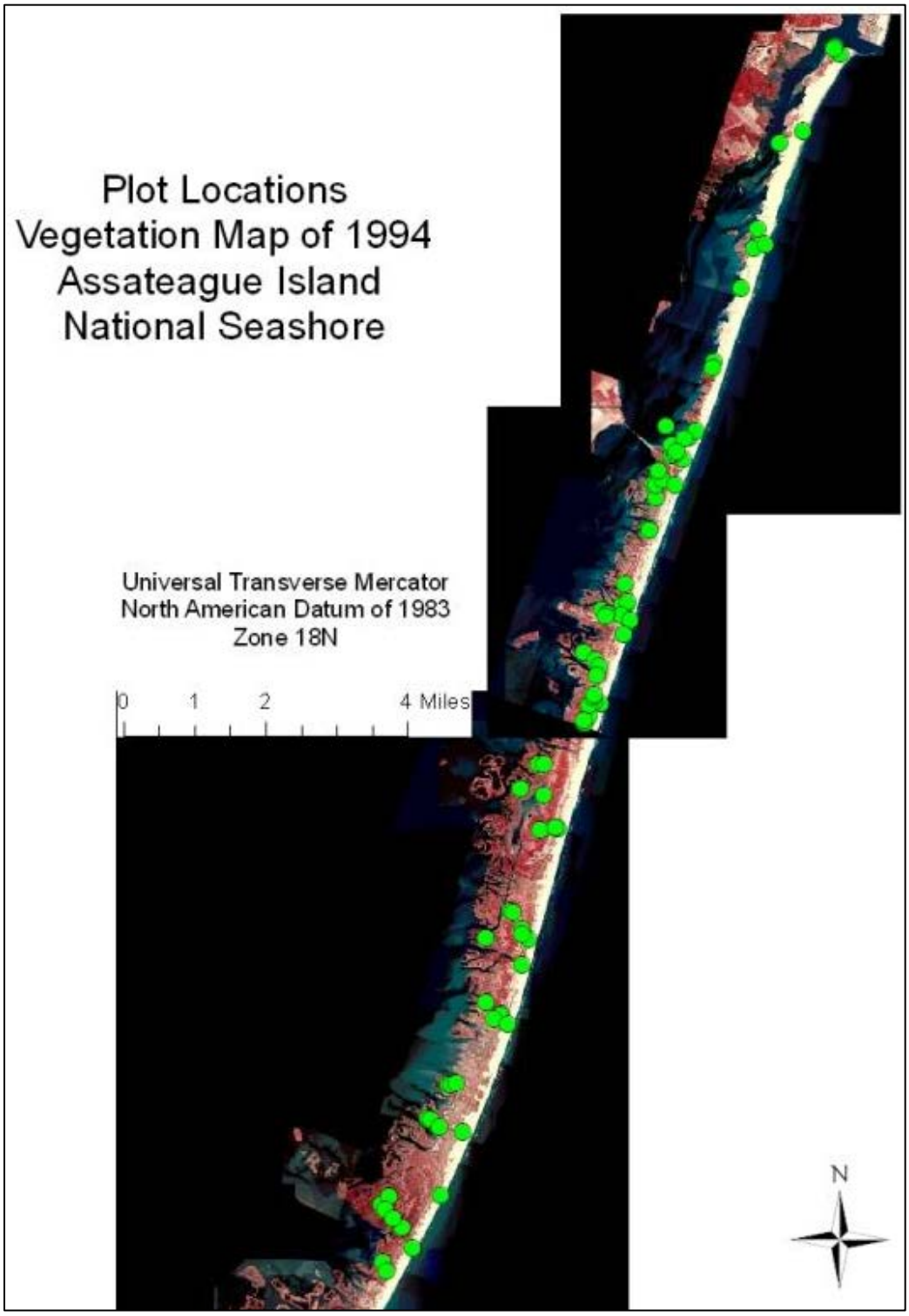


Figure 2. Plot locations of Assateague Island, overview.

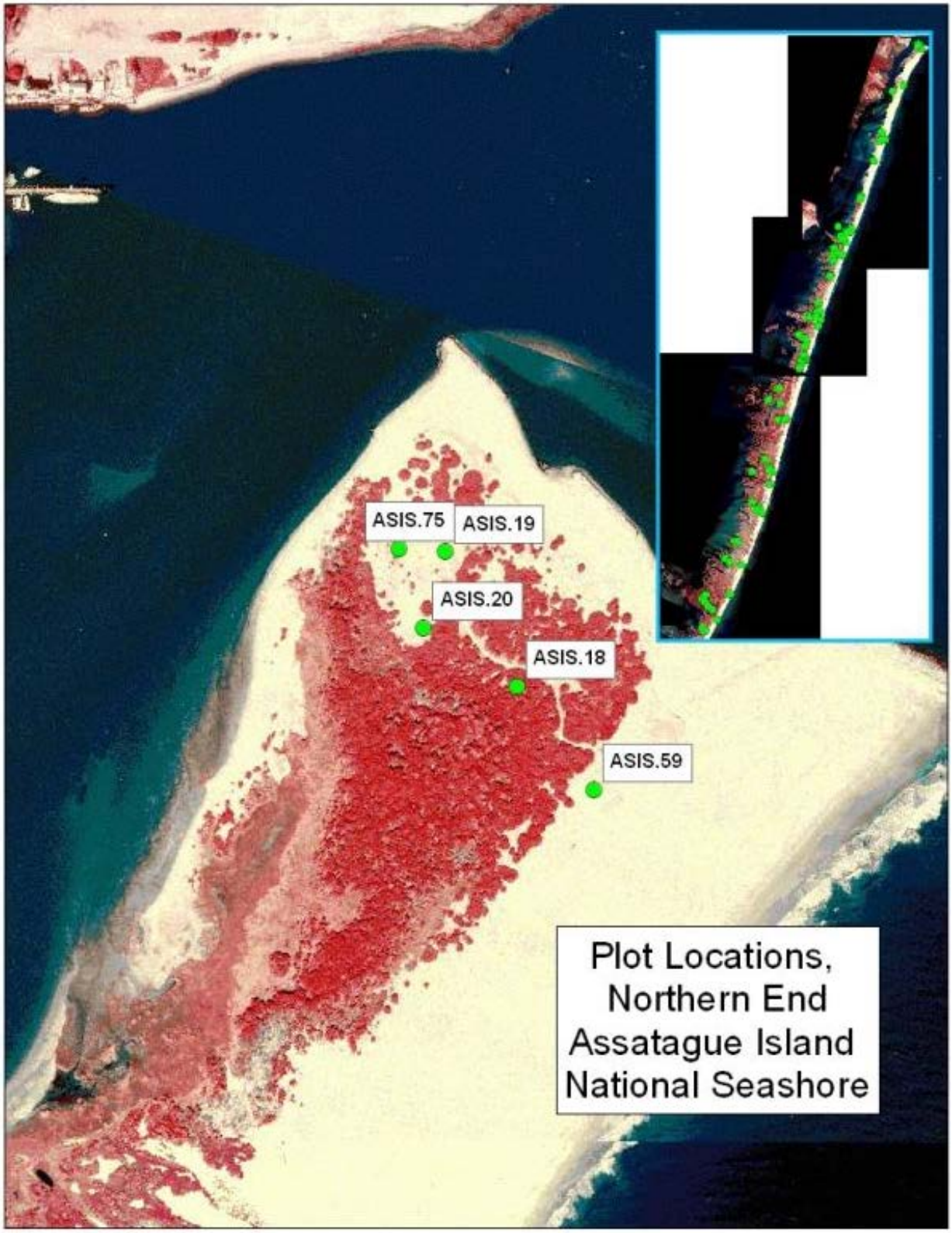


Figure 3. Plot locations, northern end.

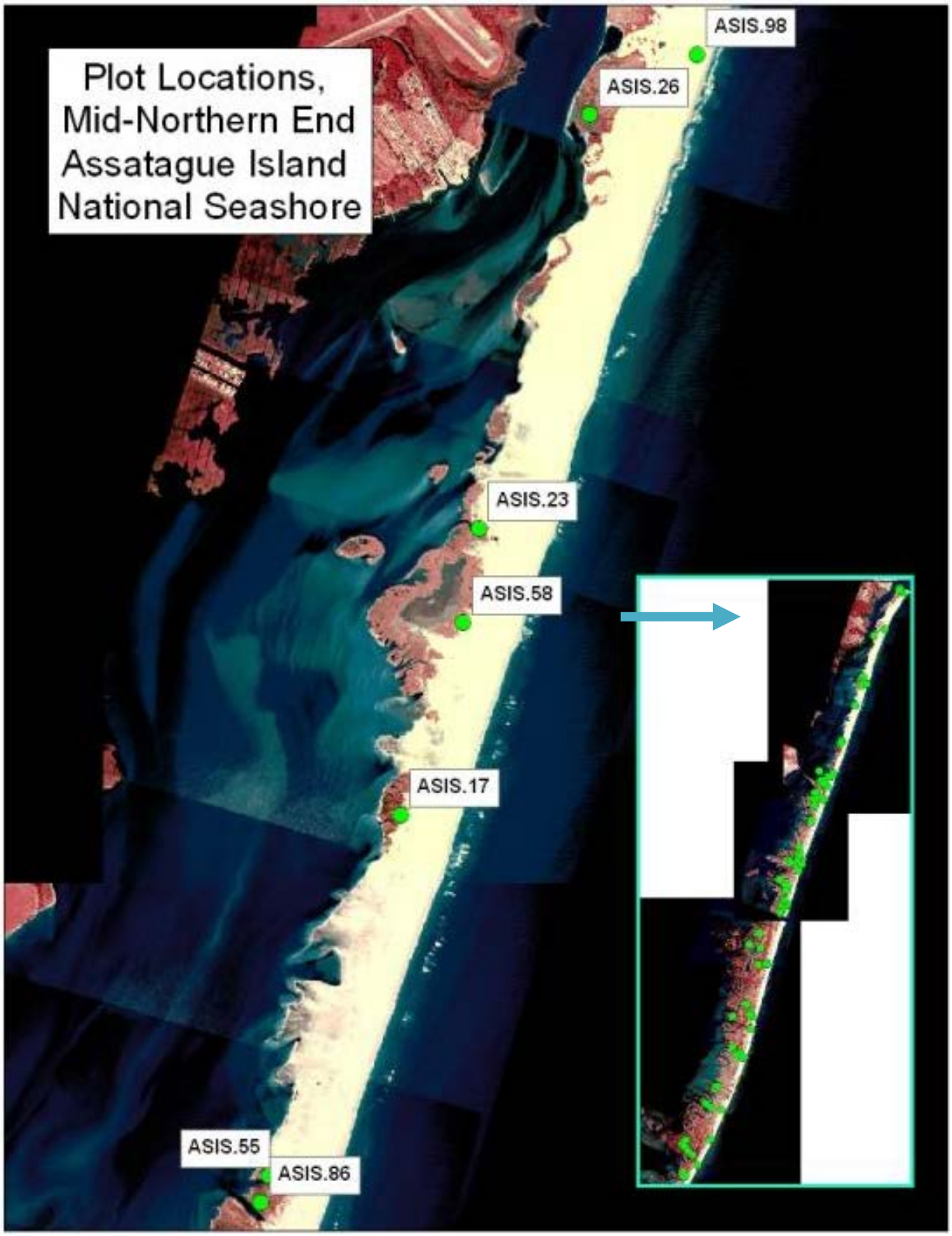


Figure 4. Plot locations, mid-northern end.

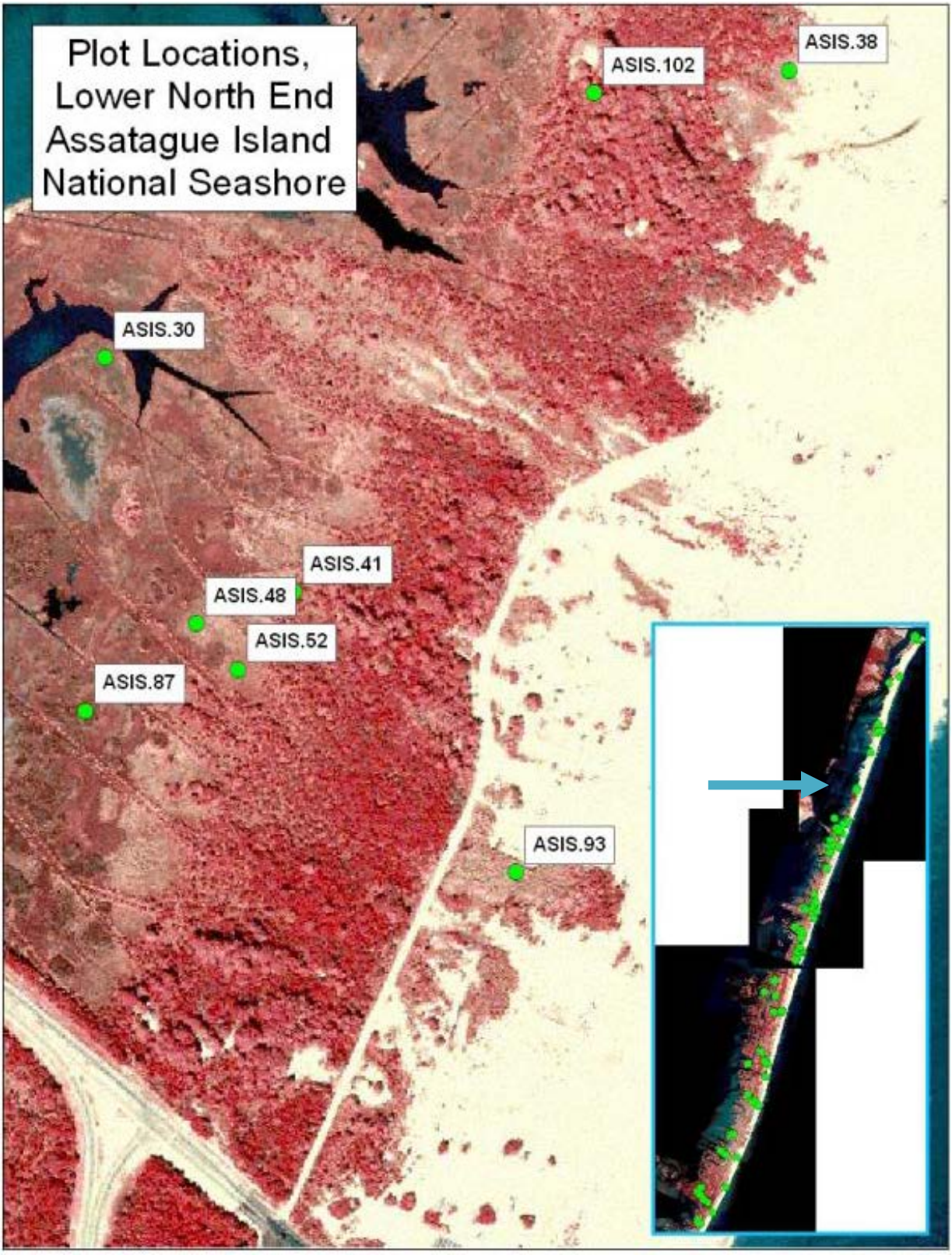


Figure 5. Plot Locations, lower north end.

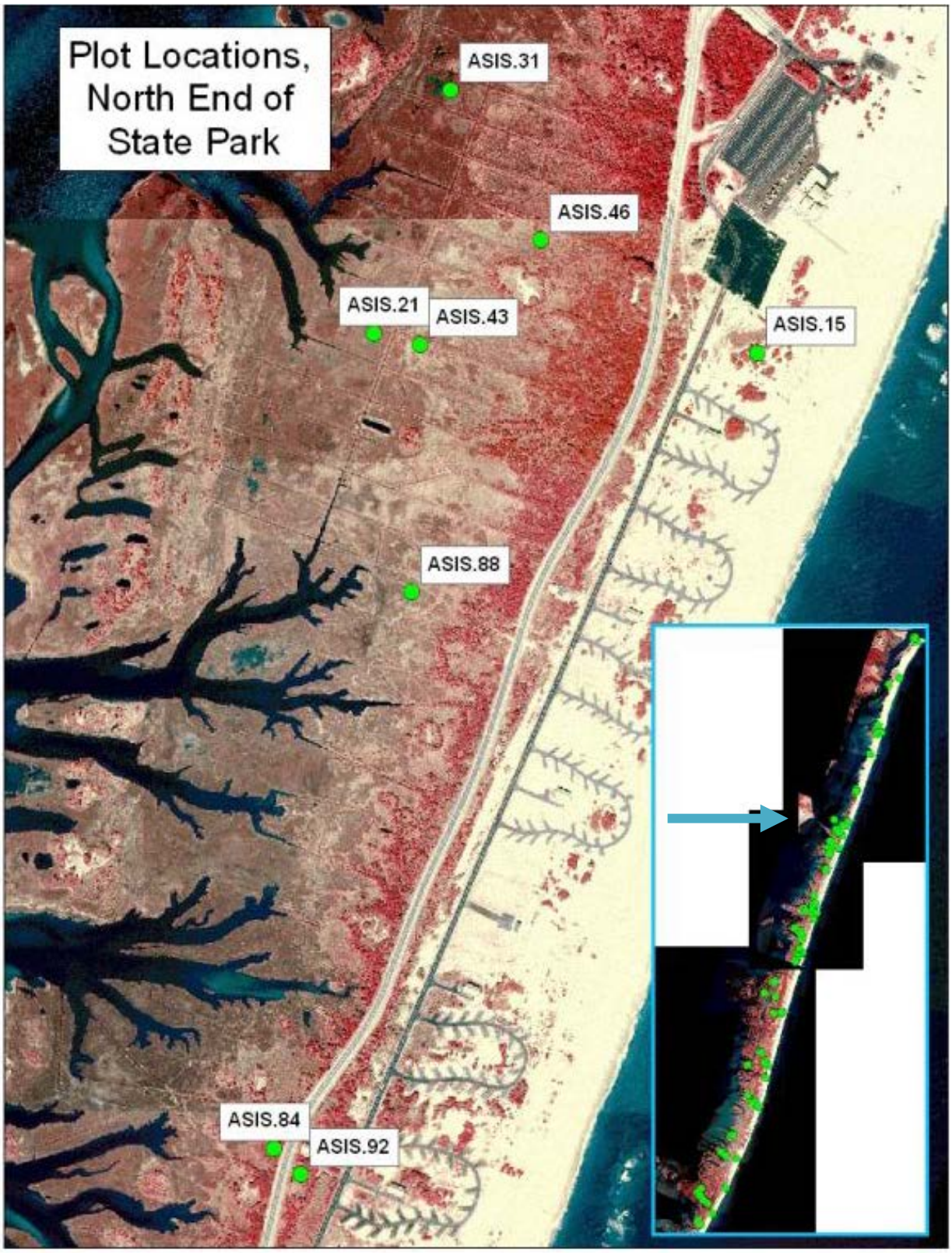


Figure 6. Plot Locations, north end of State Park.

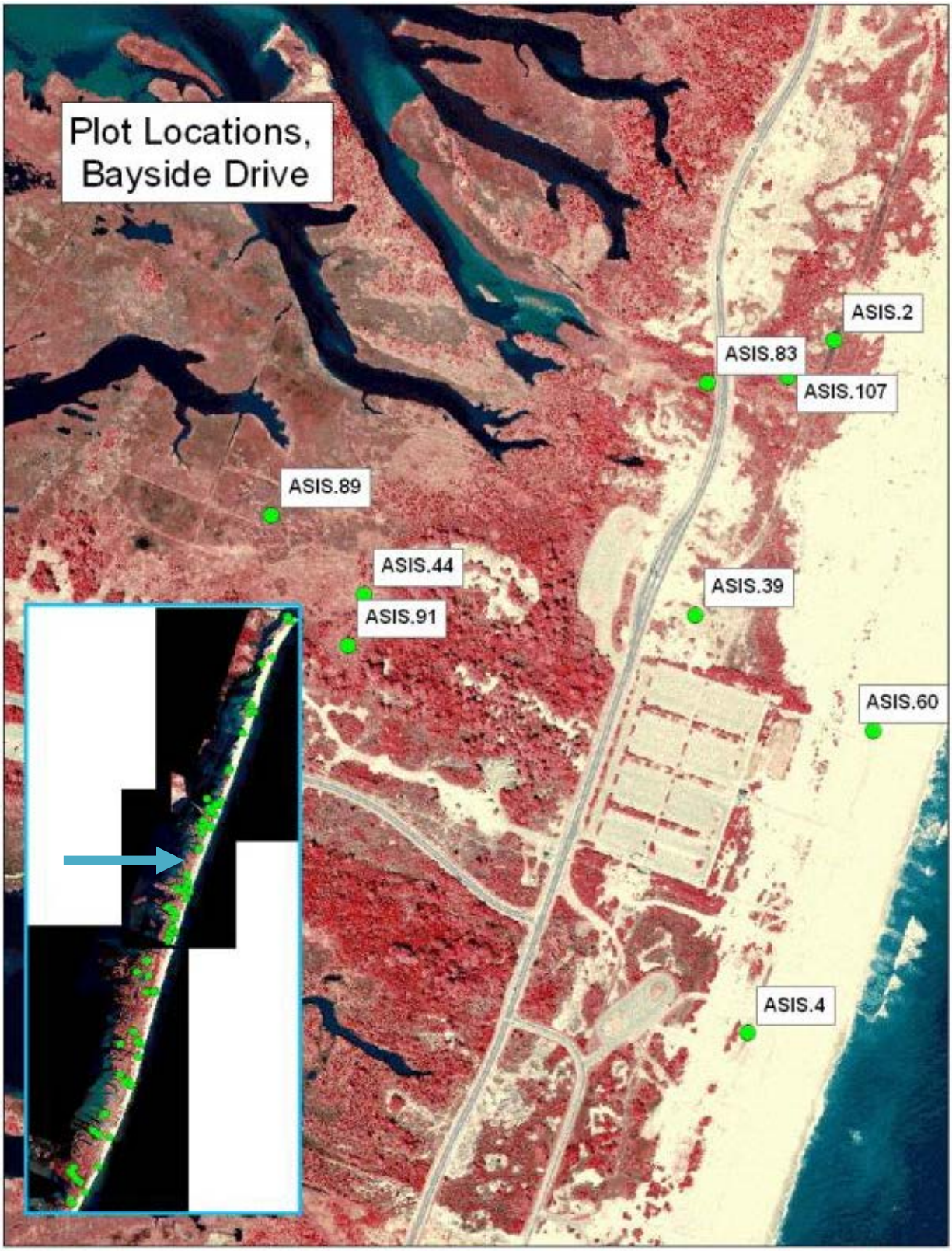


Figure 7. Plot Locations, Bayside Drive.



Figure 8. Plot Locations, Old Ferry Landing.

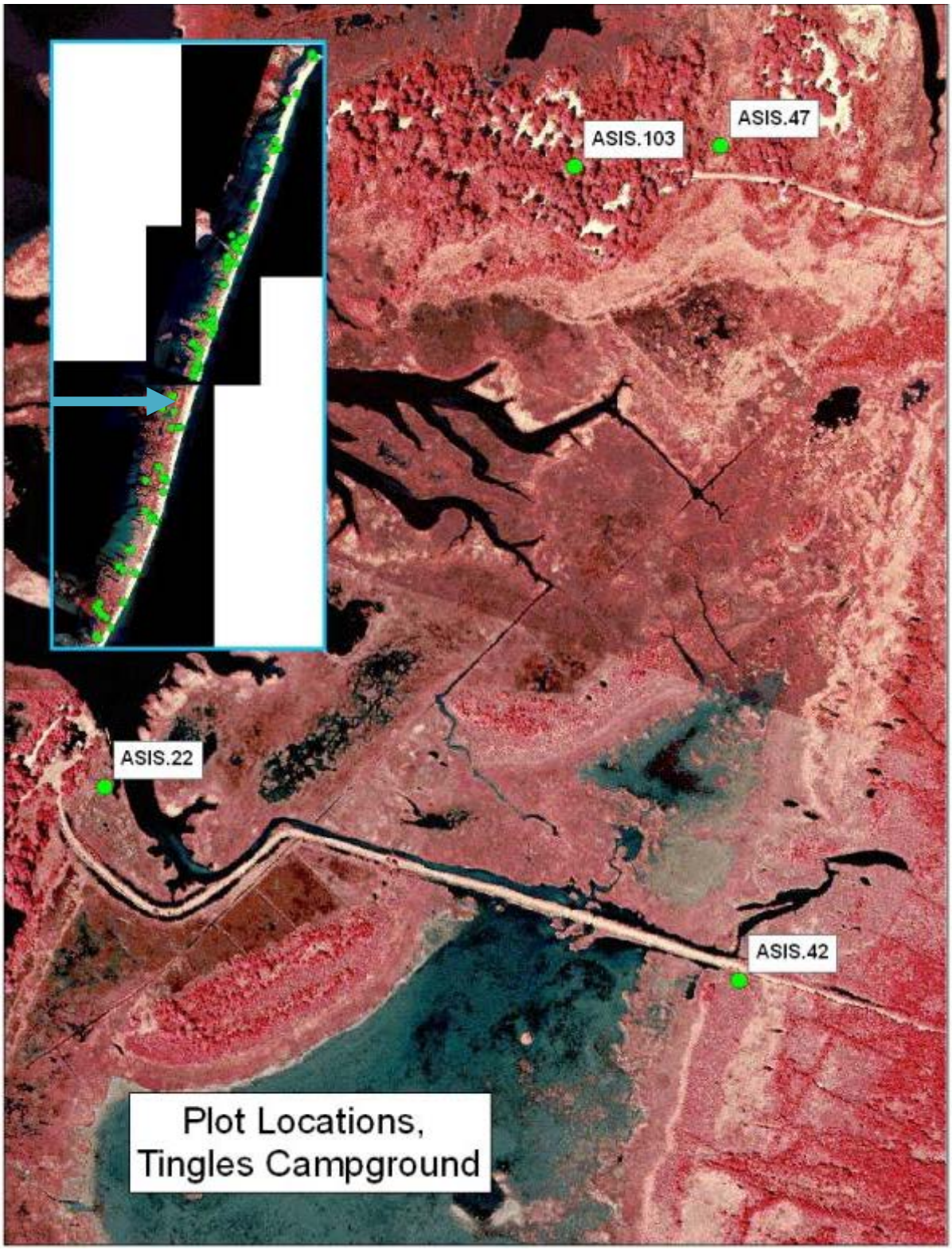


Figure 9. Plot Locations, Tingles Campground.

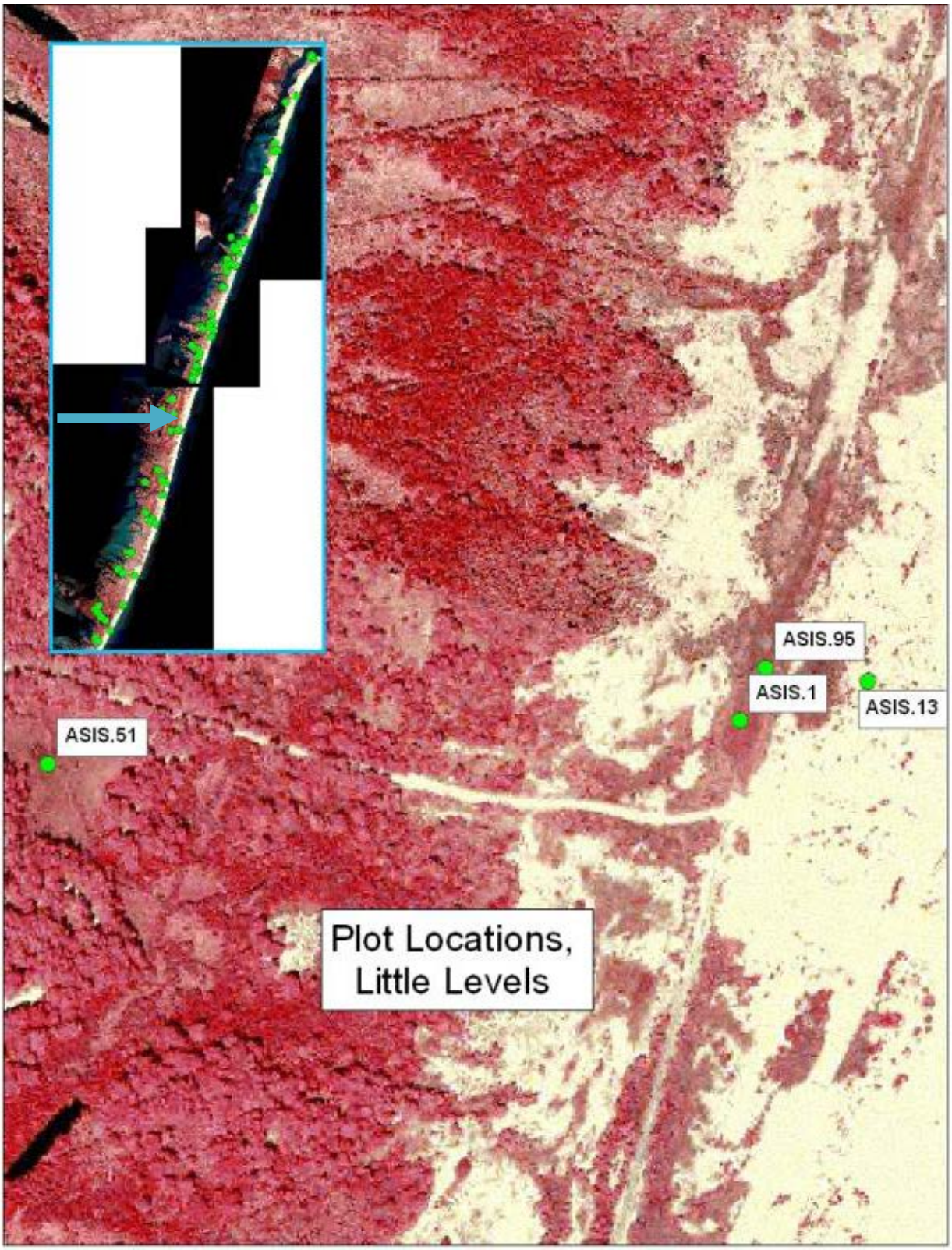


Figure 10. Plot Locations, Little Levels.

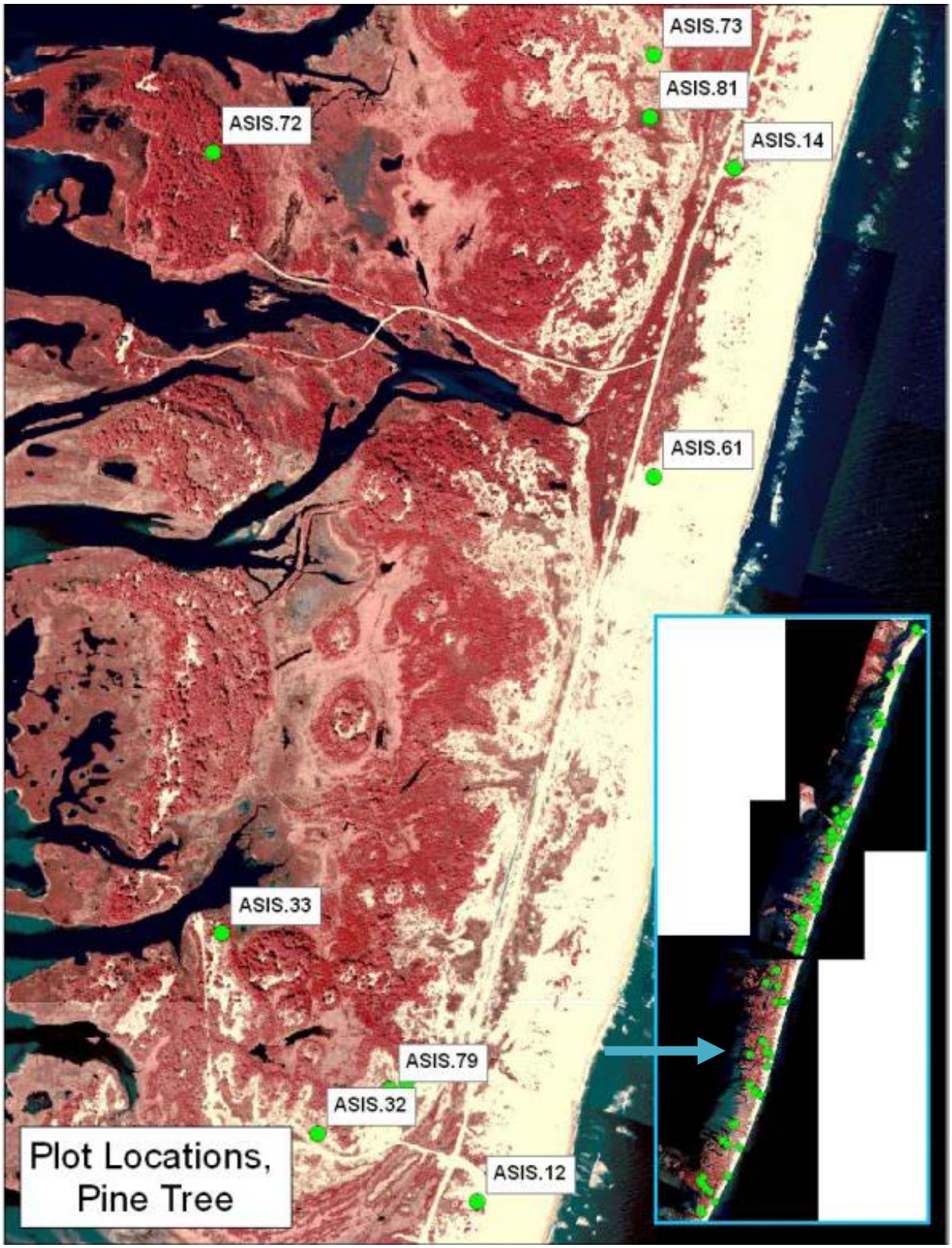


Figure 11. Plot Locations, Pine Tree.

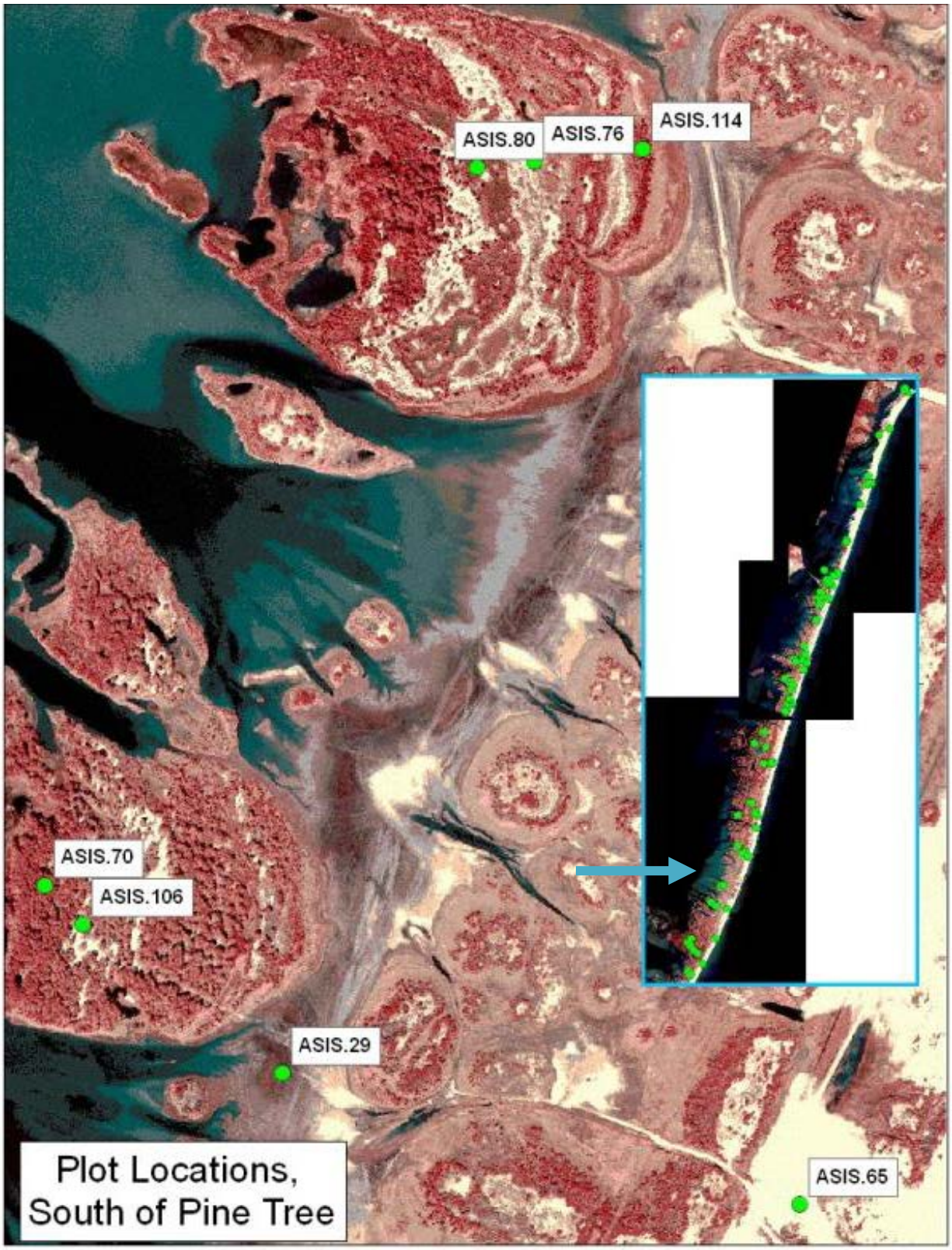


Figure 12. Plot Locations, south of Pine Tree.

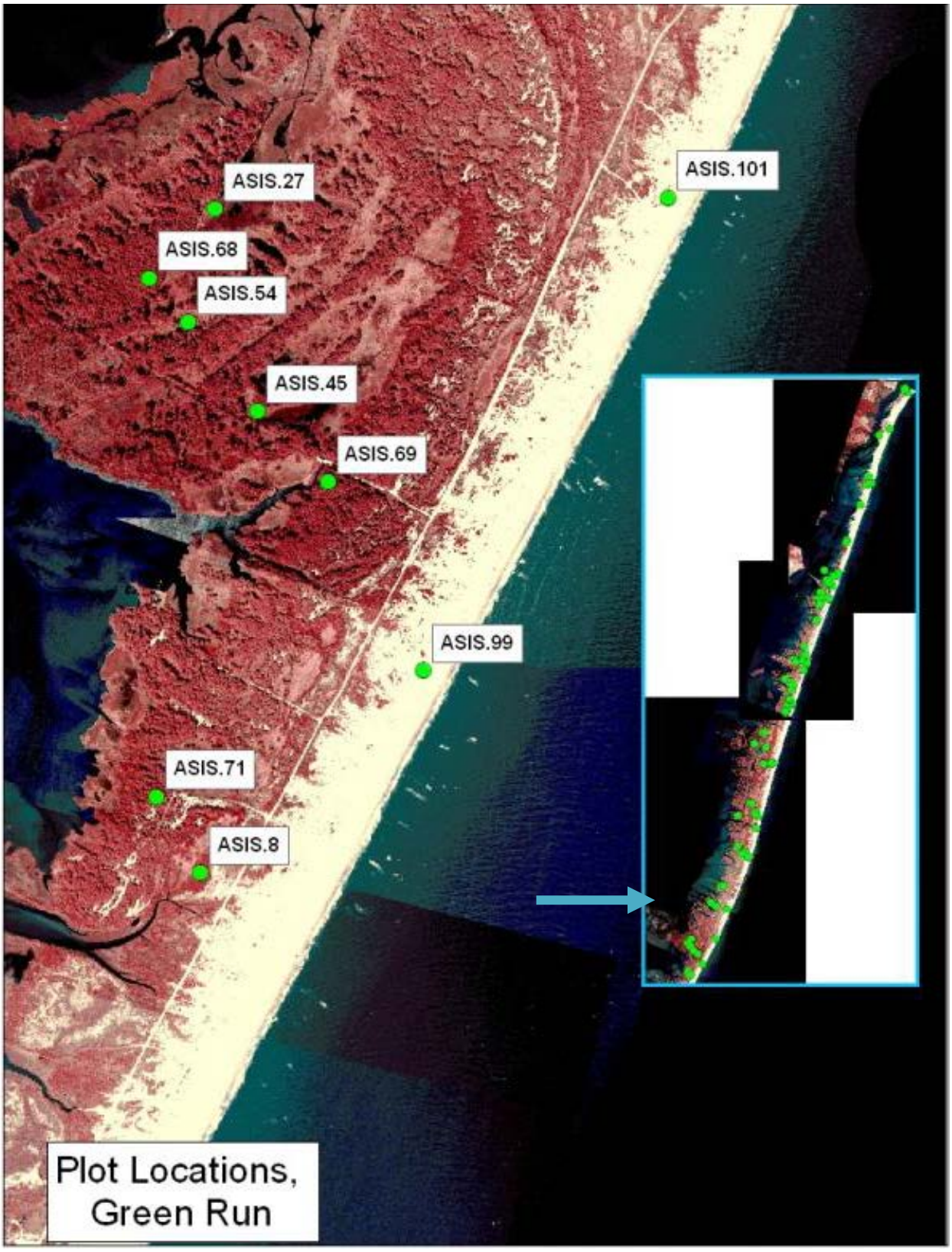


Figure 13. Plot Locations, Green Run.

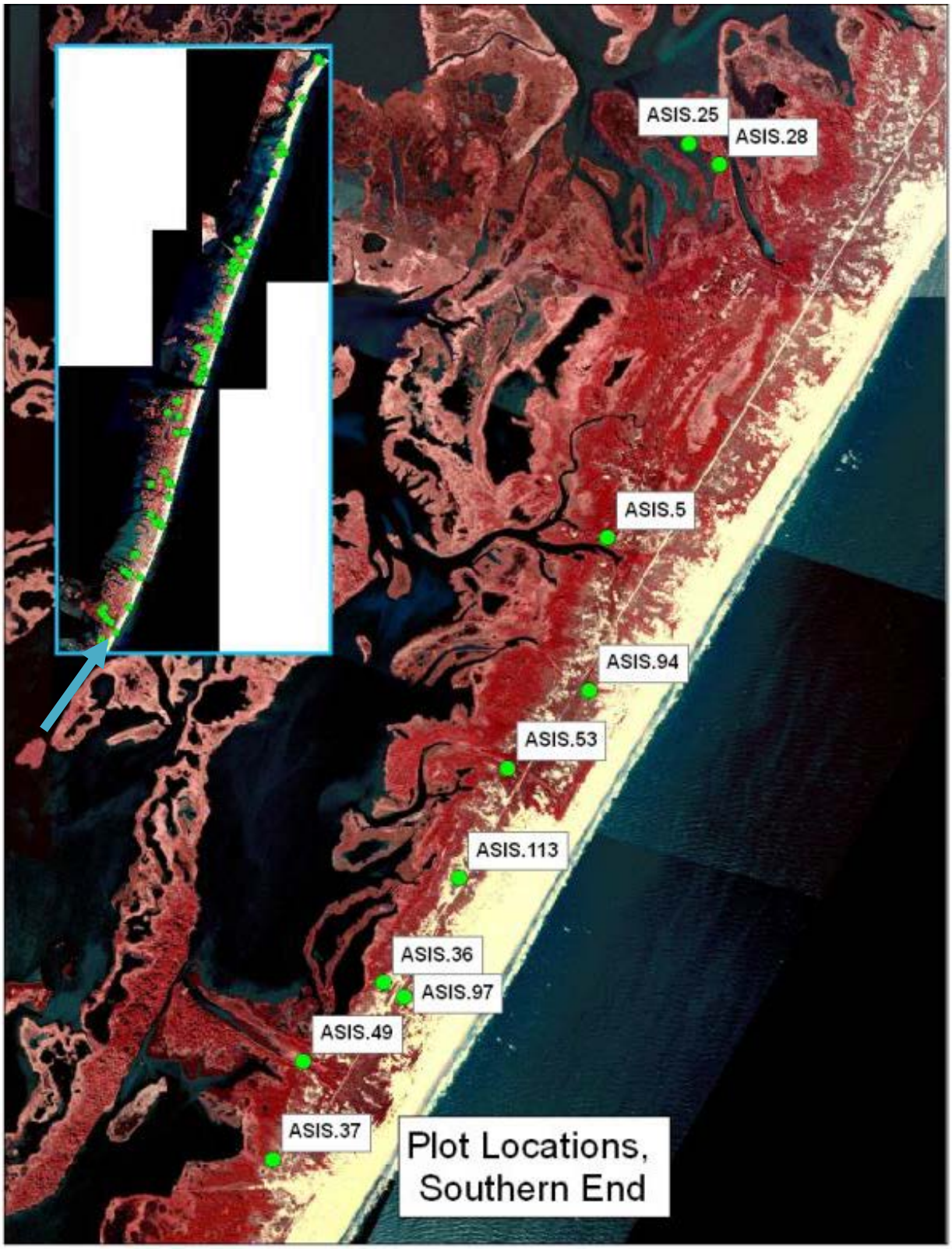


Figure 14. Plot Locations, southern end.

Vegetation Classification and Characterization – Methods, 1994

Original plot data were entered in Cornell condensed format, and analyzed using Two-Way Indicator Species Analysis (TWINSPAN) (Hill 1979). Initial results of the analysis were re-ordered slightly to group plots of similar physiognomy, to separate upland from wetland plots, and finally, by floristic similarity, in keeping with the Alliance classification of Sneddon and Anderson (1994). In some cases, single plots were different enough floristically from all other plots that these were also recognized as separate alliances. The alliances that were recognized in 1994 represented geographically broad units, and the association level of the nascent classification hierarchy had not yet been developed. However, the concept of "community" (later to be recognized as "association"), a more geographically limited portion of the alliance, was in development. For example, the *Myrica pensylvancia – Prunus maritima* Shrubland Alliance was known to occur from North Carolina north to southern Maine, but more than one community was thought to comprise this alliance. These communities were surmised to be geographically discreet, so that only one community of the alliance occurred at Assateague Island National Seashore, the *Myrica pensylvanica / Diodia teres* Shrubland. This 1:1 correspondence between alliance and community at the park allowed for the assignment of provisional community names that were later recognized as USNVC associations.

Each group of plots representing an individual alliance was assigned a provisional community name. A detailed description of the community was written based on the plot data, as well as on literature sources that described similarly scaled vegetation. Descriptions included USNVC hierarchical levels, classification confidence, range, environmental setting, most abundant species, diagnostic species, conservation rank, vegetation description, other noteworthy species, conservation rank, rank justification, comments, references, and the plot numbers assigned to that type. This information reflected what was thought to be the global range of variation of the type, based largely on literature. Because vegetation of the association varies to some degree among sites, an additional description of the type based only on the plot data and literature sources referring only to Assateague Island National Seashore was developed, referred to as the Local Description.

Storage of plot data

Subsequent to the ASIS vegetation classification and mapping project, the NPS Vegetation Mapping Inventory Program developed a database to house plot data. The database, named PLOTS 2.0, was built on a Microsoft Access platform. The database was pre-populated with database codes in the format ASIS.xxx, and these codes were in turn assigned to plot data sheets as they were entered into the database. Table 1 provides the PLOTS database code, community name, and corresponding field code.

Table 1. PLOTS database code, classified community name, and corresponding field plot codes, using 1994 classification.

Database Plot Code	Classified Community Name	Field plot code
ASIS.1	*Scirpus pungens, Fimbristylis castanea* Herbaceous Vegetation	47-AB-04
ASIS.10	*Juncus dichotomous, Drosera intermedia* Herbaceous Vegetation	42CEF01
ASIS.11	*Juncus dichotomous, Drosera intermedia* Herbaceous Vegetation	42CEF03
ASIS.12	*Myrica pensylvanica / Diodia teres* Shrubland	57AB08
ASIS.13	*Myrica pensylvanica / Diodia teres* Shrubland	47AB06
ASIS.14	*Myrica pensylvanica / Diodia teres* Shrubland	52AB06
ASIS.15	*Myrica pensylvanica / Diodia teres* Shrubland	32CEF01
ASIS.16	*Myrica pensylvanica / Diodia teres* Shrubland	77AB05
ASIS.17	*Myrica pensylvanica / Diodia teres* Shrubland	22RR01
ASIS.18	*Myrica pensylvanica / Diodia teres* Shrubland	12RR04
ASIS.19	*Myrica pensylvanica / Diodia teres* Shrubland	12RR02
ASIS.2	*Scirpus pungens, Fimbristylis castanea* Herbaceous Vegetation	37RR04
ASIS.20	*Myrica pensylvanica / Diodia teres* Shrubland	12RR03
ASIS.21	*Spartina alterniflora / Ascophyllum nodosum* Herbaceous Vegetation	32RR12
ASIS.22	*Spartina alterniflora / Ascophyllum nodosum* Herbaceous Vegetation	47RR02
ASIS.23	*Spartina alterniflora / Ascophyllum nodosum* Herbaceous Vegetation	22RR02
ASIS.24	*Spartina alterniflora / Ascophyllum nodosum* Herbaceous Vegetation	32RR15
ASIS.25	*Spartina alterniflora / Ascophyllum nodosum* Herbaceous Vegetation	72AB02
ASIS.26	*Spartina alterniflora / Ascophyllum nodosum* Herbaceous Vegetation	17RR01
ASIS.27	*Spartina alterniflora / Ascophyllum nodosum Herbaceous Vegetation*	67AB07
ASIS.28	*Salicornia spp., Sarcocornia perennis, Spartina alterniflora Herbaceous Vegetation*	72AB03
ASIS.29	*Salicornia spp., Sarcocornia perennis, Spartina alterniflora Herbaceous Vegetation*	62AB03
ASIS.3	*Scirpus pungens, Fimbristylis castanea Herbaceous Vegetation*	TNC12
ASIS.30	*Salicornia spp., Sarcocornia perennis, Spartina alterniflora Herbaceous Vegetation*	32RR08
ASIS.31	*Salicornia spp., Sarcocornia perennis, Spartina alterniflora Herbaceous Vegetation*	32RR13
ASIS.32	*Smilax glauca, Toxicodendron radicans Vine Shrubland*	57AB07
ASIS.33	*Smilax glauca, Toxicodendron radicans Vine Shrubland*	57AB06
ASIS.34	*Smilax glauca, Toxicodendron radicans Vine Shrubland*	57AB05
ASIS.35	*Smilax glauca, Toxicodendron radicans Vine Shrubland*	42RR02
ASIS.36	*Myrica pensylvanica / Schizachyrium scoparium ssp. littorale, Eupatorium hyssopifolium Sparse Shrubland*	77AB01
ASIS.37	*Myrica pensylvanica / Schizachyrium scoparium ssp. littorale, Eupatorium hyssopifolium Sparse Shrubland*	77AB03

Table 1 (continued). PLOTS database code, classified community name, and corresponding field plot codes, using 1994 classification.

Database Plot Code	Classified Community Name	Field plot code
ASIS.38	*Myrica pensylvanica / Schizachyrium scoparium ssp. littorale, Eupatorium hyssopifolium* Sparse Shrubland	32RR01
ASIS.39	*Myrica pensylvanica / Schizachyrium scoparium ssp. littorale, Eupatorium hyssopifolium* Sparse Shrubland	37RR05
ASIS.4	*Scirpus pungens, Fimbristylis castanea* Herbaceous Vegetation	TNC18
ASIS.40	*Myrica pensylvanica / Schizachyrium scoparium ssp. littorale, Eupatorium hyssopifolium* Sparse Shrubland	TNC4
ASIS.41	*Baccharis halmifolia, Iva frutescens / Spartina patens* Shrubland	32RR06
ASIS.42	*Baccharis halmifolia, Iva frutescens / Spartina patens* Shrubland	47AB03
ASIS.43	*Baccharis halmifolia, Iva frutescens / Spartina patens* Shrubland	32RR11
ASIS.44	*Baccharis halmifolia, Iva frutescens / Spartina patens* Shrubland	37AB02
ASIS.45	*Baccharis halmifolia, Iva frutescens / Spartina patens* Shrubland	67AB08
ASIS.46	*Baccharis halmifolia, Iva frutescens / Spartina patens* Shrubland	32RR10
ASIS.47	*Spartina patens, Distichilis spicata, Borrichia frutescens* Herbaceous Vegetation	47AB02
ASIS.48	*Spartina patens, Distichilis spicata, Borrichia frutescens* Herbaceous Vegetation	32RR05
ASIS.49	*Spartina patens, Distichilis spicata, Borrichia frutescens* Herbaceous Vegetation	77AB02
ASIS.5	*Prunus serotina / Myrica cerifera / Smilax rotundifolia* Forest	72AB01
ASIS.50	*Spartina patens, Distichilis spicata, Borrichia frutescens* Herbaceous Vegetation	TNC11
ASIS.51	*Spartina patens, Distichilis spicata, Borrichia frutescens* Herbaceous Vegetation	47RR01
ASIS.52	*Spartina patens, Distichilis spicata, Borrichia frutescens* Herbaceous Vegetation	32RR07
ASIS.53	*Spartina patens, Distichilis spicata, Borrichia frutescens* Herbaceous Vegetation	77AB07
ASIS.54	*Spartina patens, Distichilis spicata, Borrichia frutescens* Herbaceous Vegetation	67AB02
ASIS.55	*Spartina patens, Scirpus pungens, Solidago sempervirens* (Upland) Herbaceous Vegetation	27RR01
ASIS.56	*Spartina patens, Distichilis spicata, Borrichia frutescens* Herbaceous Vegetation	TNC15
ASIS.57	*Spartina patens, Distichilis spicata, Borrichia frutescens* Herbaceous Vegetation	TNC17
ASIS.58	*Spartina patens, Scirpus pungens, Solidago sempervirens* (Upland) Herbaceous Vegetation	22RR03
ASIS.59	*Ammophila brevigulata, Panicum (amarum, amarulum)* Herbaceous Vegetation	12RR05
ASIS.6	*Prunus serotina / Myrica cerifera / Smilax rotundifolia* Forest	42AB03

Table 1 (continued). PLOTS database code, classified community name, and corresponding field plot codes, using 1994 classification.

Database Plot Code	*Classified Community Name*	Field plot code
ASIS.60	*Ammophila brevigulata, Panicum (amarum, amarulum)* Herbaceous Vegetation	37RR03
ASIS.61	*Ammophila brevigulata, Panicum (amarum, amarulum)* Herbaceous Vegetation	52AB05
ASIS.62	*Ammophila brevigulata, Panicum (amarum, amarulum)* Herbaceous Vegetation	TNC16
ASIS.63	*Ammophila brevigulata, Panicum (amarum, amarulum)* Herbaceous Vegetation	TNC14
ASIS.64	*Ammophila brevigulata, Panicum (amarum, amarulum)* Herbaceous Vegetation	TNC8
ASIS.65	*Ammophila brevigulata, Panicum (amarum, amarulum)* Herbaceous Vegetation	62AB04
ASIS.66	*Ammophila brevigulata, Panicum (amarum, amarulum)* Herbaceous Vegetation	32RR02
ASIS.67[1]	*Spartina patens, Scirpus pungens, Solidago sempervirens* (Upland) Herbaceous Vegetation	TNC13
ASIS.68	*Pinus taeda / Myrica cerifera /Vitis rotundifolia* Forest	67AB01
ASIS.69	*Pinus taeda / Myrica cerifera /Vitis rotundifolia* Forest	67AB06
ASIS.7	*Prunus serotina / Myrica cerifera / Smilax rotundifolia* Forest	42AB01
ASIS.70	*Pinus taeda / Myrica cerifera /Vitis rotundifolia* Forest	62AB01
ASIS.71	*Pinus taeda / Myrica cerifera /Vitis rotundifolia* Forest	67AB04
ASIS.72	*Pinus taeda / Myrica cerifera /Vitis rotundifolia* Forest	52AB07
ASIS.73	*Hudsonia tomentosa / Panicum (amarum, amarulum)* Dwarf-shrubland	52AB02
ASIS.74	*Hudsonia tomentosa / Panicum (amarum, amarulum)* Dwarf-shrubland	42AB02
ASIS.75	*Hudsonia tomentosa / Panicum (amarum, amarulum)* Dwarf-shrubland	12RR01
ASIS.76	*Hudsonia tomentosa / Panicum (amarum, amarulum)* Dwarf-shrubland	57AB02
ASIS.77	*Hudsonia tomentosa / Panicum (amarum, amarulum)* Dwarf-shrubland	TNC10
ASIS.78	*Pinus taeda / Myrica cerifera / Osmunda regalis* Forest	42AB05
ASIS.79	*Myrica (cerifera, pensylvanica, Vaccinium corymbosum* Shrubland	57AB04
ASIS.8	*Myrica cerifera / Hydrocotyle spp.* Shrubland	67AB05
ASIS.80	*Myrica (cerifera, pensylvanica, Vaccinium corymbosum* Shrubland	57AB01
ASIS.81	*Myrica (cerifera, pensylvanica, Vaccinium corymbosum* Shrubland	52AB01
ASIS.82	*Myrica (cerifera, pensylvanica, Vaccinium corymbosum* Shrubland	42CEF02
ASIS.83	*Typha angustifolia, Hibiscus moscheutos* Herbaceous Vegetation	37AB04
ASIS.84	*Typha angustifolia, Hibiscus moscheutos* Herbaceous Vegetation	37RR02
ASIS.9	*Myrica cerifera / Hydrocotyle spp.* Shrubland	37AB06

Table 1 (continued). PLOTS database code, classified community name, and corresponding field plot codes, using 1994 classification.

Database Plot Code	*Classified Community Name*	Field plot code
ASIS.85	*Typha angustifolia, Hibiscus moscheutos* Herbaceous Vegetation	42RR03
ASIS.86	*Juncus roemerianus* Herbaceous Vegetation	27RR02
ASIS.87	*Juncus roemerianus* Herbaceous Vegetation	32RR09
ASIS.88	*Juncus roemerianus* Herbaceous Vegetation	32RR14
ASIS.89	*Juncus roemerianus* Herbaceous Vegetation	37AB01
ASIS.90	*Juncus roemerianus* Herbaceous Vegetation	42RR01
ASIS.91	*Phragmites australis* Eastern North America Temperate Semi-natural Herbaceous Vegetation	37AB03
ASIS.92	*Phragmites australis* Herbaceous Vegetation	37RR01
ASIS.93	*Phragmites australis* Herbaceous Vegetation	32RR04
ASIS.94	*Panicum virgatum, Spartina patens* Herbaceous Vegetation	47AB08
ASIS.95	*Panicum virgatum, Spartina patens* Herbaceous Vegetation	47AB05
ASIS.96	*Panicum virgatum, Spartina patens* Herbaceous Vegetation	52AB04
ASIS.97	*Panicum virgatum, Spartina patens* Herbaceous Vegetation	77AB04
ASIS.98	*Cakile edentula ssp. edentula – Salsola caroliniana* Sparse Vegetation	17RR02
ASIS.99	*Cakile edentula ssp. edentula – Salsola caroliniana* Sparse Vegetation	67AB03
ASIS.100	*Cakile edentula ssp. edentula – Salsola caroliniana* Sparse Vegetation	22RR04
ASIS.101	*Cakile edentula ssp. edentula – Salsola caroliniana* Sparse Vegetation	62AB05
ASIS.102	*Pinus taeda / Hudsonia tomentosa* Woodland	32RR03
ASIS.103	*Pinus taeda / Hudsonia tomentosa* Woodland	47AB01
ASIS.104	*Pinus taeda / Hudsonia tomentosa* Woodland	52AB03
ASIS.105	*Pinus taeda / Hudsonia tomentosa* Woodland	42AB04
ASIS.106	*Pinus taeda / Hudsonia tomentosa* Woodland	62AB02
ASIS.107	*Myrica cerifera, Baccharis halimifolia / Spartina patens* Shrubland	37AB05
ASIS.108	*Myrica cerifera, Baccharis halimifolia / Spartina patens* Shrubland	TNC09
ASIS.109	*Myrica cerifera, Baccharis halimifolia / Spartina patens* Shrubland	TNC02
ASIS.110	*Myrica cerifera, Baccharis halimifolia / Spartina patens* Shrubland	TNC07
ASIS.111	*Myrica cerifera, Baccharis halimifolia / Spartina patens* Shrubland	TNC03
ASIS.112	*Myrica cerifera, Baccharis halimifolia / Spartina patens* Shrubland	TNC01
ASIS.113[2]	*Myrica cerifera, Baccharis halimifolia / Spartina patens* Shrubland	77AB06
ASIS.114	*Myrica cerifera, Baccharis halimifolia / Spartina patens* Shrubland	57AB03

[1] Reclassified to *Ammophila breviligulata - Panicum amarum* var. *amarum* Herbaceous Vegetation

[2] Reclassified to *Spartina patens - Schoenoplectus pungens - Solidago sempervirens* Herbaceous Vegetation

Photo Interpretation – Methods, 1994

The following are excerpts of a complete project report produced by the mapping firm, Aerial Information Systems of Redlands, California. The full report is attached as Appendix 1.

Preparation – Methods, 1994

Upon receipt of the project materials, they were organized and prepared for the mapping effort. Color-infrared (CIR), 1:12,000 scale, stereo-paired aerial imagery, dated October 1993, was used for the photointerpretation effort. A flight line index was created, showing the relationship of the photos to the study area. The photos were compared to one another to ensure there were no gaps in the imagery and that there was full coverage of the study area. A total of 25 photos (non-stereo pairs) were needed to provide full photo coverage of the study area. Each photo was prepared with three mylar overlays; one for the vegetation delineations, one for the floristics codes, and one for the height and density codes. The photo overlays were pin-registered to the photos and labeled appropriately. A photointerpretation boundary was drafted onto the photo overlays and edgematched with adjacent photos to ensure full coverage.

Digital orthophoto images of the 1994 CIR's were used as the project base. The digital images were identical to the hardcopy CIR's used for the photointerpretation effort. A total of nine photo mosaics was used (approximately three photos per mosaic) to cover the entire island. They were corrected for both the x and y coordinates but not the z coordinates, therefore there was no elevational data associated with them.

Field reconnaissance – Methods, 1994

A field reconnaissance visit was conducted in June 1995 to familiarize the photointerpreters with the vegetation types and their photo signatures before the actual mapping process. Prior to field work, each photo was given a mylar overlay upon which roads and trails were drafted. Each photo was reviewed and field sites were chosen representing different signature types, environmental conditions and topography. The sites were drafted onto the overlays with notations as needed. Multiple sites were chosen to provide alternatives if one or more sites were inaccessible.

The field crew conducted field investigations over a five-day period during which the ecologists provided preliminary identifications of vegetation types. The data was annotated directly onto a photo overlay, noting location and photo signature. A field notebook was used to record pertinent information, e.g., past disturbances, recent climatic and microclimatic conditions, general topography, etc. Ground photos were taken and referenced back to the aerial photos. Random field sites were input into a Global Positioning System (GPS) database.

Photo Signature Key – Methods, 1994

Following the field visit, a photo signature key for Assateague Island was developed, correlating physical descriptions of the photo signature (color, texture, height, and tone) with the appropriate vegetation type (Appendix 2). The photos and field overlays were reviewed and consistent

correlations between signature and vegetation types were noted. Upon completion, the signature key was submitted to the TNC[6] field team for comment and review.

Mapping Criteria – Methods, 1994

Three features were annotated during photointerpretation: stature (growth form), density and floristic composition.

- Growth forms noted included trees (defined as single-stemmed woody plants, generally greater than five meters in height except where dwarfed by environmental factors), shrubs (multi-stemmed woody plants, generally under 5 meters in height), and herbaceous (non-woody). Height of each layer was also recorded.

- Density, or an estimation of percent cover of each growth form. Absolute density (total of visible cover totaling 100%) was always recorded for the uppermost layer. Relative density (where understory vegetation was visible and measurable) was recorded where possible. Absolute crown density is normally the most accurate way of estimating plant coverage and was used to determine the percentage of vegetation cover within a polygon.

- Floristic composition, referring to the species or genus that could be identified on aerial photography.

The minimum mapping unit (mmu) was established at 1/4 hectare and the mapping scale at 1:12,000. In addressing specific interests of Park personnel, special attention was paid to three species in particular:

- *Hudsonia tomentosa* - 1/4 hectare mmu was disregarded and *Hudsonia tomentosa* was mapped wherever it occurred as a mappable unit, i.e., large enough to be represented by a polygon.

- *Ammophila breviligulata* – this species was not visible on the fall photography but according to the park personnel, it is always present on the primary dunes. Stereo viewing allowed for identification of primary dunes, which were used as a proxy for *Ammophila breviligulata.*

- *Phragmites australis* – this invasive exotic grass was listed in the floristic composition at any location where it was visible.

Photointerpretation – Methods, 1994

The stereo-paired CIR diapositives were viewed through a stereoscope and the vegetation boundaries were drafted onto a mylar photo overlay. The codes for each polygon were written on separate overlays; one for the height and density codes, another for the floristic composition codes. Each photo was edgematched to the adjacent photos to ensure a seamless coverage in the database. Delineations and codes were compared and discrepancies between photos were resolved and

[6] This project began with The Nature Conservancy, prior to the establishment of NatureServe.

corrected on the appropriate mylar overlays. Any uncertain interpretations were flagged on the mylar overlay for review during the quality control task, during which senior interpreters reviewed photo interpretations. The field verification trip occurred in July 1995. John Menke, AIS, working with Lesley Sneddon and Ashton Berdine, TNC, conducted on-site visits to map units flagged during the photointerpretation effort. Random sites were also checked to verify the accuracy of the photointerpretations. Field notes and revisions to the data were made directly to the photo overlays.

Data conversion (Map preparation) – Methods, 1994

Converting delineations to a digital format involved four main procedures: a) preparation of manuscript maps b) input of the spatial data: c) populating of the attribute tables, and d) conversion to GIS. Each step included many quality control steps.

Manuscript maps were prepared by pin-registering a clean sheet of mylar to each photo and transferring delineations to the new overlay in ink. Each manuscript map was edgematched to the adjoining sheet. Each photo was numbered, and each polygon on the photo was numbered in sequence. An attribute table was created containing a field each for the photo number, polygon sequence number, land use code, layer number, stature type, height, density, and floristic composition attributes.

The manuscript maps were scanned and converted into ARC/INFO coverages at ESRI, and each polygon was assigned a unique identifier and labels were digitized. ESRI produced plots of the converted data and sequence numbers (label I.D.s) for each photo. The plots were overlaid to the manuscript maps to verify that the scanned data was not distorted beyond .02 map inches. The corrected plots were delivered back to ESRI. Processors conducted interactive ARCEDIT sessions to make the necessary corrections to the coverages. ARC/INFO software CLEAN command was used to create the coverage topology. The resulting file was converted to UTM Zone 18, NAD 83 coordinate system. The converted file was compared to the orthophotos used as the base. Interactive ARCEDIT sessions were conducted to register the data to the digital image and correct any distortions. Code files were converted into INFO files and related to the feature attribute table. A total of 25 coverages were created. The 25 coverages were edgematched using procedures in the ARC editor linking the nodes from one coverage to the nodes of the adjoining coverage. Adjustments were made when necessary. NPS personnel created a digital map of the Assateague Island coastline from the orthophoto imagery that was then converted to an ARC/INFO coverage. The shoreline coverage was digitally compared to the vegetation coverage and areas that were mapped beyond the digital shoreline were clipped.

Accuracy Assessment – Methods, 1999

Positional Accuracy Assessment

Positional accuracy of the original vegetation map was conducted in 2002. GPS readings were taken from 105 locations easily discernible from aerial photographs, such as road intersections, rectangular parking lot corners, and other developed features (Figures 15-20).

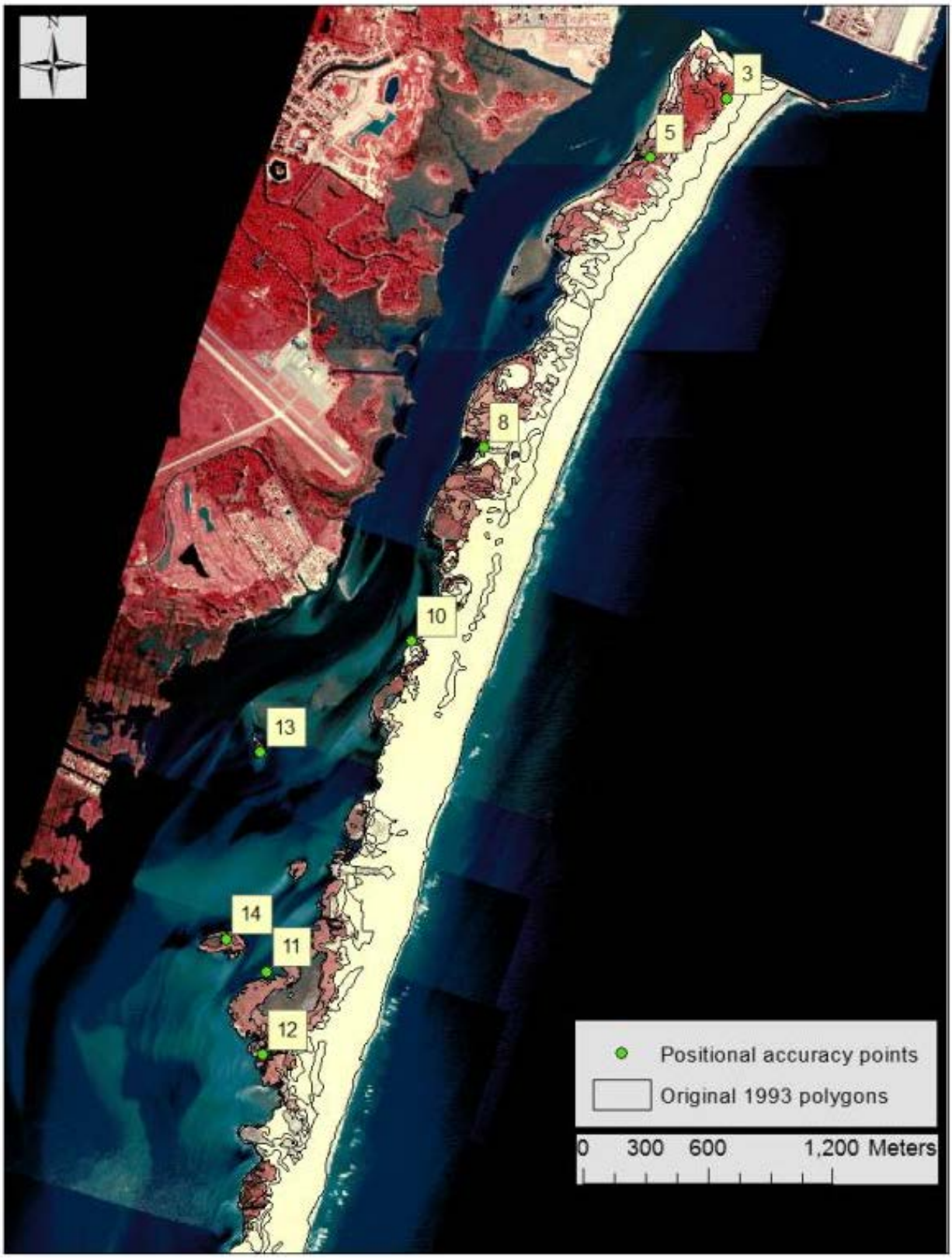


Figure 15. Positional accuracy assessment points, north end.

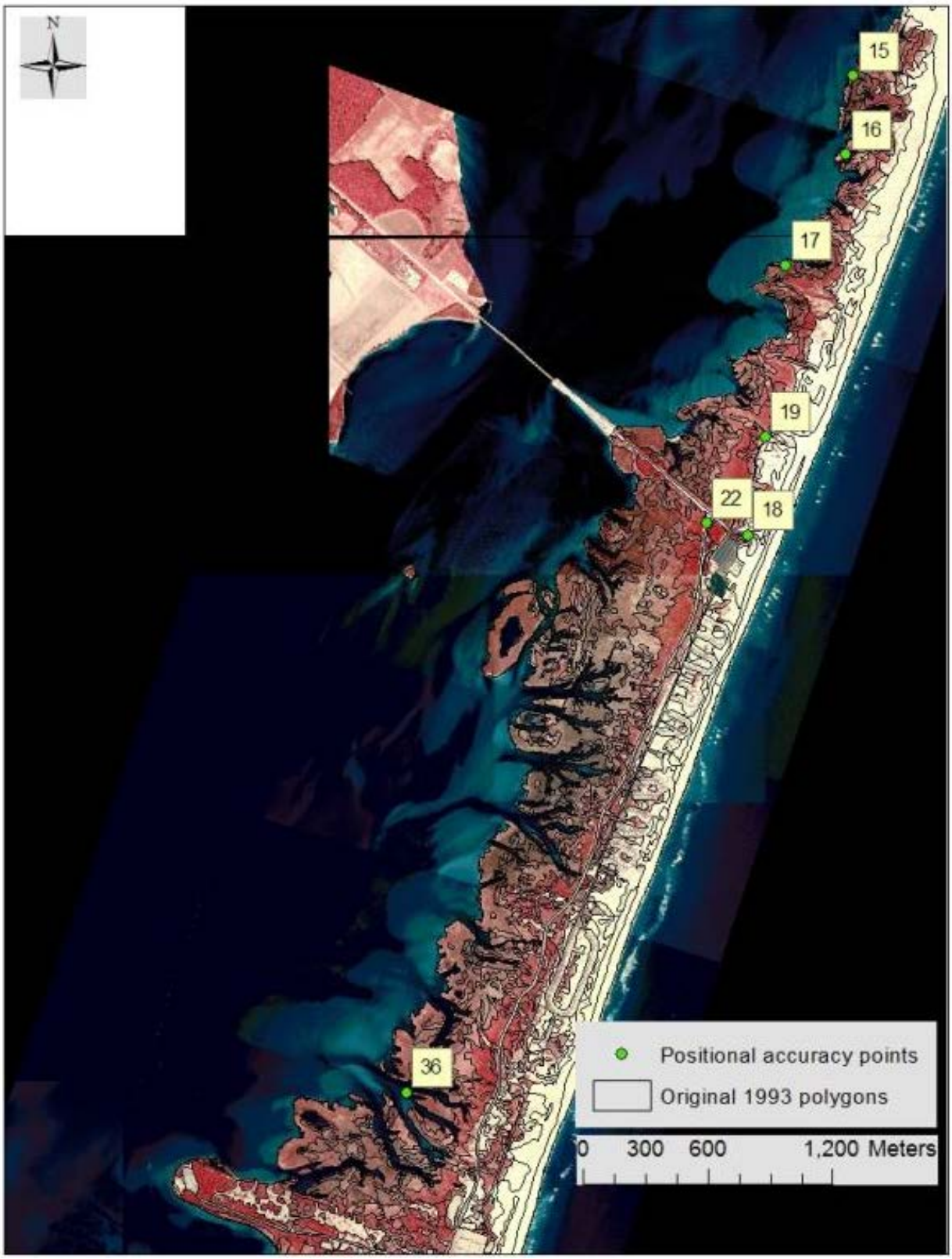


Figure 16. Positional accuracy assessment points, south of bridge.

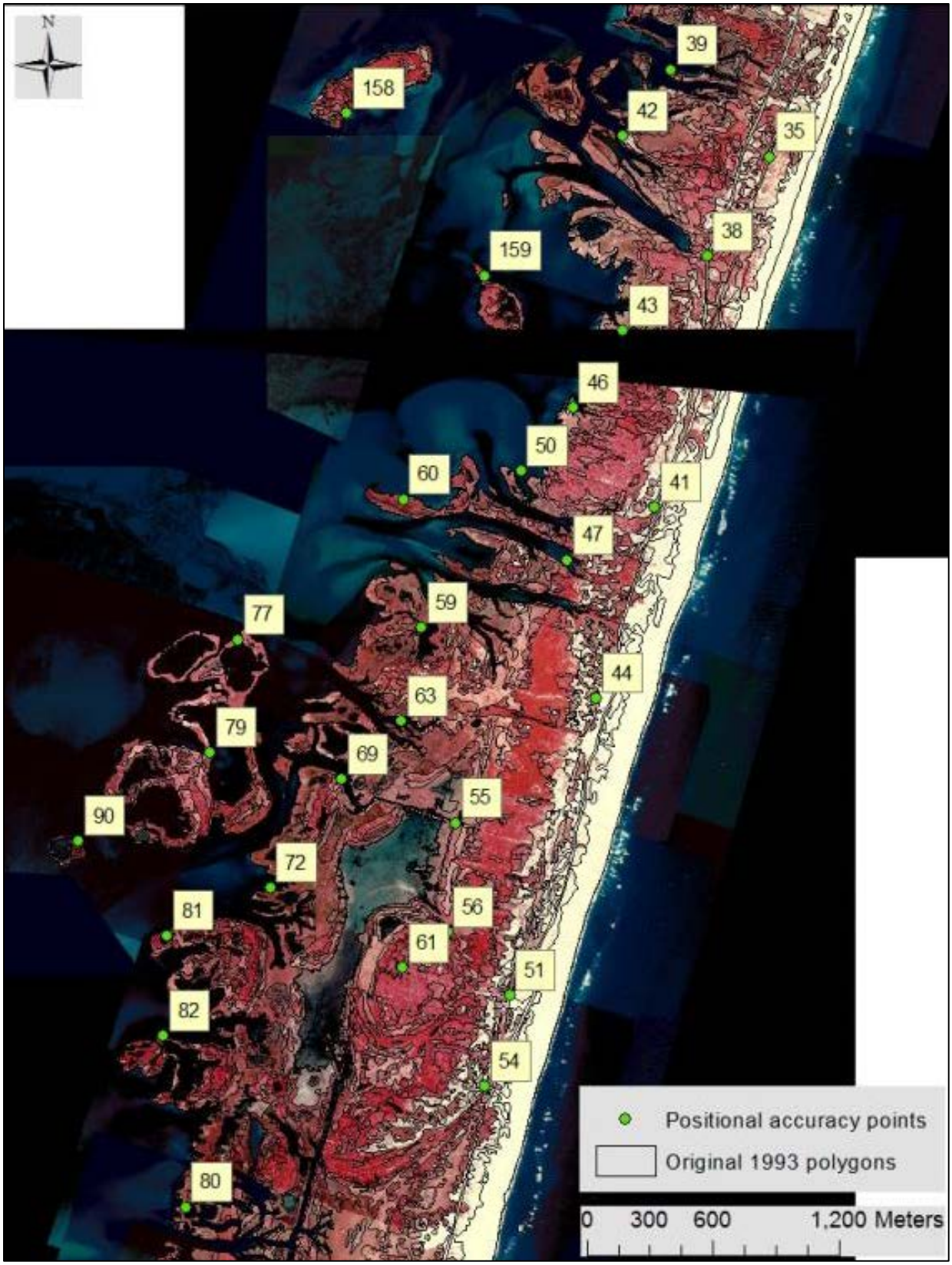


Figure 17. Positional accuracy assessment points, Tingles Campground area.

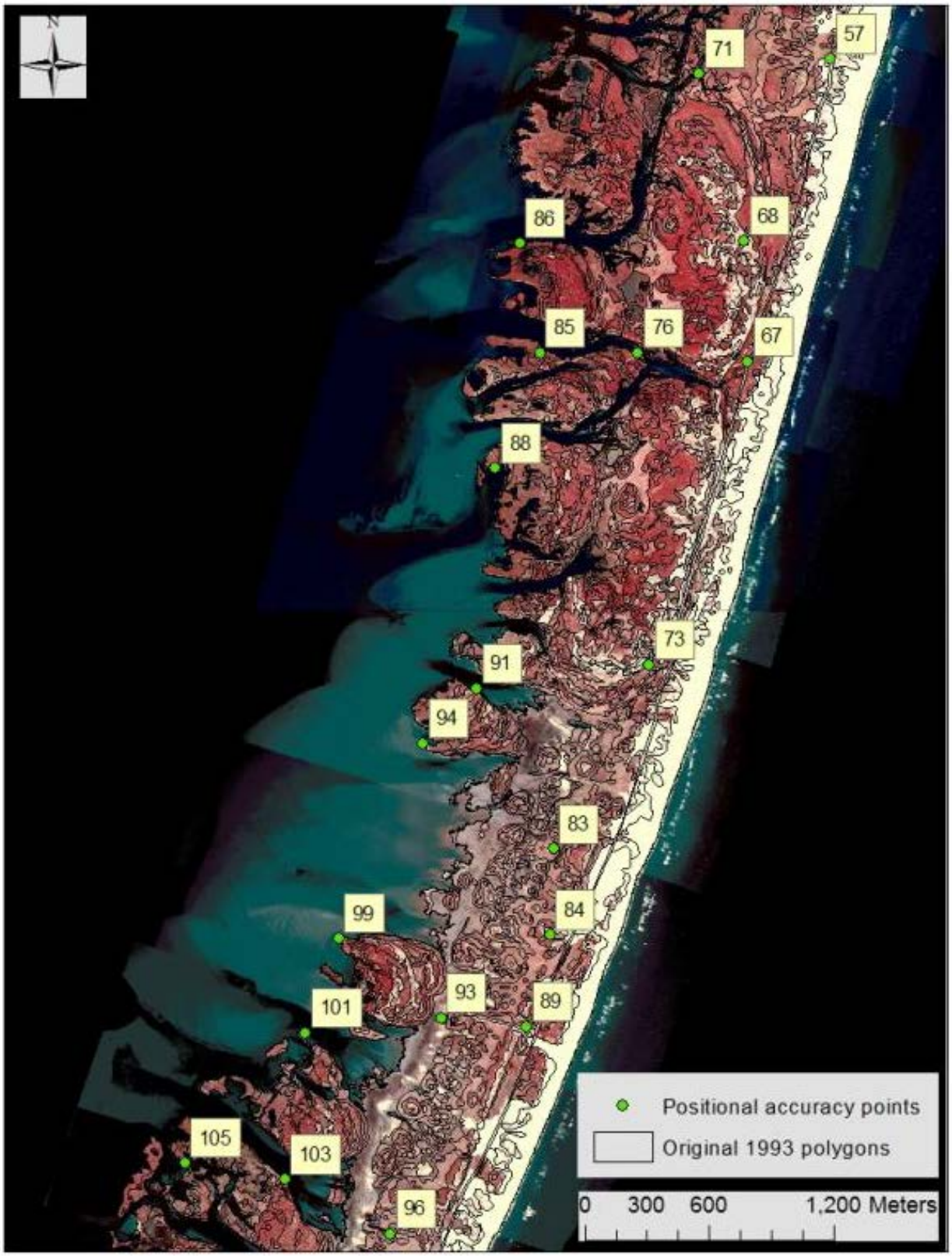


Figure 18. Positional accuracy assessment points, Pine Tree area.

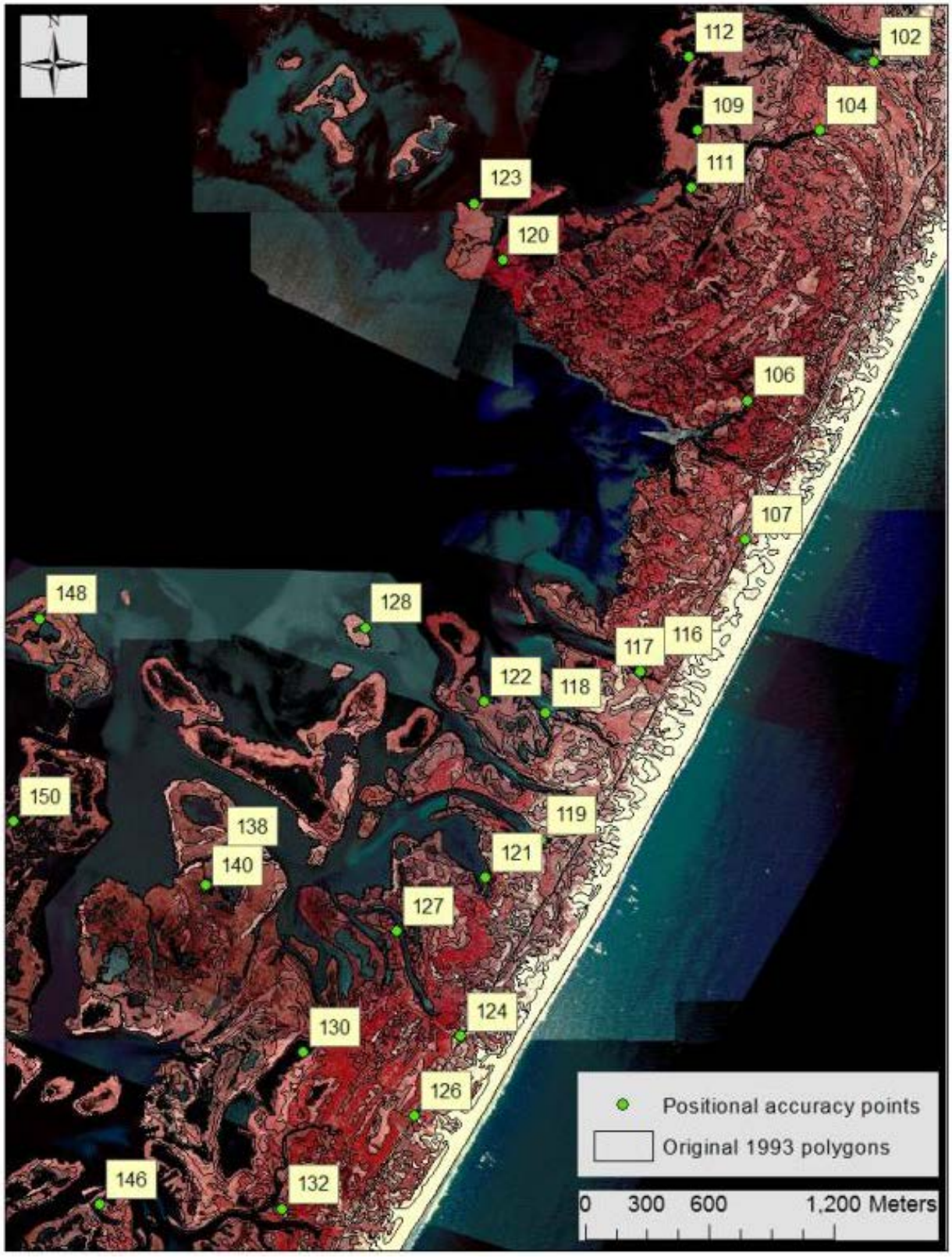


Figure 19. Positional accuracy assessment points, Pirate Islands and Green Run area.

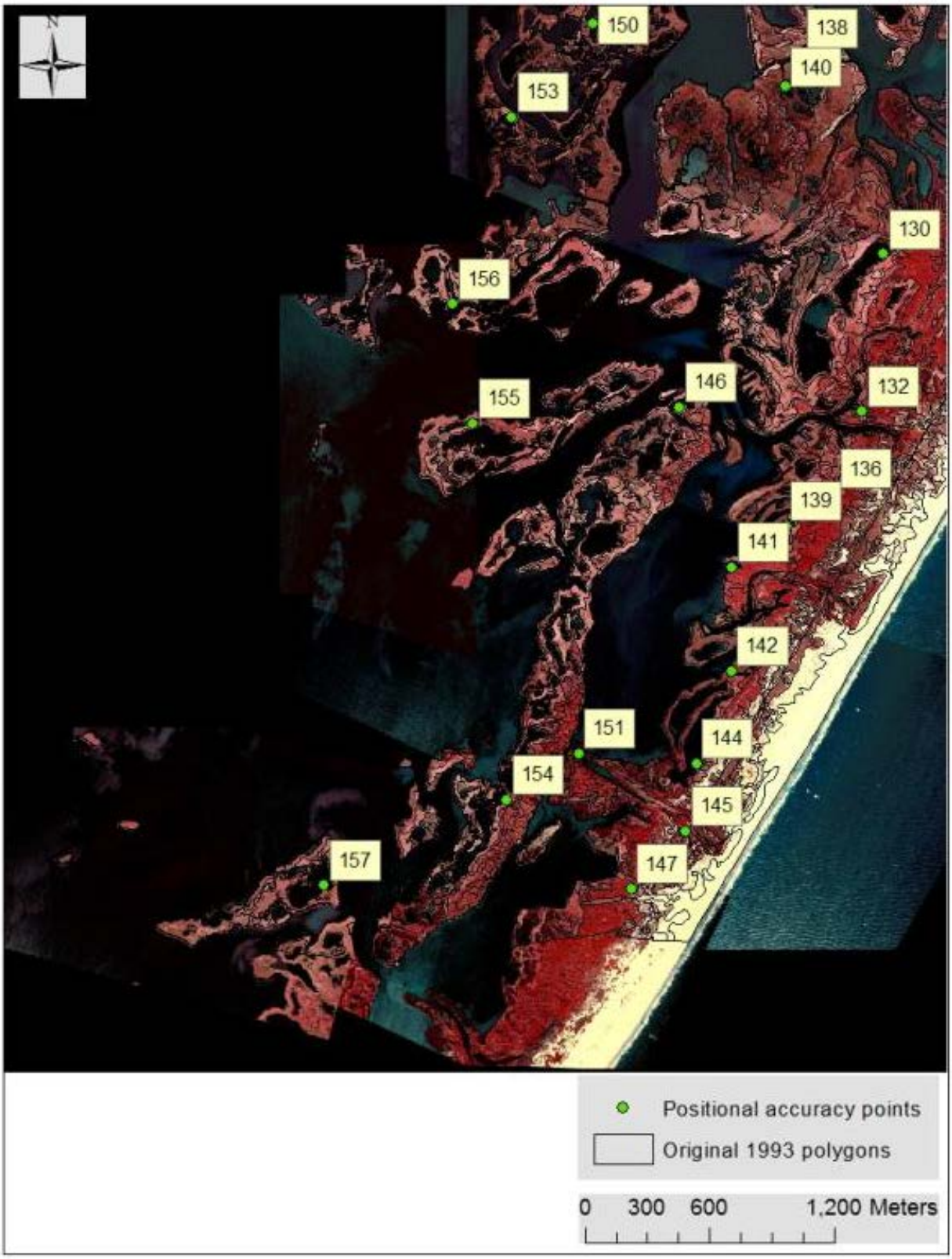


Figure 20. Positional accuracy assessment points, southern end of park.

Thematic Accuracy Assessment

Initial thematic accuracy of the original vegetation map was undertaken in 1998, during which 789 accuracy assessment points (Figures 21 – 35) were collected using stratified random sampling. In this approach, the number of samples assigned per association was scaled to the rarity of the vegetation association, both in terms of number of polygons and in polygon size. The following rules were used to determine the number of points assigned to each association (The Nature Conservancy and Environmental Systems Research Institute 1994c):

Scenario A: The class is abundant. It covers more than 50 hectares 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 hectares 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 polygon in that association.

Scenario C: The association is relatively rare. It covers less than 50 hectares 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 hectares. 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.

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

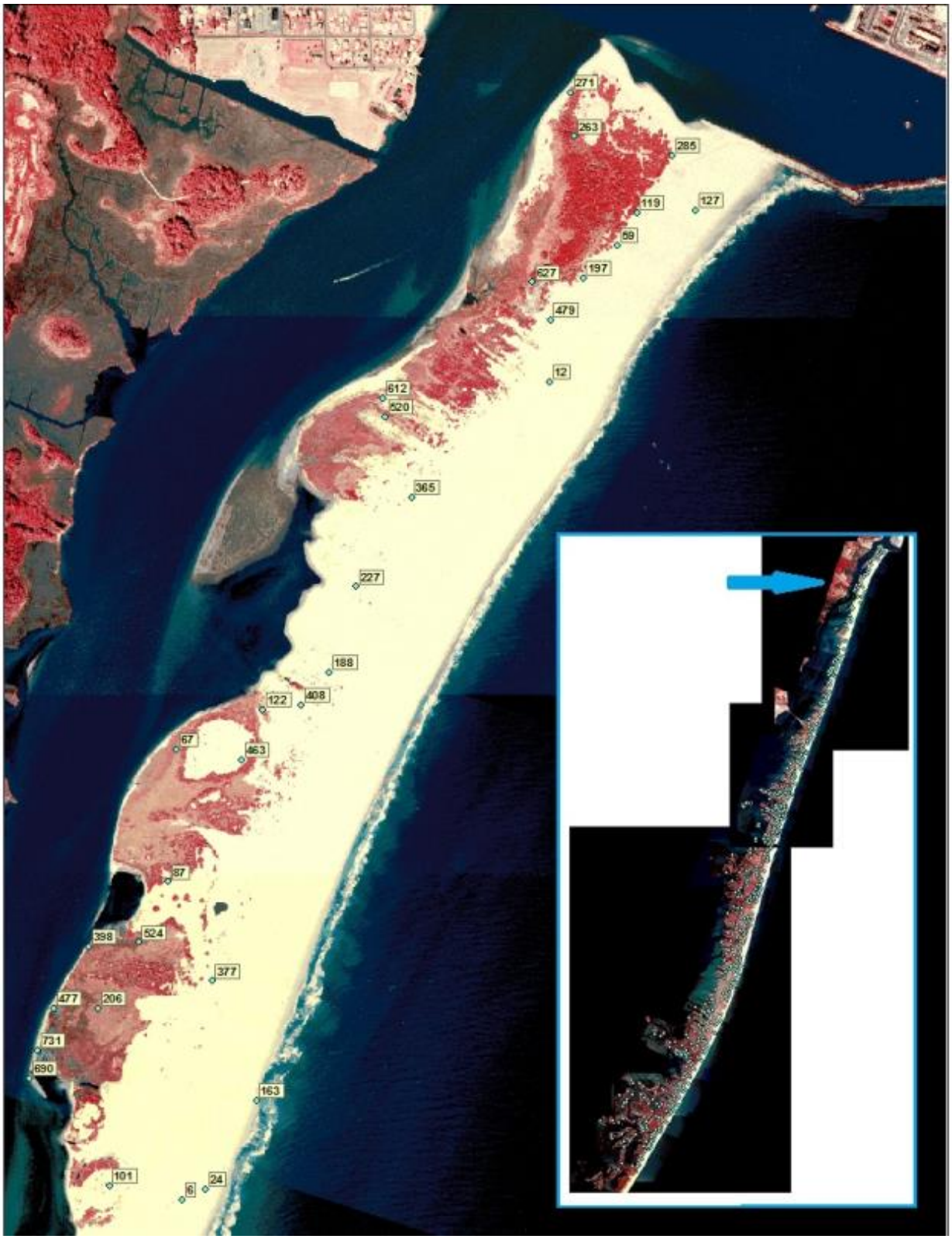


Figure 21. Accuracy Assessment Points Locations, north end.

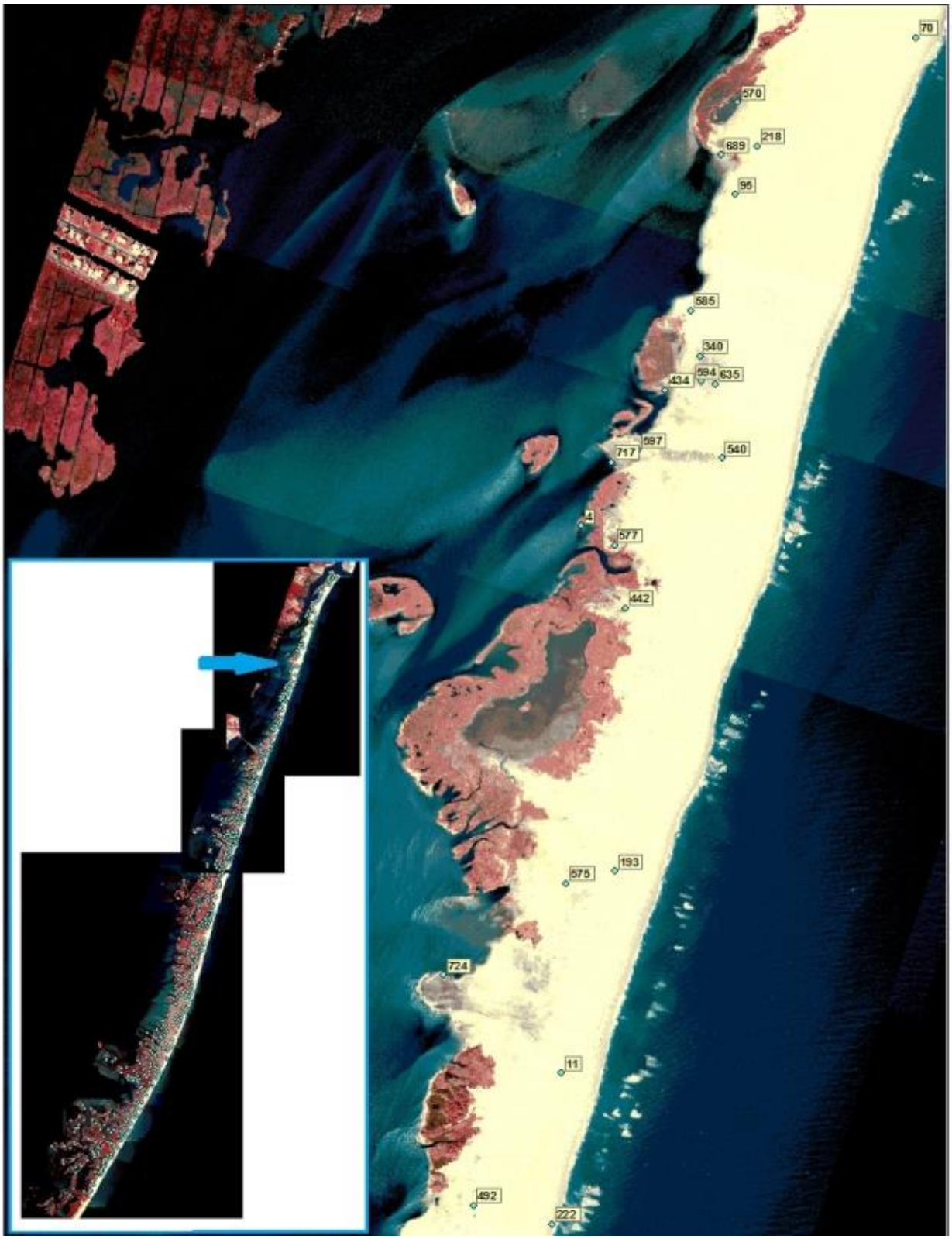


Figure 22. Accuracy Assessment Point Locations, mid-northern end.

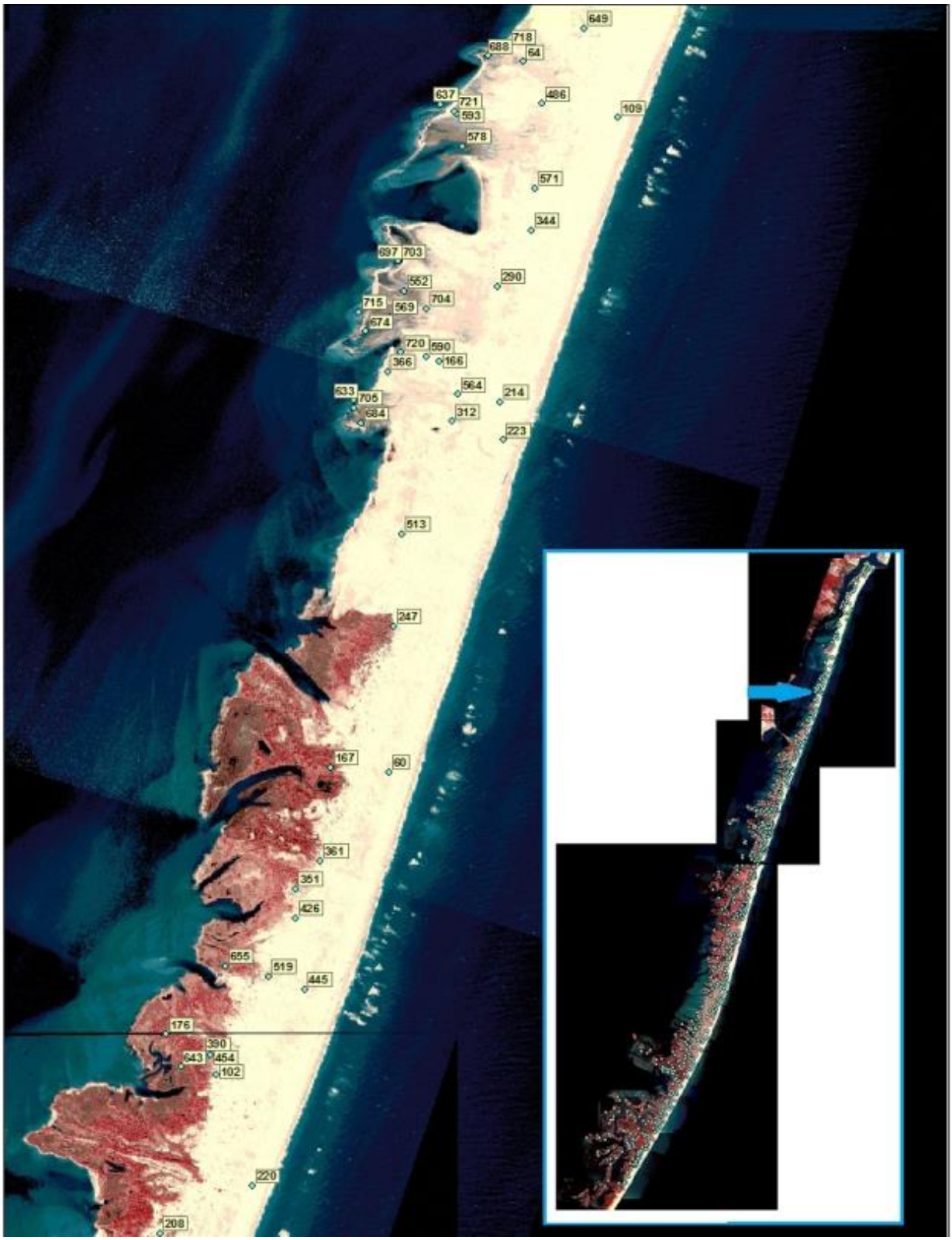


Figure 23. Accuracy Assessment Point Locations, lower north end.



Figure 24. Accuracy Assessment Point Locations, north end of state park.

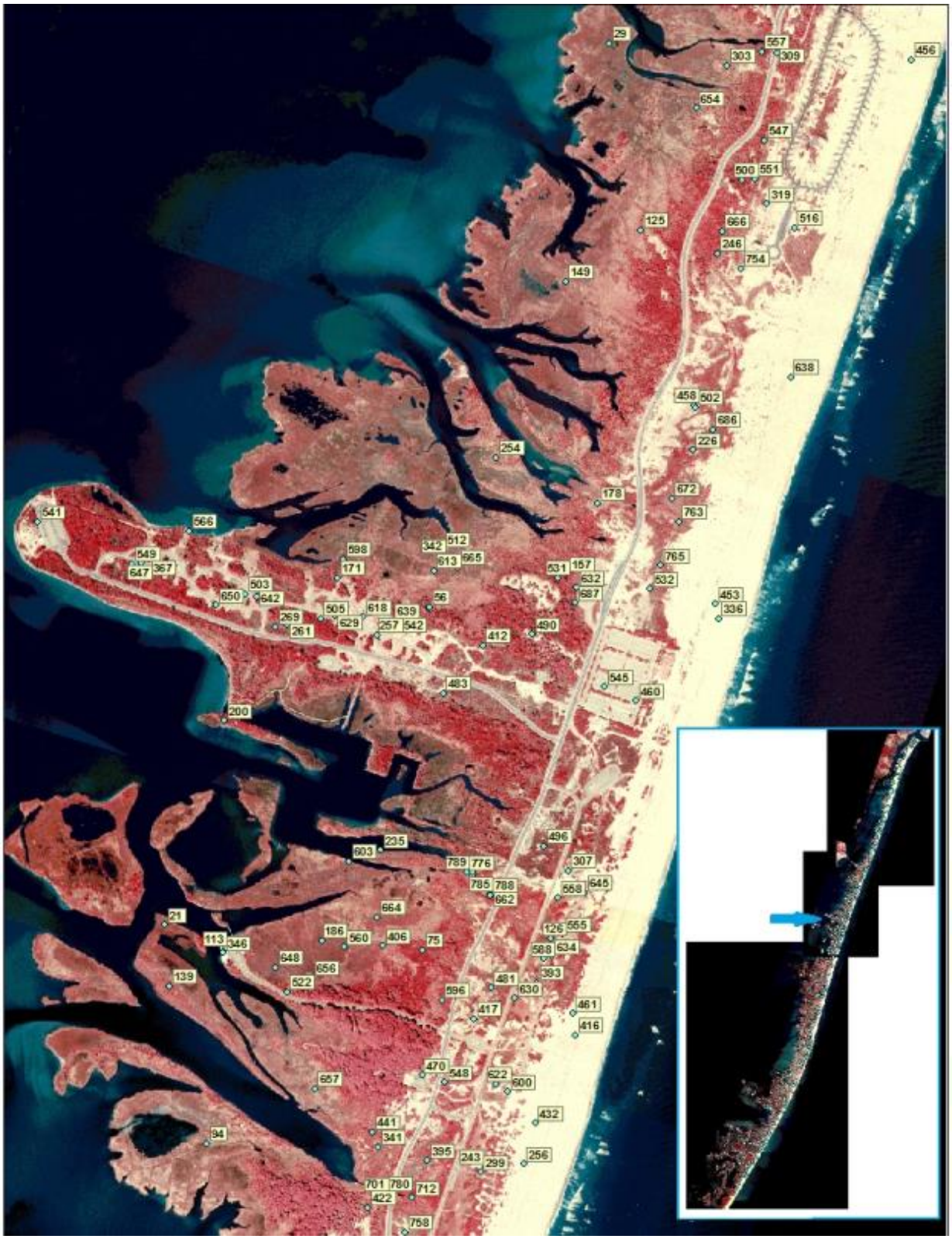


Figure 25. Accuracy Assessment Point Locations, Bayside Drive.

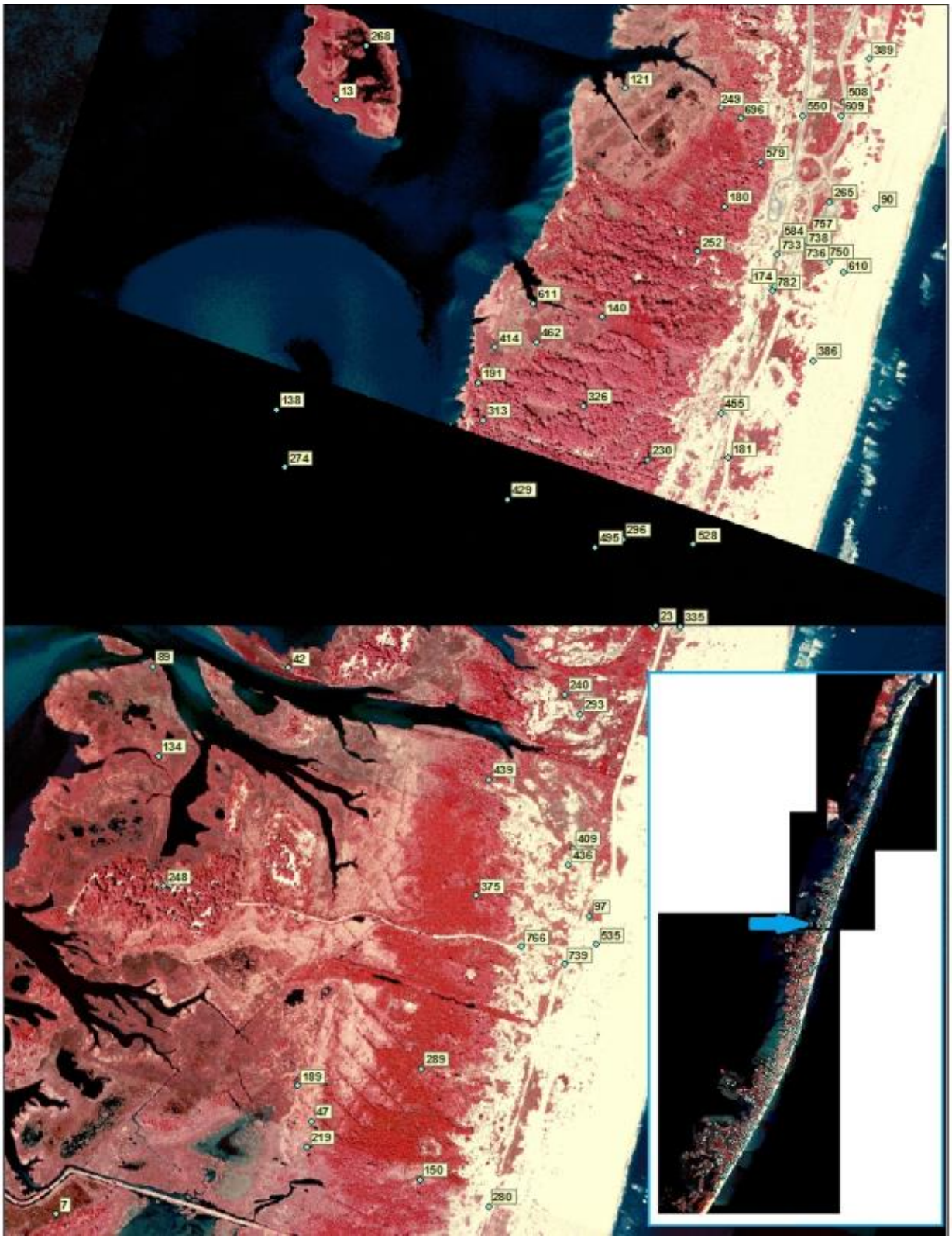


Figure 26. Accuracy Assessment Point Locations, Tingles Campground.

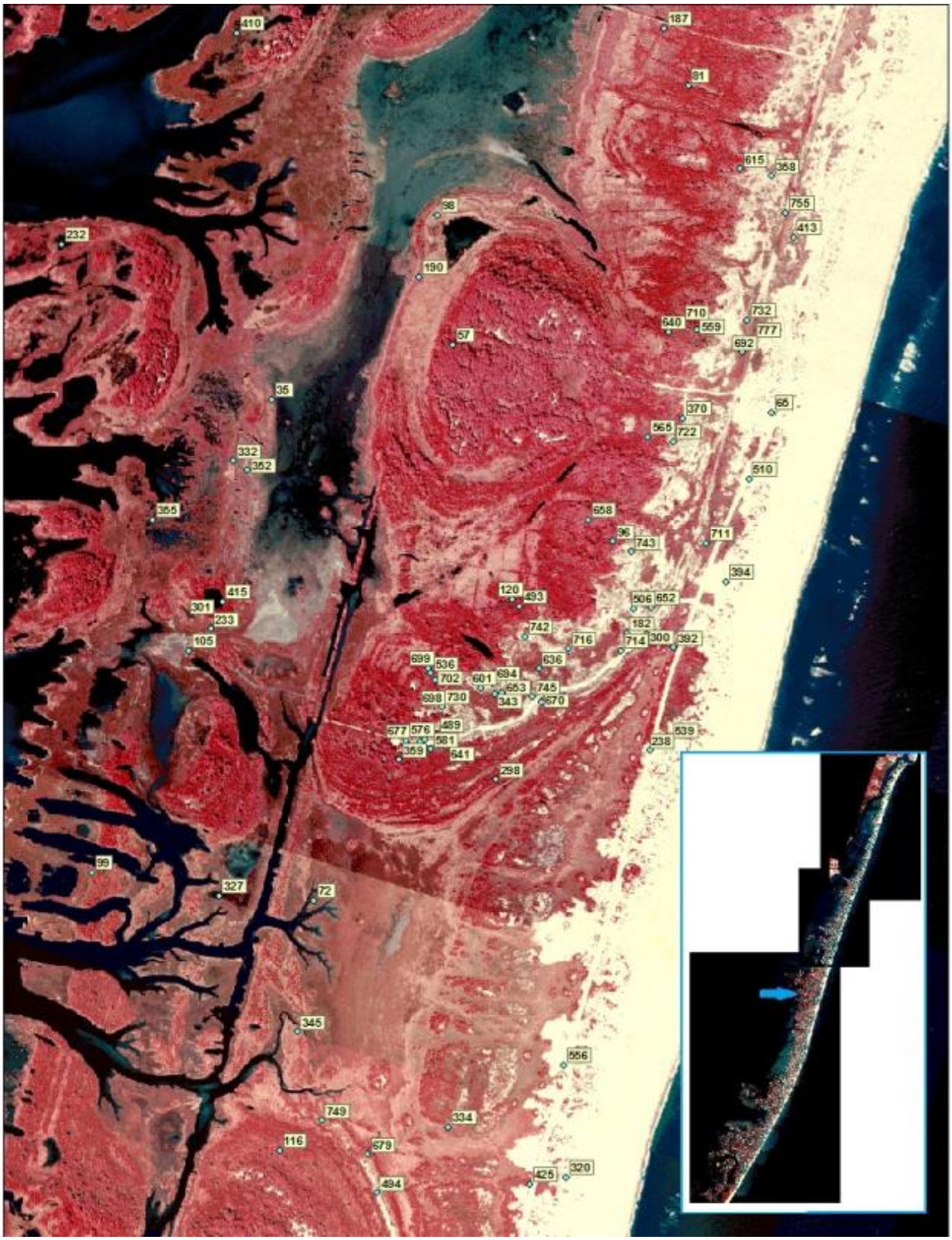


Figure 27. Accuracy Assessment Point Locations, Little Levels.

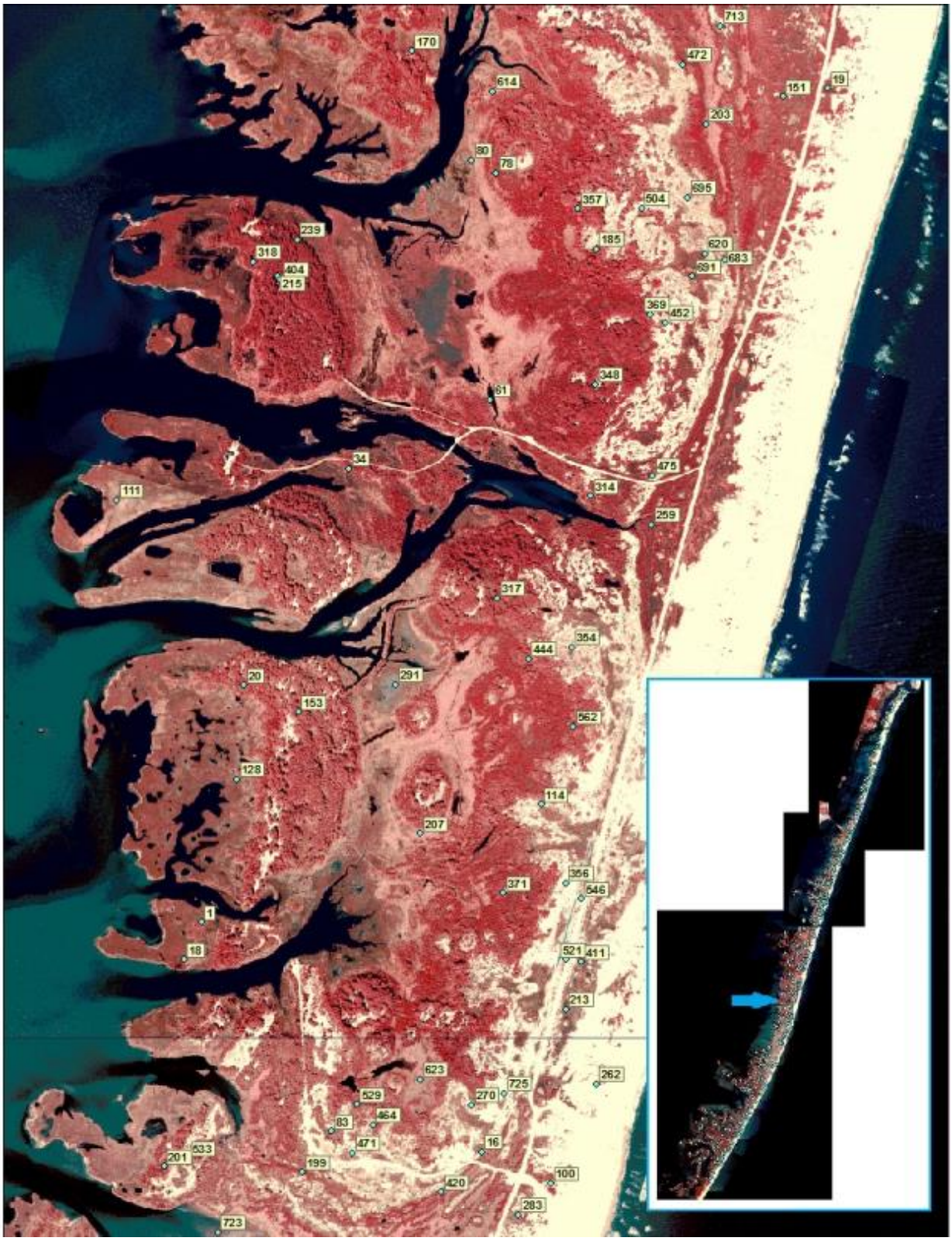


Figure 28. Accuracy Assessment Point Locations, Pine Tree.



Figure 29. Accuracy Assessment Point Locations, Fox Hill Levels.

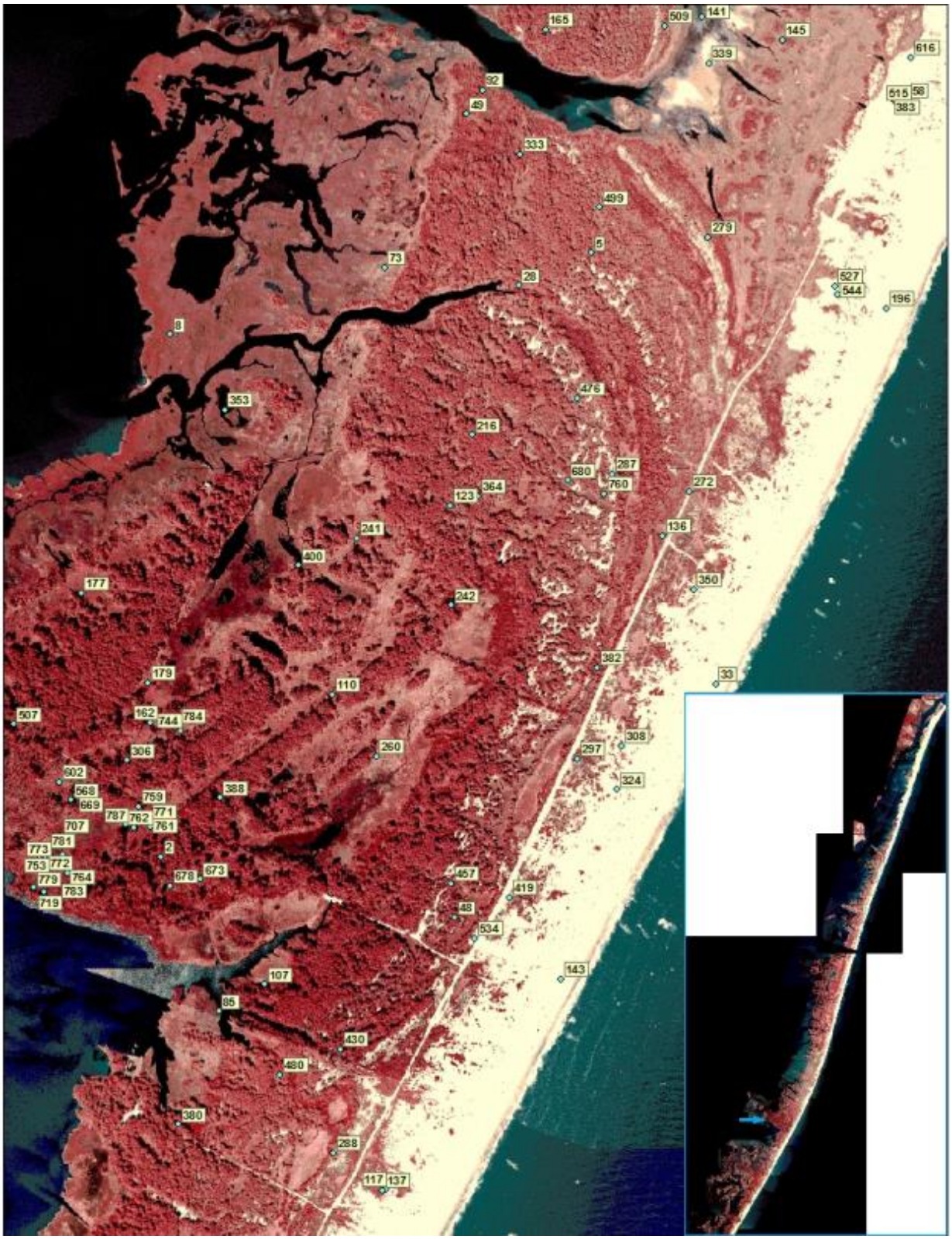


Figure 30. Accuracy Assessment Point Locations, east of Pirate Islands.

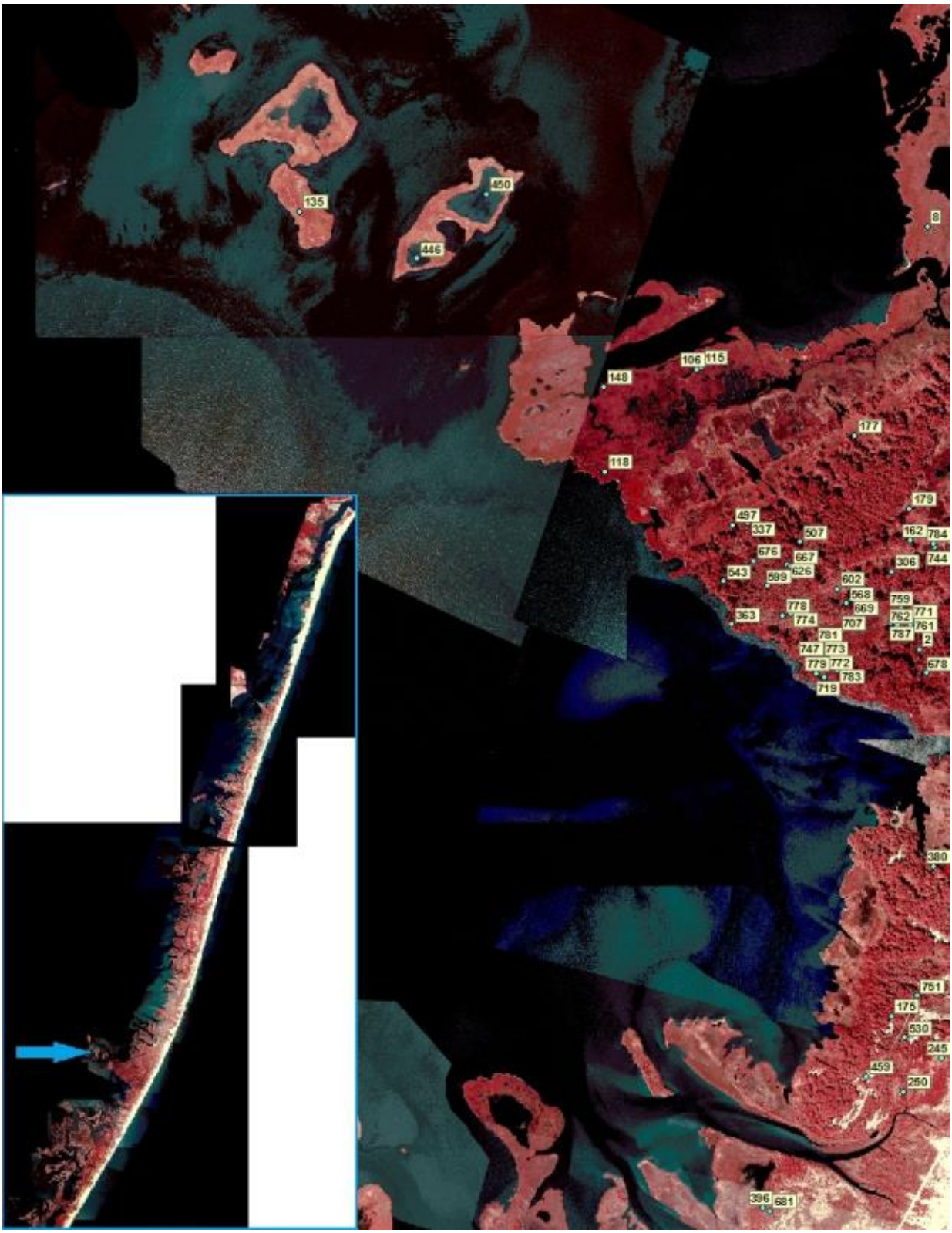


Figure 31. Accuracy Assessment Point Locations, Pirate Islands.

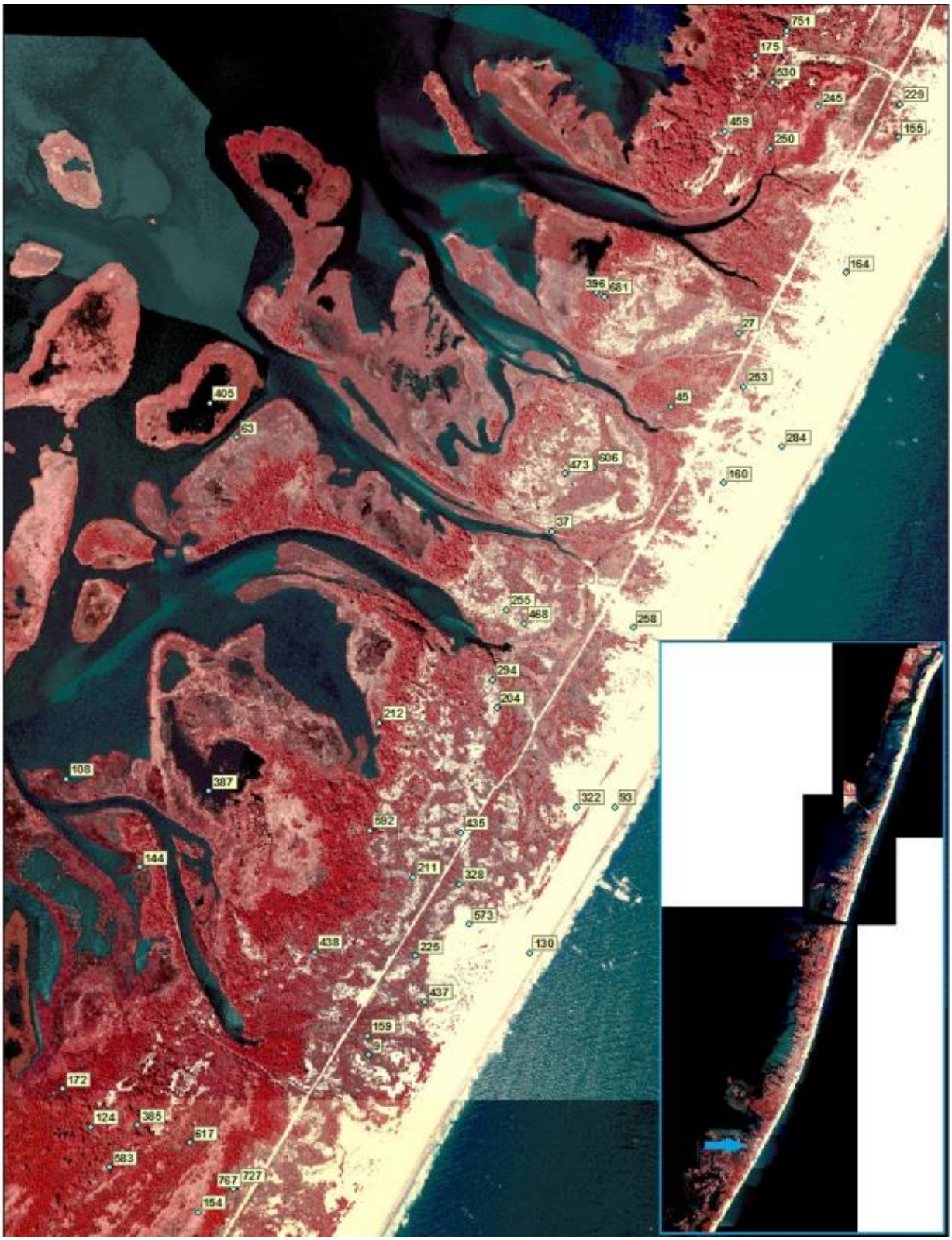


Figure 32. Accuracy Assessment Point Locations, Green Run.

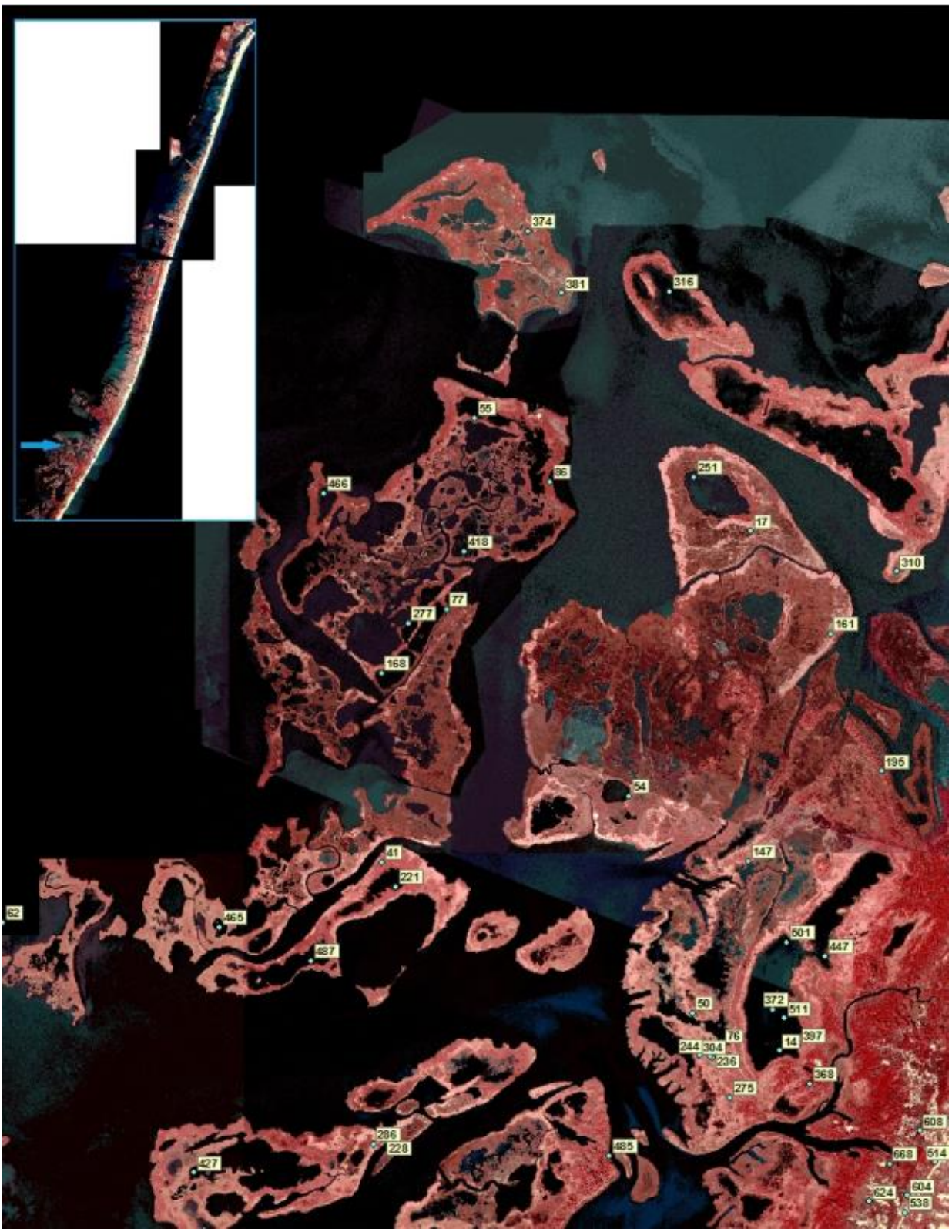


Figure 33. Accuracy Assessment Point Locations, Green Run West.

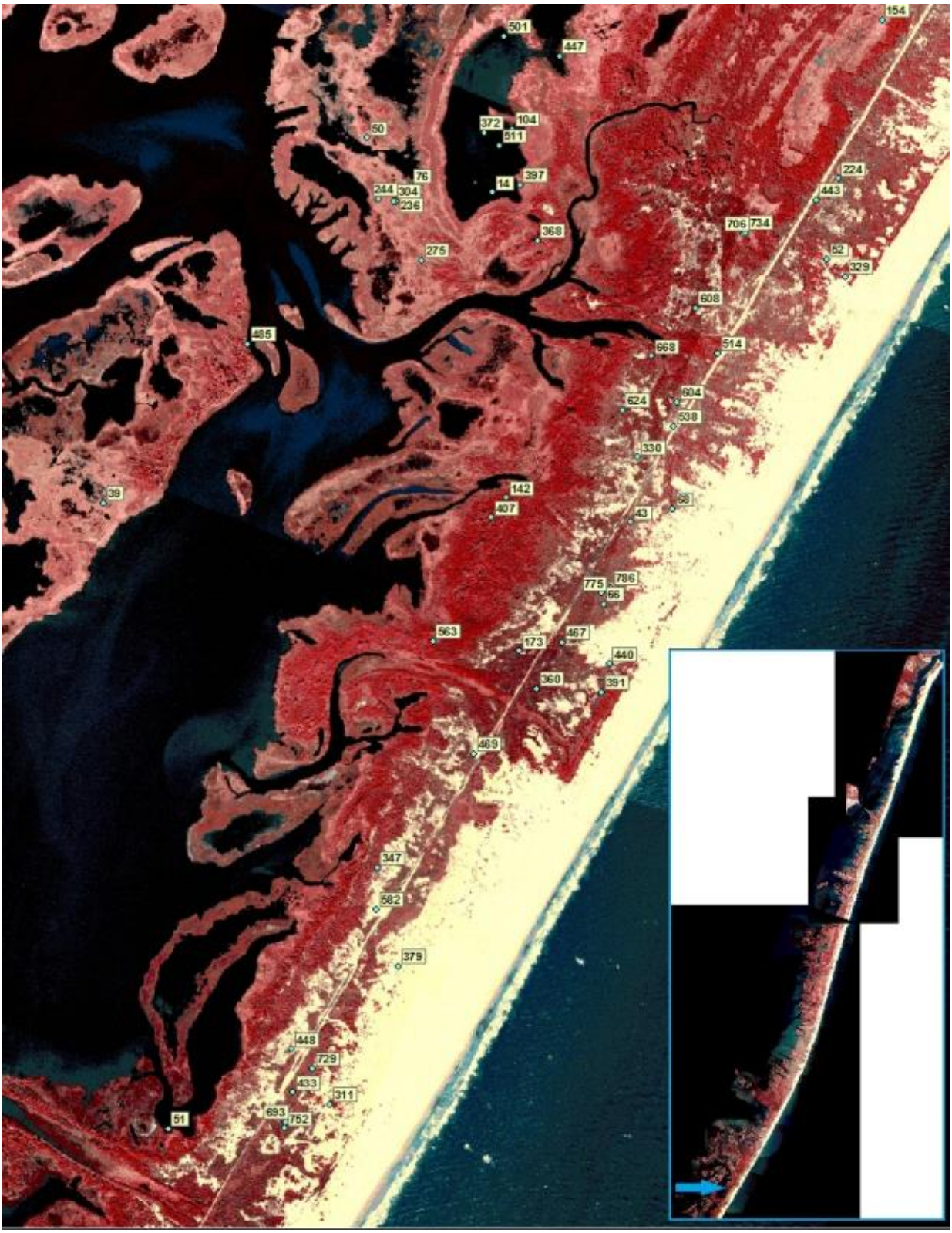


Figure 34. Accuracy Assessment Point Locations, Pope Bay.

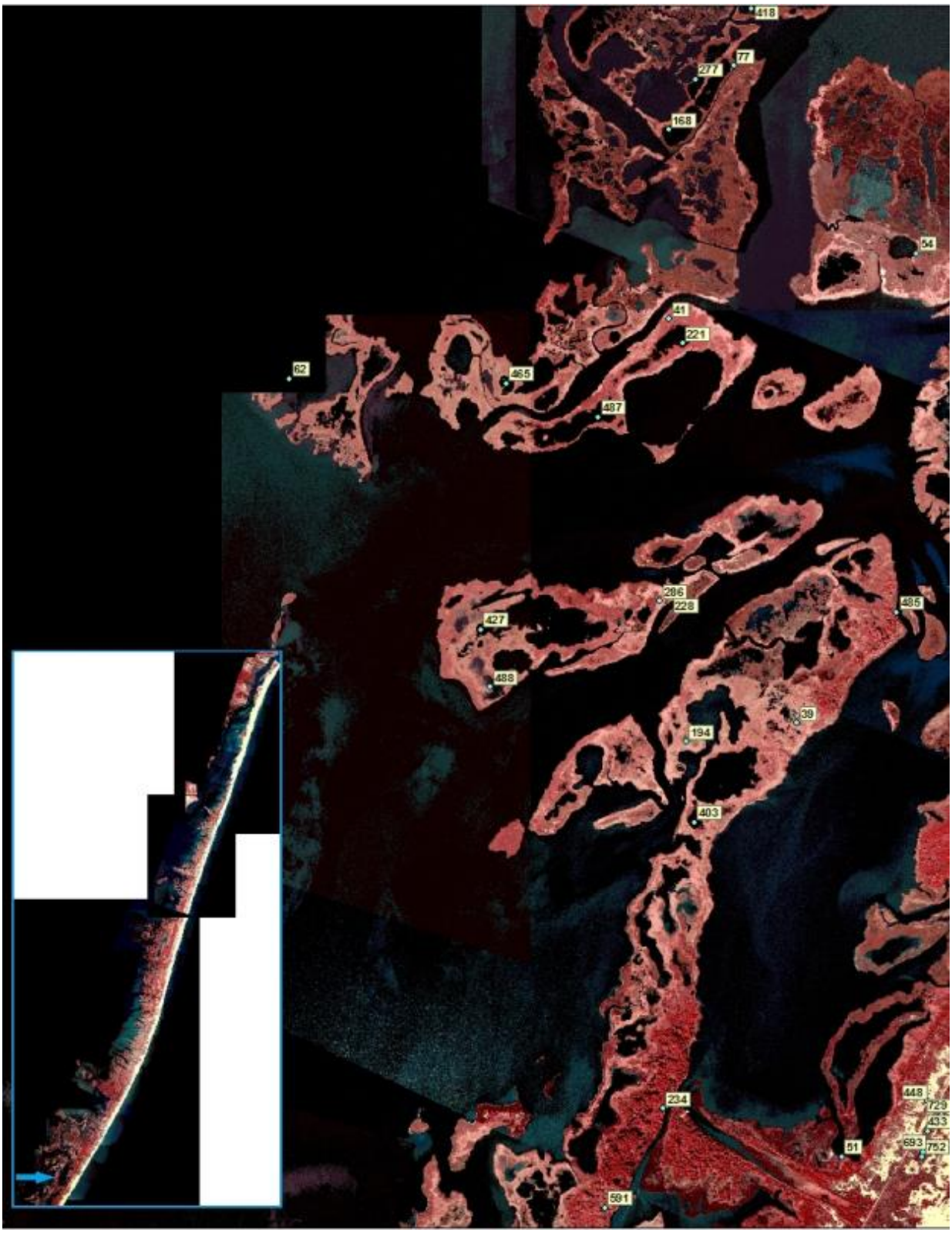
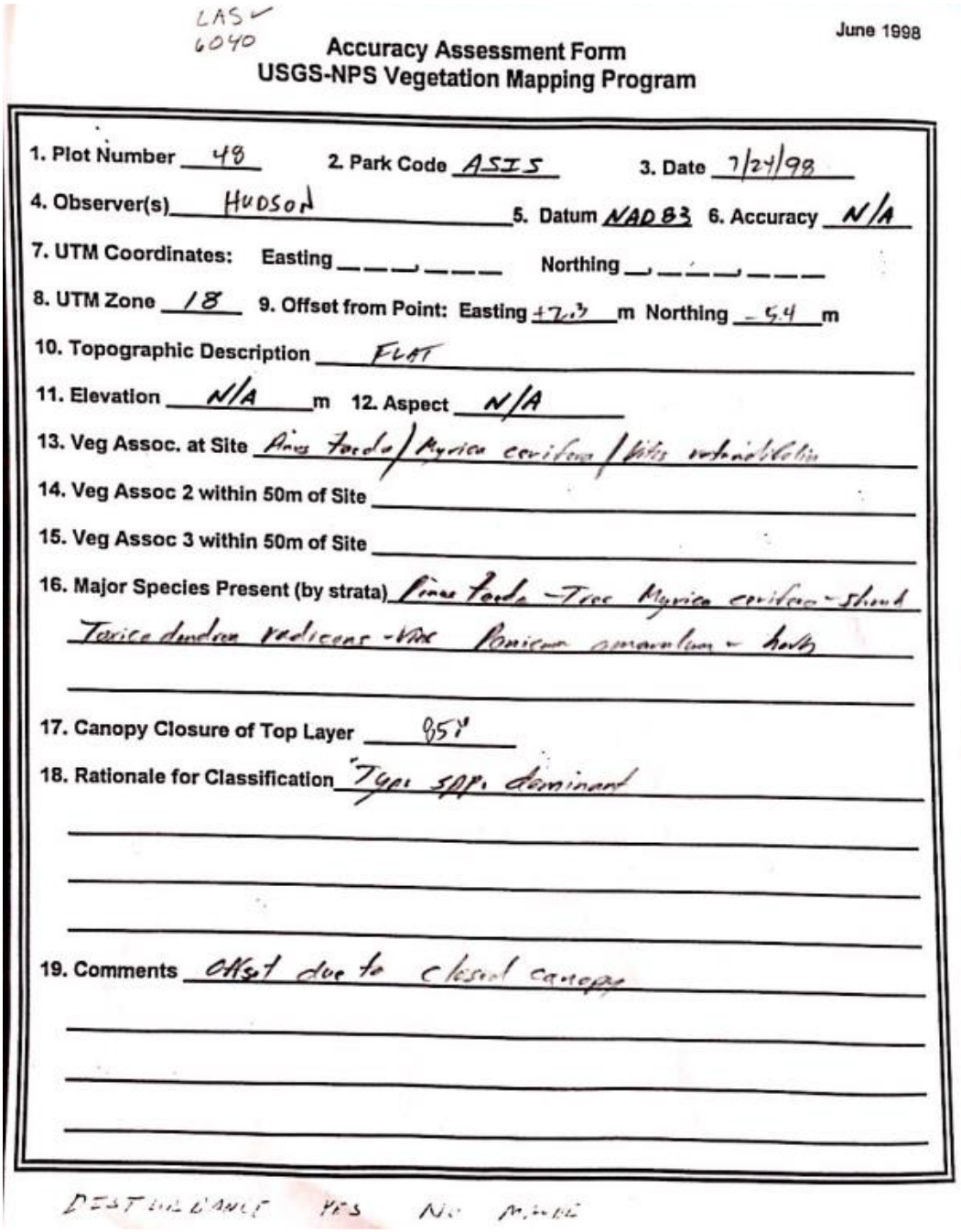


Figure 35. Accuracy Assessment Point Locations, Pope Bay West.

Accuracy assessment points were distributed across the park according to the allocation scheme, including islands. Points were placed within polygons, but were not buffered (set deliberately away from polygon boundaries). The pre-selected points were uploaded to a Trimble GPS unit and provided to the researcher collecting the accuracy assessment data. A field form for data collection was designed by NPS ecologist Chris Lea, and included location information, point code, date, observer, major species noted at the point, canopy closure, and other associations noted within 50m of the site (Figure 36).



LAS ✓
6040

June 1998

Accuracy Assessment Form
USGS-NPS Vegetation Mapping Program

1. Plot Number 48 2. Park Code ASIS 3. Date 7/24/98
4. Observer(s) HUDSON 5. Datum NAD83 6. Accuracy N/A
7. UTM Coordinates: Easting ____, ____ Northing ____, ____
8. UTM Zone 18 9. Offset from Point: Easting +7.3 m Northing -5.4 m
10. Topographic Description FLAT
11. Elevation N/A m 12. Aspect N/A
13. Veg Assoc. at Site Pinus taeda / Myrica cerifera / Vitis rotundifolia
14. Veg Assoc 2 within 50m of Site
15. Veg Assoc 3 within 50m of Site
16. Major Species Present (by strata) Pinus taeda - Tree Myrica cerifera - Shrub
Toxicodendron radicans - Vine Panicum amarulum - Herb
17. Canopy Closure of Top Layer 95%
18. Rationale for Classification "Type" spp. dominant
19. Comments offset due to closed canopy

DISTURBANCE YES NO MINE

Figure 36. Sample accuracy assessment form, 1998.

A park-specific dichotomous key to alliances was designed to guide accuracy assessment (Appendix D). The key is structured by a series of couplets, two statements that describe different, mutually exclusive characteristics of the alliance. The key was used in conjunction with the detailed alliance descriptions to confirm that the alliance selected with the key is appropriate.

Vegetation Classification and Revised Mapping – Methods, 2009

Field data collected in 1994 was augmented with the accuracy assessment data collected in 1999, as well as with ASIS field experience of NPS biologist Chris Lea to determine the extent of change in classification units. Numerous vegetation studies had been conducted in coastal regions of the northeast in subsequent years, resulting in a much more robust classification. Despite addition of more detailed range-wide information, nomenclature changes, and changes in the USNVC hierarchy since 1994, many of the communities mapped and classified in the 1994 mapping effort at ASIS retained the same scale and concept, and were, in large part, easily re-classified as associations recognized in the 2009 version of the USNVC. Qualitative analysis of the 1998 accuracy assessment data revealed several associations that had not been recognized in the original mapping effort, and these were added to the classification used to re-map ASIS in 2009. Qualitative analysis also suggested re-classification of several of the original plots.

All accuracy assessment forms were reviewed to incorporate any additional field data into local association descriptions, and to review classification assignments made in the 1999 accuracy assessment. The revised USNVC association descriptions were compared to the accuracy assessment field data, and each form was annotated with an association name and code. All 1994 plot forms were compared to the new set of associations, and also updated, and in some cases changed, to the revised set of associations and codes.

Addressing Mapping Errors

As expected in the first vegetation classification and mapping effort undertaken by the NPS Vegetation Mapping Inventory Program, a number of issues were identified following the 1999 accuracy assessment. There were many individual issues identified in both classification and mapping of vegetation, but in general, these could be collapsed into the two major reasons for low accuracy: 1) the vegetation classification was in development during the mapping as opposed to prior to mapping, and 2) as a result, the changing nature of the classification resulted in an inconsistent understanding of the types by photointerpreters. Several meetings among mappers and ecologists directly involved with the project were held to identify and address mapping and classification challenges that may be addressed both at ASIS and in parks to be mapped subsequently by the NPS Vegetation Mapping Inventory Program. During the course of this review, we noted that several vegetation types at ASIS were consistently mapped incorrectly. Tall shrublands in particular were noted to be particularly problematic, especially since only leaf-on photography had been available at the time of photointerpretation. In 2006, NPS ecologist Chris Lea met with NatureServe ecologist Lesley Sneddon to discuss a means to correct some of the errors by re-attributing a subset of polygons to better reflect the concept of the mapping units. Use of additional winter color infrared aerial photography acquired in 1999 was useful in that the evergreen *Morella cerifera* could be discerned from deciduous shrubs, aiding better discrimination among shrub types. The USNVC had

also been improved upon significantly since the original classification had been developed, so this effort provided an opportunity to update the classification at the association level and incorporate those changes into the vegetation map.

Following the meeting with Chris Lea in 2006, NatureServe ecologists developed an ArcGIS map document that included the shapefile of the 1994 vegetation map, the scanned 1993 color-infrared aerial photos, leaf-off color-infrared aerial photography flown in 1999 (Duffy and Brock 1999) and provided by Chris Lea, 2008 true-color leaf-on aerial photography (Maryland State Highway Administration 2008) provided by park staff, the original plot shapefile, the 1998 accuracy assessment point shapefile, and the Digital Elevation Model (DEM) developed by Brock (2006). The 1998 accuracy assessment shapefile was annotated with the USNVC code or other map unit, such as water or other unvegetated cover, corresponding to the USNVC codes annotated on the accuracy assessment field forms.

The editing process involved several different approaches, depending on the type. The first step was to examine each polygon containing either an accuracy assessment point or plot, for each association, to identify the photo signature and its range of variation. The original photo signature key developed by AIS was also used, since the signatures by dominant and individual species easily seen on the photographs, had been described. The other ancillary layers were used to varying degrees for each type. For example, the 1999 leaf-off color infrared photos were especially useful in distinguishing between the associations characterized by the two species of *Morella (=Myrica). Morella cerifera* is evergreen and identifiable in leaf-off photography by the red signature, and occurs more widely in wetland areas, as opposed to deciduous *Morella pensylvanica* occurring on upland dunes. These photos aided in differentiating between *Morella pensylvanica / Diodia teres* Shrubland from *Morella cerifera / Spartina patens* or *Morella cerifera / Hydrocotyle* spp. Shrublands. The 1999 photos were also useful in distinguishing uplands from wetlands, usually indicated by a dark signature, in areas not forested by evergreen *Pinus taeda*. In general, the 2008 true-color aerial photos of the island were of considerably higher resolution than that of digital photos from either 1993 or 1999, and were sometimes helpful in seeing greater detail when needed. However, the much more recent photography had to be used with caution, as the dynamic nature of this barrier island reflected considerable change in some areas of the island since the original mapping effort. The Digital Elevation Model proved to be especially helpful in identifying dune crests that were essentially invisible in the digital photos. Dune crests were much more likely to support beach grasses than were the dune slacks, so this layer was especially helpful in identifying *Ammophila breviligulata – Panicum amarum* var. *amarum* Herbaceous Vegetation.

The use of additional data layers often revealed information that would likely influence the line work as well as the association identity of the polygon, but this degree of editing was beyond the scope of the project, and only the polygon attributes were changed. In some cases, polygons included portions of more than one association, or in other cases, were too finely drawn. The latter situation was particularly problematic in the case of *Pinus taeda / Hudsonia tomentosa* Woodland. This type covers large patches, with an open forested canopy and *Hudsonia tomentosa* patches that are clearly recognizable. In many cases, individual small polygons of *Hudsonia tomentosa / Panicum amarum*

var. *amarum* Shrubland and *Pinus taeda / Morella cerifera / Vitis rotundifolia* Forest were delineated within what should have been one large polygon of *Pinus taeda / Hudsonia tomentosa* Woodland. In this and similar cases, some polygons were merged to correctly reflect the appropriate association.

As expected, the resolution of the scanned 1993 aerial photos was of coarser resolution than was subsequent photography, and at large scales, detail was obscured. In some cases, the original diapositive film was referred to when editing the map. The time required to locate the proper photo, and the specific location on that photo, precluded this as a frequently used method. Where the orange signature of *Vaccinium corymbosum* was often visible on the diapositive film only, this method was used when differentiating the *Morella cerifera – Vaccinium corymbosum* Shrubland from the two other associations dominated by *Morella cerifera*.

A copy was made of the 1994 map, and editing was done on this version by systematically visually scanning the entire map by type, from north to south, and either changing the polygon attribution or by merging polygons as appropriate.

Accuracy Assessment II – Methods, 2009

Changes made to the original map invalidated the original accuracy assessment, so plans were made to repeat the accuracy assessment following map editing. The same formula used in the 1999 accuracy assessment was used in 2009 for allocating 455 points to vegetation types in the second phase. The method deviated in that the points were buffered by 5m from polygon boundaries, using the buffer tool in ArcGIS to create a negative buffer. The ArcView extension Hawth's Tools was used to generate random points by vegetation type. These points were then loaded into a Garmin GPSmap 60CSx. Paper field maps were also made from 1993 photography, with polygon boundaries and numbered accuracy assessment points over the photography. The key to associations was revised using the updated classification. Field maps, GPS points, field forms, dichotomous key and association descriptions were provided to the field crew, NatureServe ecologists Ery Largay and Sue Gawler, who conducted the accuracy assessment during late summer and early fall 2009. One or more digital ground photos were taken at nearly each location; rainy weather precluded ground photographs on occasion.

Results

Vegetation Classification and Characterization – Results, 1994

Analysis of the original plots collected in 1994 yielded 24 alliances, including: 2 upland forest types, 2 wetland forest types, 1 woodland type, 3 upland shrubland types, 4 wetland shrubland types, 1 dwarf-shrub type, 2 upland herbaceous types, 8 wetland herbaceous types, and 1 sparsely vegetated type. (One additional wetland forest association was defined from observation but was not represented by a plot). The original TWINSPAN output was modified to place plots together that were classified as the same alliance (Table 1). The TWINSPAN data analysis below indicates the identity of the numerical codes at the head of each row by field plot number.

Modified TWINSPAN table original data analysis indicating resulting alliances:

FORESTS	WOOD LANDS	SHRUBLANDS	DWARF-SHRUBLANDS

```
Prunus serotina - Amelanchier canadensis Forest Alliance
|   Pinus taeda Forest Alliance
|   |     Pinus taeda Seasonally Flooded Forest Alliance
|   |     |   Pinus taeda Woodland Alliance
|   |     |   |      Myrica pensylvanica - (Prunus maritima) Shrubland Alliance
|   |     |   |      |         Smilax glauca - Toxicodendron radicans Shrubland Alliance
|   |     |   |      |         |    Myrica cerifera - Baccharis halimifolia Seasonally Flooded Shrubland
|   |     |   |      |         |    Alliance
|   |     |   |      |         |    |        Myrica cerifera Seasonally Flooded Shrubland Alliance
|   |     |   |      |         |    |        |  Myrica cerifera - Vaccinium corymbosum Saturated Shrubland
|   |     |   |      |         |    |           Alliance
|   |     |   |      |         |    |        |  |    Baccharis halimifolia - Iva frutescens Tidal Shrubland
|   |     |   |      |         |    |        |  |    Alliance
|   |     |   |      |         |    |        |  |    |       Hudsonia tomentosa Dwarf-shrubland Alliance
|   |     |   |      |         |    |        |  |    |       |
-----------------------------------------------------------------
                                        1                  111  ←   Plot numbers (read down)
999 88888 8   99999  777777711 3333      110 11 1112 788788  99000
567 45678 9   31402  412356756 2354 12345027 34 7890 801923  98012  ↓   Species

451 --1-- -   -22--  1-------- ---- -------- -- ---- ------  1---- Prunus serotina
2-- --24- -   -----  --------- ---- -------- -- ---- ------  ----- Amelanchier canadensis
--- 12241 -   -----  --------- ---- -------- -- ---- ------  ----- Amelanchier canadadensis sdlg
-14 ----- -   --2--  --------- ---- -------- -- ---- ------  ----- Aronia arbutifolia
-44 --442 -   -----  --------- ---- -------1 -- ---- ------  ----- Acer rubrum
21- 55555 5   55555  --------- ---- -------- -- ---- ------  ----- Pinus tadea
11- 44244 -   -21--  --------- 12-4 ----1--- 1- ---- ------  1---- Vitis rotundifolia
--- 42121 -   -21--  --------- ---- -------- 5- ---- ------  ----- Chasmanthium laxum
--- 1-1-2 -   -1---  ----1---- ---- -------- -- ---- ------  ----- Sassafras albidum
2-- 1--1- -   -----  --------- ---- -------- -- ---- ------  ----- Diospyros virginiana
--- ----- -   11152  --------- ---- 2------- -- 2-42 ------  ----- Andropogon virginicus
-1- ----- -   11-11  11---1--- 1--- ------5- -- 1--1 ------  ---1- Dichanthelium acuminatum
--- ----- -   ---1-  4542545-1 ---2 --1----- -- ---4 ------  -1-22 Myrica pensylvanica
--- ----- -   -----  4-------- ---- -------- -- ---- ------  ----- Prunus maritima
--1 ----- -   ---1-  244122252 1--2 11--2111 -- 1--2 -2---2  111-1 Solidago sempervirens
```

```
                                        1                  111  ←   Plot numbers (read down)
999 88888 8   99999  777777711 3333      110 11 1112 788788  99000
567 45678 9   31402  412356756 2354 12345027 34 7890 801923  98012  ↓   Species

--- ----- -   -----  2--1-1122 ---- -------- -- ---- ------  1-1-- Diodea teres
--- ----- -   -----  ----11-11 ---- -------- -- ---- ------  --1-- Oenothera humifusa
222 14144 4   12121  -1-14---- 1133 22115524 54 4--1 2----4  -1--- Toxicodendron radicans
111 -121- 2   -----  4-------- 12-4 -------- 11 ---- ------  ----- Parthinocissus quinquefolia
42- 1--22 -   242--  --------- 55-4 -------- -- ---- ------  ----- Smilax glauca
545 4-241 1   -1---  -54424--- 1-12 51555545 55 4554 -----5  ----- Myrica cerifera
--- ----- -   -----  --------- ---- --5--12- -- 2--- ------  ----- Juncus scirpoidea
--- ----- -   -----  --------- ---- -------- 12 --1- -1---1  ----- Carex hormathodes
--- ----- -   -----  --------- ---- -------- 11 --1- ------  ----- Calystegia sepium
--- ----- 1   -----  --------- ---- -------- 14 ---- ------  ----- Polygonum pensylvanicum
--- ----- -   -----  --------- ---- -------- -4 ---- ------  ----- Hydrocotyle verticillata
--- ----- -   -----  --------- ---- -------- -- -1-- ------  ----- Hydrocotyle umbellata
--- ----- -   -----  ----2---- ---- 1------2 -1 -11- ------  ----- Rosa palustris
--- ----- -   -----  --------- ---- -------- -- -11- ------  ----- Rhexia mariana
--- ----- -   -----  --------- ---- -------- -- 21-- ------  ----- Triadenum virginicum
--- ----- -   -----  --------- ---- -------- -- 11-- ------  ----- Osmunda regalis
--- ----- -   ---1-  --------- ---- -------- -- --2- ------  ----- Ascyrum hypericoides
--- ----- -   -----  --------- ---- -------- -- 4426 ------  ----- Drosera intermedia
--- ----- -   -----  --------- ---- -------- -- 11-- ------  ----- Lycopodium appressum
144 12124 -   1-221  --------- ---- -------- -- 4222 ------  1---- Vaccinium formosum
--- ----- -   -----  --------- ---- -------- -- 111- ------  ----- Pluchea foetidus
--- ----- -   -----  --------- ---- -------- -- 11-- ------  ----- Xyris torta
--- ----- -   -----  ---44---- ---- 4155-524 4- ---- 2-2-11  ----- Baccharis halimifolia
--- ----- -   -----  --------- ---- -------- -- ---- 555552  ----- Iva frutescens
--- ----- -   -----  --------- ---- -------- -1 ---- 4----5  ----- Eleocharis rostellata
--- ----- -   1-2-1  2---11-24 422- -------- -- ---- ------  55555 Hudsonia tomentosa
1-- ----- -   --1--  1----111- 1--1 -1------ -- ---2 ------  12--- Panicum amarum
--- ----- -   -----  1------1- 11-- -------- -- ---- ------  12112 Lechea maritima
--- ----- -   -----  1------1- ---- -------- -- ---- ------  --1-1 Cyperus grayi
--- ----- -   -----  --------- ---- -------- -- ---- ------  ----- Typha angustifolia
--- ----- -   -----  --------- ---- -------- -- ---- ------  ----- Eupatorium capillaceum
--- ----- -   -----  --------- ---- -------- -- ---- -51---  ----- Eleocharis palustris
--- 12-1- -   11--2  --------- ---- 4-51--2- -- 454- ------  ----1 Panicum virgatum
--- ----- -   1---1  --------- ---- -1------ -1 1-41 ------  ----- Juncus canadensis
--- ----- 1   -----  ----1---- ---- ----1--5 11 --1- ------  ----- Phragmites austalis
--- ----- -   -----  --------- ---- -------- -- ---- ----1-  ----- Spartina alterniflora
--- ----- -   -----  --------- ---- -------- -- ---- ---2--  ----- Limonium nashii
--- ----- -   1----  --2------ ---- 4--1---2 -- 1254 54---1  ----- Scirpus pungens
--- ----- -   -----  221122112 11-1 -------- -- ---- ------  111-- Ammophila breviligulata
--- ----- -   -----  -----1--1 ---- -------- -- ---- ------  ----- Chamaecyse polygonifolia
-1- ----- -   -----  --------- ---- -1---12- -- 1--- ------  ----- Eupatorium hyssopifolium
--- ----- -   -----  ----1---- -4-- -----51- -- ---- ------  ---2- Schizachyrium scoparium
--- ----1 -   ---1-  1-------- ---- -----2-- -- 111- ------  ----- Euthamia tenuifolia
--- ----- -   ----1  --------- ---- ------2- -- ---- ------  ----- Hypericum gentianoides
1-- ----- -   -----  2------2- -111 -------- -- ---- ------  ----- Rumex acetosella
--1 ----- 2   -----  ----1---- 1--1 -------- 1- ---- ------  -1--- Rubus argutus
-1- ----- -   ---1-  --------- ---1 -------- -- ---- ------  1---- Gnaphalium obtusum
--- ----- -   -----  --------- ---- -------- -- ---- ------  ----- Juncus roemerianus
--- ----- -   1--21  ----1---- ---- 11---121 -- 2-44 1-----  ----- Juncus dicotomus
--- ----- -   -----  --------- ---- -------- -- 1--1 ------  ----- Linum medium
```

```
                                        1                  111  ←   Plot numbers (read down)
999 88888 8   99999  777777711 3333      110 11 1112 788788  99000
567 45678 9   31402  412356756 2354 12345027 34 7890 801923  98012  ↓   Species

--- ----- -   -----  --------- ---- --1----- -- ---4 ------  ----- Fimbristylis castanea
--- ----- -   -----  --------- ---- -------- -- ---- ------  ----- Sabatia stellaris
--- ----- -   -----  2-5-----2 1--- 55-5-542 -- ---- 555555  --1-- Spartina patens
--- ----- -   -----  --------- ---- -------- -- ---- 5--5--  ----- Distichlis spicata
--- ----- -   -----  ---1----- ---- -------- -- ---- ------  ----- Scirpus robustus
--- ----- -   -----  --------- ---- -------- -- ---- ------  ----- Salicornia bigelovii
--- ----- -   -----  --------- ---- -------- -- ---- ------  ----- Cakile edentula
--- ----- -   -----  --------- ---- -------- -- ---- ------  ----- Salsola carolinana
--- ----- -   -----  ---111--1 ---- -------- -- ---- ------  --1-- Triplasis purpurea
--- ----- -   -1---  ----1---- ---1 11------ -- 1--- --1---  ----- Dichanthelium scoparium
--- 1---- -   -----  --------- ---- -------- -- 2-1- ------  ----- Andropogon glomeratus
--- ----- -   -----  --------- ---- -------- -- 4--2 ------  ----- Mikania scandens
--- ----- -   -----  -1------- --1- -------- -- ---- ------  ----- Dichanthelium sphaerocarpon
-1- ----- -   -1-1-  --------- ---- -----21- -- 1--- ------  ----- Eupatorium rotundifolium
--- 1-1-- -   11--2  --------- -1-- ------1- -- 111- ------  -1-1- Pinus taeda seedling
--- 1---- -   ---1-  --------- ---- -------- -- -1-- ------  ----- Acer rubrum seedling
--- ----- -   -----  --------- ---- -------- -- ---- ------  ----- Fimbristylis autumnalis
11- ----- -   -11--  --------- --1- -----1-- -- ---- ------  ----- Rhus copallinum
22- ----- -   -----  --------- ---1 -----1-- 1- ---- -----1  ----- Festuca rubra
545 15455 5   -42--  --------- --44 -------- -- ---- ------  1---- Smilax rotundifolia
--- 1--2- -   2----  ------1-- ---1 -------- -- ---- ------  ----- Diospyros virginiana seedling
-1- ----- -   -12--  --------- ---1 -------- -- ---- ------  ----- Ilex opaca
-1- --1-- -   -----  --------- ---- -------- -- ---- ------  ----- Campsis radicans
--- ----- -   --4--  --------- ---- -------- -- ---- ------  ----- Quercus falcata
--- ----- -   -----  -1------- ---- -------- -1 ---- ------  ----- Galium obtusum
--- ----- -   -----  -------11 1--1 -------- -- -2-- ------  11--- Linaria canadensis
--- ----- -   -----  2------12 ---- -------- -- ---- ------  ----- Vulpia myuros
--- ----- -   -----  2------14 ---- -------- -- ---- ------  ----- Bromus tectorum
--- ----- -   -----  -------11 ---- -------- -- ---- ------  --1-- Heterotheca subaxillaris
--- ----- -   -----  -------11 ---- -------- -- ---- ------  ----- Polygonella articulata
--- ----- -   -----  -----1-1- ---- -------- -- ---- ------  ----- Cenchrus tribuloides
--- ----- -   -----  --------- ---- -------- -1 ---- ------  ----- Ptilimnium capillaceum
--- 1---- -   -1---  --------- ---- 1------- 1- ---- ------  ----- Carex albolutescens
--- ----- -   -----  --------- ---- -------- -2 ---- ------  ----- Lycopus americanus
--- ----- -   -----  --------- ---- -------- -- ---- -2----  ----- Lythrum lineare
```

HERBACEOUS VEGETATION	SPARSE VEGETATION

```
Typha (angustifolia, domingensis) Tidal Herbaceous Alliance
|     Panicum virgatum Seasonally Flooded Herbaceous Alliance
|     |    Phragmites australis Tidal Herbaceous Alliance
|     |    |   Spartina alternifora Tidal Herbaceous Alliance
|     |    |   |       Scirpus pungens - Spartina patens Herbaceous Alliance
|     |    |   |       |    Ammophila breviligulata Herbaceous Alliance
|     |    |   |       |    |        Schizachyrium scoparium Shrub Herbaceous Alliance
|     |    |   |       |    |        |     Juncus roemerianus Tidal Herbaceous Alliance
|     |    |   |       |    |        |     |     Juncus dicotomous Seasonally Flooded Herbaceous Alliance
|     |    |   |       |    |        |     |     |   Scirpus pungens Seasonally Flooded Herbaceous Alliance
|     |    |   |       |    |        |     |     |   |     Spartina patens Tidal Herbaceous Alliance
|     |    |   |       |    |        |     |     |   |     |          Salicornia spp.-Spartina alterniflora
|     |    |   |       |    |        |     |     |   |     |          Tidal Herbaceous Alliance
|     |    |   |       |    |        |     |     |   |     |          |      Cakile Edentula Sparsely Vegetated
|     |    |   |       |    |        |     |     |   |     |          |      Alliance
|     |    |   |       |    |        |     |     |   |     |          |      |
-------------------------------------------------------------------------------
111      111                              11111                                ←  TWINSPAN number (READ DOWN)
000 5555 000 2233222 4444 45666666     1 11111 55 34444 45355337 2222   6666
435 3456 689 8901567 5678 49013452 67891 02341 78 82031 92901670 1234   6789         Species ↓
--- ---- --- ------- ---- -------- ---2- ----- -- ----- -------- ----   ---- Prunus serotina
--- ---- --- ------- ---- -------- ----- ----- -- ----- -------- ----   ---- Amelanchier canadensis
--- ---- --- ------- ---- -------- ----- ----- -- ----- -------- ----   ---- Amelanchier canadadensis seedling
--- ---- --- ------- ---- -------- ----- ----- -- ----- -------- ----   ---- Aronia arbutifolia
--- ---- --- ------- ---- -------- ----- ----- -- ----- -------- ----   ---- Acer rubrum
--- -2-- --- ------- ---- -------- ----- ----- -- ----- -------- ----   ---- Pinus tadea
--- ---- --- ------- ---- -------- ----- ----- -- ----- -------- ----   ---- Vitis rotundifolia
--- ---- --- ------- ---- -------- ----- ----- -- ----- -------- ----   ---- Chasmanthium laxum
--- ---- --- ------- ---- -------- ----- ----- -- ----- -------- ----   ---- Sassafras albidum
--- ---- --- ------- ---- -------- ----- ----- -- ----- -------- ----   ---- Diospyros virginiana
--- ---- --- ------- ---- -------- -1-4- ----- 45 ----- -------- ----   ---- Andropogon virginicus
--- ---- --- ------- ---- -------- --1-5 ----- 2- ----- -------- ----   ---- Dichanthelium acuminatum
2-- ---- --- ------- ---- ---1---2 2124- ----- -2 -1-1- -------- ----   ---- Myrica pensylvanica
--- ---- --- ------- ---- -------- ----- ----- -- ----- -------- ----   ---- Prunus maritima
1-- 1-21 --- ------- ---2 14--1444 21-25 ----- 22 11-22 -----1-- ----   ---- Solidago sempervirens
--- ---- --- ------- ---- -------1 ----- ----- -- ---1- -------- ----   ---- Diodea teres
--- ---- --- ------- ---- -1------ ----- ----- -- -1--- -------- ----   ---- Oenothera humifusa
2-- 111- 42- ------- ---- -------1 4142- ----- -- ----- ------1- ----   ---- Toxicodendron radicans
1-- ---- --1 ------- ---- -------- --1-- ----- -- ----- -------- ----   ---- Parthinocissus quinquefolia
--- ---- --- 1------ ---- -------- ----- ----- -- ----- -------- ----   ---- Smilax glauca
-1- 421- 1-- ------- ---- --1----- --214 ----- 2- ----1 ------1- ----   ---- Myrica cerifera
--- ---- --- ------- ---- -------- ----5 ----- -- ----- -------- ----   ---- Juncus scirpoidea
--- -1-- --- ------- ---- -------- ----- ----- -- ----- -------- ----   ---- Carex hormathodes
--- -1-- 2-- ------- ---- -------- ----- ----- -- ----- -------- ----   ---- Calystegia sepium
111 ---- --1 ------- ---- -------- ----- ----- -- ---1- -------- ----   ---- Polygonum pensylvanicum
--- ---- --- ------- ---- -------- ----- ----- -- ----- -------- ----   ---- Hydrocotyle verticillata
--4 ---- --- ------- ---- -------- ----- ----- -- ----- -------- ----   ---- Hydrocotyle umbellata
--- -1-- -1- ------- ---- --3----- ----- ----- -- ----- -------- ----   ---- Rosa palustris
```

```
111      111                            11111                                ←  TWINSPAN number (READ DOWN)
000 5555 000 2233222 4444 45666666     1 11111 55 34444 45355337 2222   6666
435 3456 689 8901567 5678 49013452 67891 02341 78 82031 92901670 1234   6789         Species ↓
--- -1-- --- ------- ---- -------- ----- ----- -- ----- -------- ----   ---- Rhexia mariana
--- ---- --- ------- ---- -------- ----- ----- -- ----- -------- ----   ---- Triadenum virginicum
--- -2-- --- ------- ---- -------- ----- ----- -- ----- -------- ----   ---- Osmunda regalis
--- ---- --- ------- ---- -------- ----- ----- -- ----- -------- ----   ---- Ascyrum hypericoides
--- ---- --- ------- ---- -------- ----- ----- -5 ----- -------- ----   ---- Drosera intermedia
--- ---- --- ------- ---- -------- ----- ----- -4 ----- -------- ----   ---- Lycopodium appressum
--- ---- --- ------- ---- -------1 ----- ----- 12 ----- -------- ----   ---- Vaccinium formosum
--- ---- --- ------- ---- -------- ----- ----- -- --11- -------- ----   ---- Pluchea foetidus
--- ---- --- ------- ---- -------- ----- ----- -- ----- -------- ----   ---- Xyris torta
1-- 1114 --- ------- ---- -------- 2---- ----- -- 1-2-- ------11 ----   ---- Baccharis halimifolia
1-- ---- --- ------- ---- -------- ----- 2---- -- ----- -----2-- ----   ---- Iva frutescens
1-- ---- --- ------- ---- -------- ----- ----- -- ----- -----5-- ----   ---- Eleocharis rostellata
--- ---- --- ------- ---- -------- ----- ----- -- ----- -------- ----   ---- Hudsonia tomentosa
--- ---- --- ------- ---- ---21-2- -14-1 ----- 21 -2-45 -------- ----   ---- Panicum amarum
--- ---- --- ------- ---- -------- ----- ----- -- ----- -------- ----   ---- Lechea maritima
--- ---- --- ------- ---- -------- ----- ----- -- ----- -------- ----   ---- Cyperus grayi
455 ---- 1-- ------- ---- -------- ----- ----- -- ----- -------- ----   ---- Typha angustifolia
1-2 ---- --- ------- ---- -------- ----- ----- -1 ----- -------- ----   ---- Eupatorium capillaceum
-14 --4- --- ------- ---- -------- ----- ----- -- 4---4 -------- ----   ---- Eleocharis palustris
--- 5555 --- ------- ---- -------- ----- ----- -- ----- -------- ----   ---- Panicum virgatum
--- 1-11 --- ------- ---- -------- ----- ----- 22 --12- -------- ----   ---- Juncus canadensis
1-- 1--- 555 ------- ---- -------- ----- ----- -- 2-11- ----1--- ----   ---- Phragmites australis
--4 ---- --- 4544555 ---- ----4--- ----1 --1-2 -- ----- ----1--- 5445   ---- Spartina alterniflora
--- ---- --- 1-21-11 ---- -------- ----- ----2 -- ----- -2------ --2-   ---- Limonium nashii
2-2 544- --- ------- 5554 5------1 ----- ----- -- 52511 --4-145- ----   ---- Scirpus pungens
--- ---- --- ------- ---- 15542441 5---- ----- -- -5--- -------- ----   11-1 Ammophilia breviligulata
--- ---- --- ------- ---- 11111111 ----- ----- -- ----- -------- ----   11-- Chamaecyse polygonifolia
--- ---- --- ------- ---- -------- -1145 ----- 2- ----- -------- ----   ---- Eupatorium hyssopifolium
--- --1- --- ------- ---- -------- 541-1 ----- -- ----- -------- ----   ---- Schizachyrium scoparium
--- --1- --- ------- ---- -------- -11-- ----- 2- --1-2 -------- ----   ---- Euthamia tenuifolia
--- ---- --- ------- ---- -------- ----5 ----- 1- ----- -------- ----   ---- Hypericum gentianoides
--- ---- --- ------- ---- -------- 121-- ----- -- ----- -------- ----   ---- Rumex acetosella
--- ---- --- ------- ---- -------- -211- ----- -- ----- -------- ----   ---- Rubus argutus
--- ---- --- ------- ---- -------- 112-- ----- -- ----- -------- ----   ---- Gnaphalium obtusum
--- ---- --- ------- ---- -------- ----- 55555 -- ----- -------- ----   ---- Juncus roemerianus
--- --11 --- ------- ---- -------- 11-2- ----- 55 ----2 -------- ----   ---- Juncus dicotomus
--- --1- --- ------- ---- -------- ----- ----- 11 --1-- -1------ ----   ---- Linum medium
--- ---- --- ------- ---- -------- ----5 ----- -- ---21 -------- ----   ---- Fimbristylis castanea
--- ---- --- ------- ---- -------- ----- ----- -- -4--2 -4------ ----   ---- Sabatia stellaris
4-- 14-4 --- 2------ -225 ----4-51 45-41 2-1-- -- 1---- 55455255 ----   ---- Spartina patens
5-- ---- --- 55551-- ---- -------- ----- ----- -- ----- -45212-4 2--2   ---- Distichlis spicata
--- ---- --- ------- ---- -------- ----- ----- -- ----- -------5 ----   ---- Scirpus robustus
--- ---- --- ----1-- ---- -------- ----- ----- -- ----- -------- 22--   ---- Salicornia bigelovii
--- ---- --- ------- --1- --1111-1 ----- ----- -- ----- -------- ----   1122 Cakile edentula
--- ---- --- ------- ---- ---1---1 ----- ----- -- ----- -------- ----   -111 Salsola caroliniana
--- ---- --- ------- ---- 22-----1 ----- ----- -- ----- -------- ----   1--- Triplasis purpurea
--- -11- --- ------- ---- -------- -1-2- ----- 2- ----- -------- ----   ---- Dichanthelium scoparium
--- ---- --- ------- ---- -------- ----- ----- -- ----- -------- ----   ---- Andropogon glomeratus
1-- ---- --2 ------- ---- -------- ----- ----- -1 ----- -------- ----   ---- Mikania scandens
--- ---- --- ------- ---- -------- -2--- ----- -- ----- -------- ----   ---- Dichanthelium sphaerocarpon
--- ---- --2 ------- ---- -------- ---2- ----- 11 ----- -------- ----   ---- Eupatorium rotundifolium
```

```
111      111                            11111                                ←  TWINSPAN number (READ DOWN)
000 5555 000 2233222 4444 45666666     1 11111 55 34444 45355337 2222   6666
435 3456 689 8901567 5678 49013452 67891 02341 78 82031 92901670 1234   6789         Species ↓
--- -1-- --- ------- ---- -------- ----- ----- -2 ----- -------- ----   ---- Pinus taeda seedling
--- ---- --- ------- ---- -------- ----- ----- -1 ----- -------- ----   ---- Acer rubrum seedling
--- ---- --- ------- ---- -------- ----- ----- -3 ----5 -------- ----   ---- Fimbristylis autumnalis
--- ---- --- ------- ---- -------- 11--- ----- -- ----- -------- ----   ---- Rhus copallinum
--- ---1 --- ------- ---- -------- -4--- ----- -- ----- -------- ----   ---- Festuca rubra
--- ---- --- ------- ---- -------- ----- ----- -- ----- -------- ----   ---- Smilax rotundifolia
--- ---- --- ------- ---- -------- ----- ----- -- ----- -------- ----   ---- Diospyros virginiana seedling
--- ---- --- ------- ---- -------- ----- ----- -- ----- -------- ----   ---- Ilex opaca
--- ---- --- ------- ---- -------- ----- ----- -- ----- -------- ----   ---- Campsis radicans
--- ---- --- ------- ---- -------- ----- ----- -- ----- -------- ----   ---- Quercus falcata
1-- ---- --- ------- ---- -------- ----- ----- -- ----- -------- ----   ---- Galium obtusum
--- ---- --- ------- ---- -------- --1-- ----- -- ----- -------- ----   ---- Linaria canadensis
--- ---- --- ------- ---- -------- ----- ----- -- ----- -------- ----   ---- Vulpia myuros
--- ---- --- ------- ---- -------- ----- ----- -- ----- -------- ----   ---- Bromus tectorum
--- ---- --- ------- ---- -------- ----- ----- -- ----- -------- ----   ---- Heterotheca subaxillaris
--- ---- --1 ------- ---- -------- ----- ----- -- ----- -------- ----   ---- Polygonella articulata
--- ---- -1- ------- ---- -------- ----- ----- -- ----- -------- ----   ---- Cenchrus tribuloides
--1 ---- 2-- ------- ---- -------- ----- ----- -- -1--- -------- ----   ---- Ptilimnium capillaceum
--- --1- --- ------- ---- -------- ----- ----- -- ----- -------- ----   ---- Carex albolutescens
21 ---- --- ------- ---- -------- ----- ----- -- ----- -------- ----    ---- Lycopus americanus
--1 ---- --- ------- ---- -------- ----- ----- -- ----- ------4- ----   ---- Lythrum lineare
```

The state of the USNVC was highly dynamic in 1994, and the original map and classification units were planned at the alliance level. However, the concept of the association was evolving, and following the data analysis, the vegetation units were proposed as “communities”, and named as provisional units at what came to be known as the association level. Descriptions of provisional communities derived from data analysis are included in the original 1994 report (Appendix G). Table 2 illustrates the alliances identified in the TWINSPAN data analysis, and the corresponding provisional community name used in Appendix G.

Table 2. TWINSPAN table number and corresponding plot codes from TWINSPAN output above.

TWINSPAN NUMBER	PLOT CODE	TWINSPAN NUMBER	PLOT CODE	TWINSPAN NUMBER	PLOT CODE	TWINSPAN NUMBER	PLOT CODE
1	57AB03	30	22RR02	59	12RR05	88	52AB07
2	77AB06	31	32RR15	60	37RR03	89	42AB05
3	TNC01	32	57AB07	61	32RR02	90	32RR03
4	TNC03	33	57AB06	62	52AB05	91	47AB01
5	TNC07	34	57AB05	63	C16LAS	92	52AB03
6	77AB03	35	42RR02	64	C14LAS	93	62AB02
7	32RR01	36	32RR07	65	C08LAS	94	42AB04
8	77AB01	37	77AB07	66	62AB05	95	72AB01
9	37RR05	38	47AB04	67	67AB03	96	42AB03
10	TNC02	39	47RR01	68	22RR04	97	42AB01
11	TNC04	40	37RR04	69	17RR02	98	52AB02
12	TNC09	41	TNC12	70	67AB02	99	42AB02
13	67AB05	42	TNC13	71	12RR04	100	12RR01
14	37AB06	43	TNC18	72	22RR01	101	57AB02
15	12RR03	44	62AB04	73	77AB05	102	C10LAS
16	12RR02	45	27RR01	74	32EF01	103	37AB04
17	57AB04	46	22RR03	75	52AB06	104	37RR02
18	57AB01	47	TNC15	76	47AB06	105	42RR03
19	52AB01	48	TNC17	77	57AB08	106	37AB03
20	42CEF02	49	47AB02	78	32RR06	107	37AB05
21	72AB03	50	32RR05	79	32RR11	108	37RR01
22	62AB03	51	77AB02	80	37AB02	109	32RR04
23	32RR08	52	TNC11	81	47AB03	110	27RR02
24	32RR13	53	77AB08	82	67AB08	111	32RR09
25	72AB02	54	52AB04	83	32RR10	112	32RR14
26	17RR01	55	47AB05	84	67AB01	113	37AB01
27	67AB07	56	77B04	85	67AB06	114	42RR01
28	32RR12	57	42CEF01	86	67AB04		
29	47RR02	58	42CEF03	87	62AB01		

Vegetation Map Production - 1994

For the most part, map units reflected individual associations. However, two forested communities, one upland and one wetland, both dominated by evergreen *Pinus taeda*, were indistinguishable from the 1993 aerial photography, and these two associations were mapped as a combined map unit.

Four other ad-hoc map units were used to denote unvegetated areas, both natural (Naturally Unvegetated, Dead Vegetation) and anthropogenic (Built-up areas (Unvegetated)), as well as wholly cultural vegetation on roadsides, parking lots, and the like (Undifferentiated Anthropogenic Grassland). Table 3 indicates the number of polygons and number of mapped hectares of map units (community types and other land cover units). Figures 37-44 illustrate the 1994 vegetation map from north to south; note scale differences in Figures 43 and 44.

Table 3. Map units (community type or land cover unit), number of polygons and number of mapped hectares, 1994 map.

Map Unit Common Name	Map Unit Scientific Name	Number of polygons	Total mapped hectares
Backdune Grassland	*Myrica pensylvanica / Schizachyrium scoparium* ssp. *littorale, Eupatorium hyssopifolium* Sparse Shrubland	298	84.9
Bayberry Dune Shrubland	*Myrica pensylvanica / Diodia teres* Shrubland	298	191.7
Beach Heather Dune	*Hudsonia tomentosa / Panicum (amarum, amarulum)* Dwarf-shrubland	418	72.5
Beachgrass Dune	*Ammophila breviligulata , Panicum (amarum, amarulum)* Herbaceous Vegetation	123	121.8
Brackish Tidal Marsh	*Typha angustifolia, Hibiscus moscheutos* Herbaceous Vegetation	4	0.3
Deciduous Maritime Scrub Forest	*Prunus serotina / Myrica cerifera / Smilax rotundifolia* Forest	109	40.8
High Salt Marsh	*Spartina patens, Distichlis spicata, Borrichia frutescens* Herbaceous Vegetation	784	339
Interdunal Swale	*Scirpus pungens, Fimbristylis castanea* Herbaceous Vegetation	65	8.4
Loblolly Pine Dune Woodland	*Pinus taeda / Hudsonia tomentosa* Woodland	244	79
Loblolly Pine Maritime Forest	*Pinus taeda / Myrica cerifera / Osmunda regalis* Forest; *Pinus taeda / Myrica cerifera / Vitis rotundifolia* Forest	175	173.7
Low Salt Marsh	*Spartina alterniflora / Ascophyllum nodosum* Herbaceous Vegetation	1357	764.8
Maritime Shrubland	*Myrica cerifera, Baccharis halimifolia / Spartina patens* Shrubland	263	95.1
Needlerush Marsh	*Juncus roemerianus* Herbaceous Vegetation	89	25.7
Overwash Dune Grassland	*Spartina patens, Scirpus pungens, Solidago sempervirens* (Upland) Herbaceous Vegetation	74	28.3
Phragmites Wetland	*Phragmites australis Herbaceous* Vegetation	64	13.1
Salt Panne	*Salicornia spp., Sarcocornia perennis, Spartina alternifolia* Herbaceous Vegetation	463	170.5

Table 3 (continued). Map units (community type or land cover unit), number of polygons and number of mapped hectares, 1994 map.

Map Unit Common Name	Map Unit Scientific Name	Number of polygons	Total mapped hectares
Shrub Bog	*Myrica (cerifera, pensylvanica), Vaccinium corymbosum* Shrubland	52	15.5
Switchgrass Swale	*Panicum virgatum, Spartina patens* Herbaceous Vegetation	10	2
Tidal Salt Scrub	*Baccharis halimifolia, Iva frutescens* / *Spartina patens* Shrubland	827	215.3
Undifferentiated Anthropogenic Grassland	None	19	53.7
Vine Dune	*Smilax glauca, Toxicodendron radicans* Shrubland	23	7.2
Water	None	406	106.7
Wet Maritime Shrubland	*Myrica cerifera* / *Hydrocotyle spp.* Shrubland	830	507.6
Built Up Areas (Unvegetated)	None	27	23.3
Dead Vegetation	None	32	17.3
Intertidal Sand / Mud Flat	None	34	13
Naturally Unvegetated	None	59	432.9

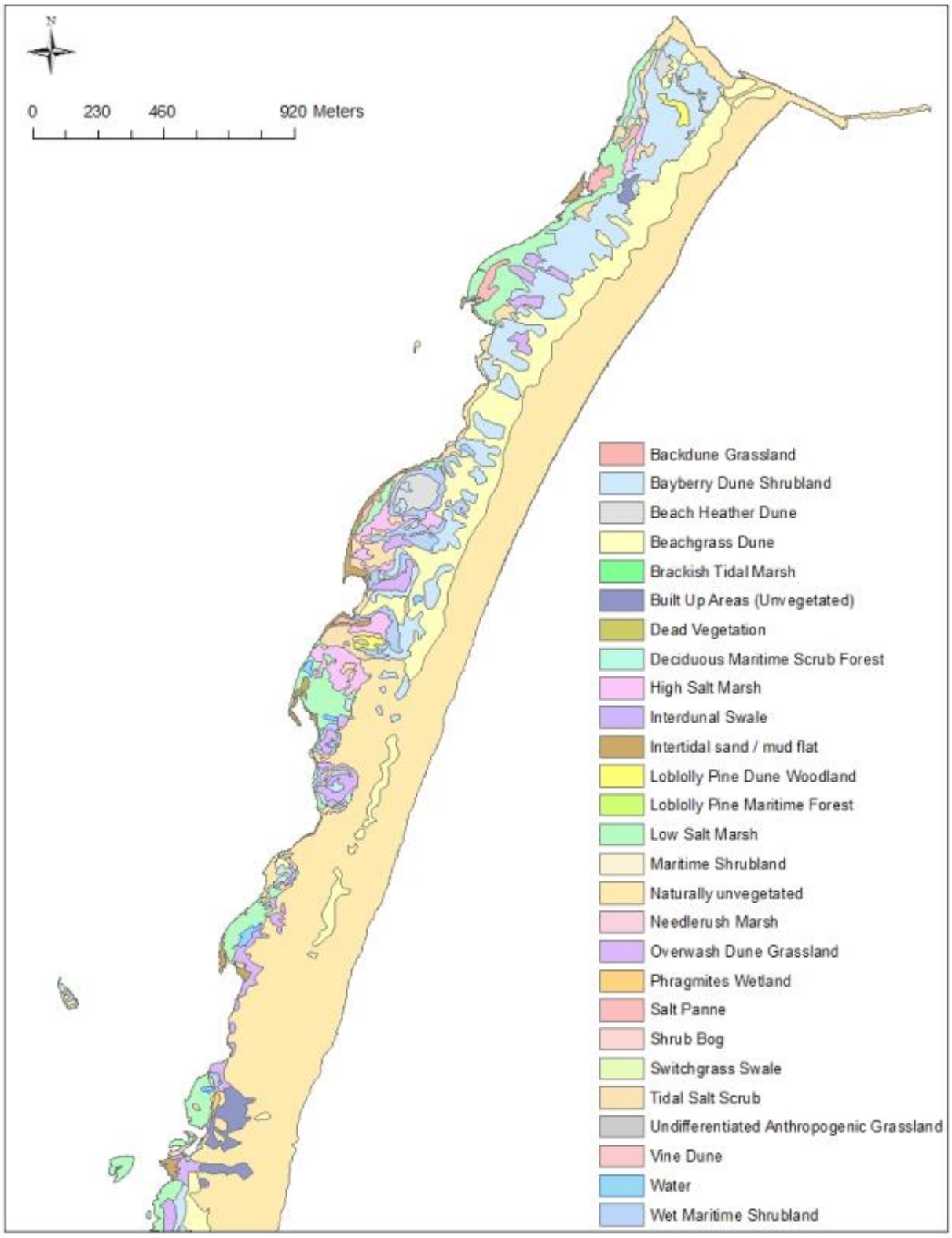


Figure 37. 1994 Vegetation map, northern end of ASIS.

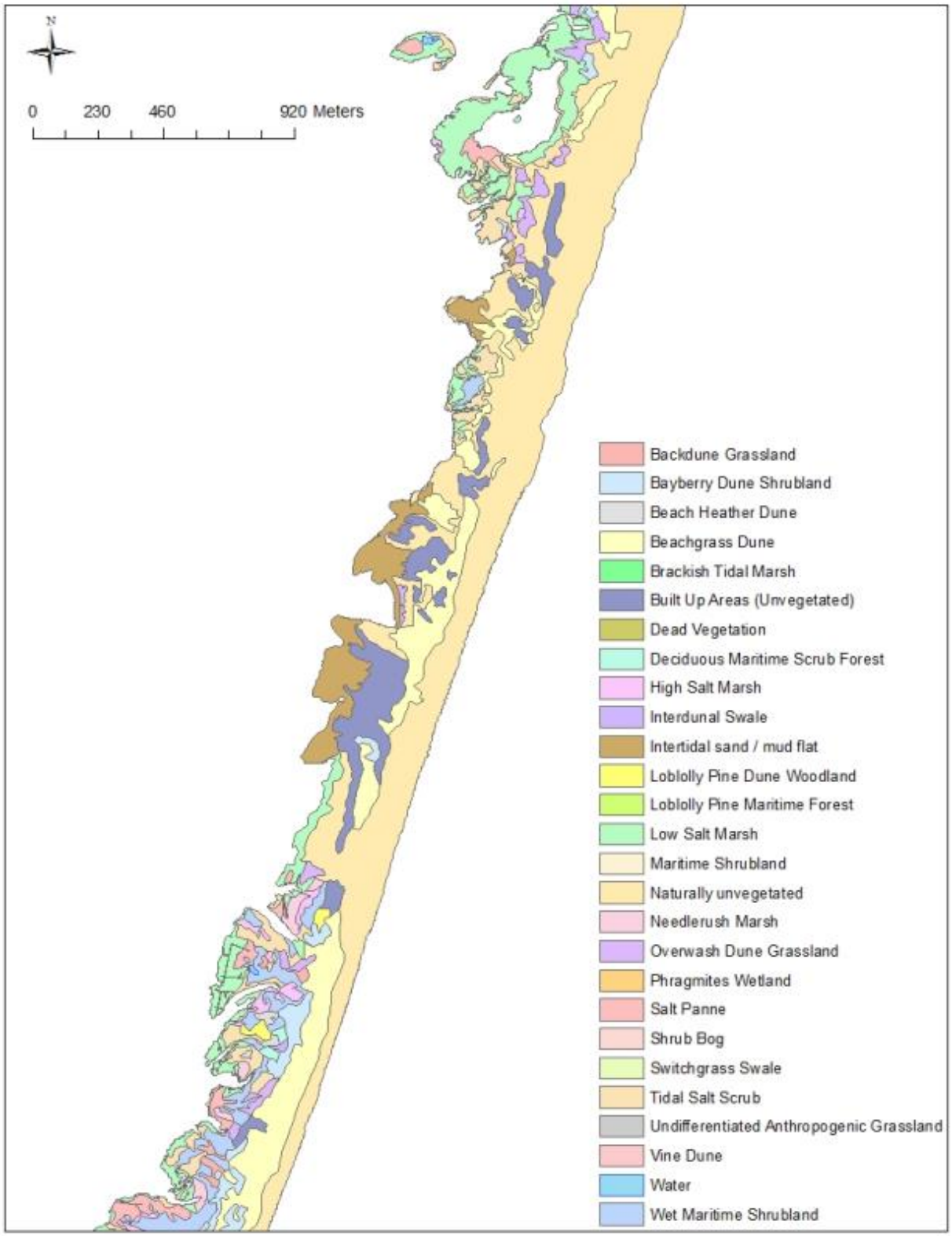


Figure 38. 1994 Vegetation map, north of bridge.

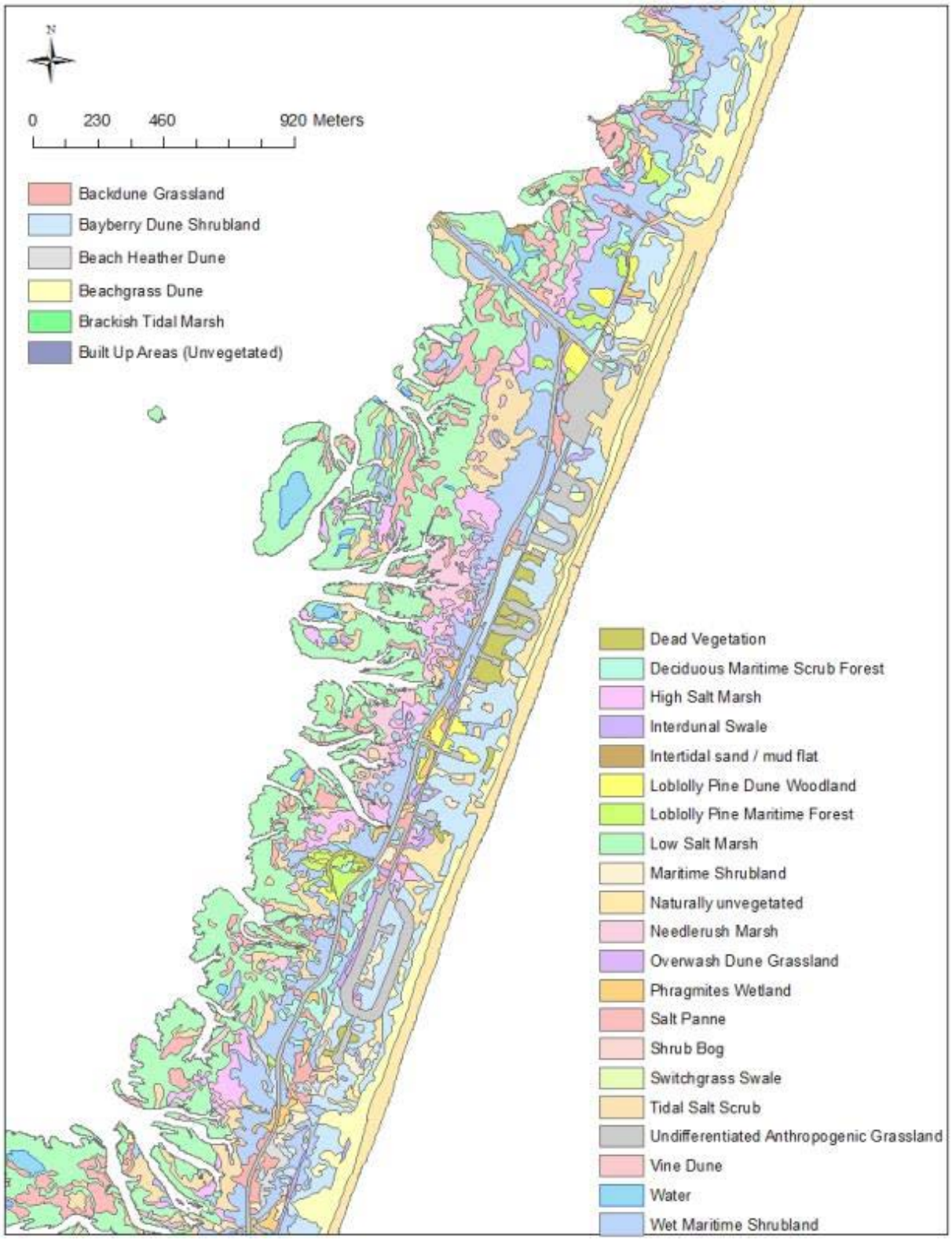


Figure 39. 1994 Assateague State Park and environments.

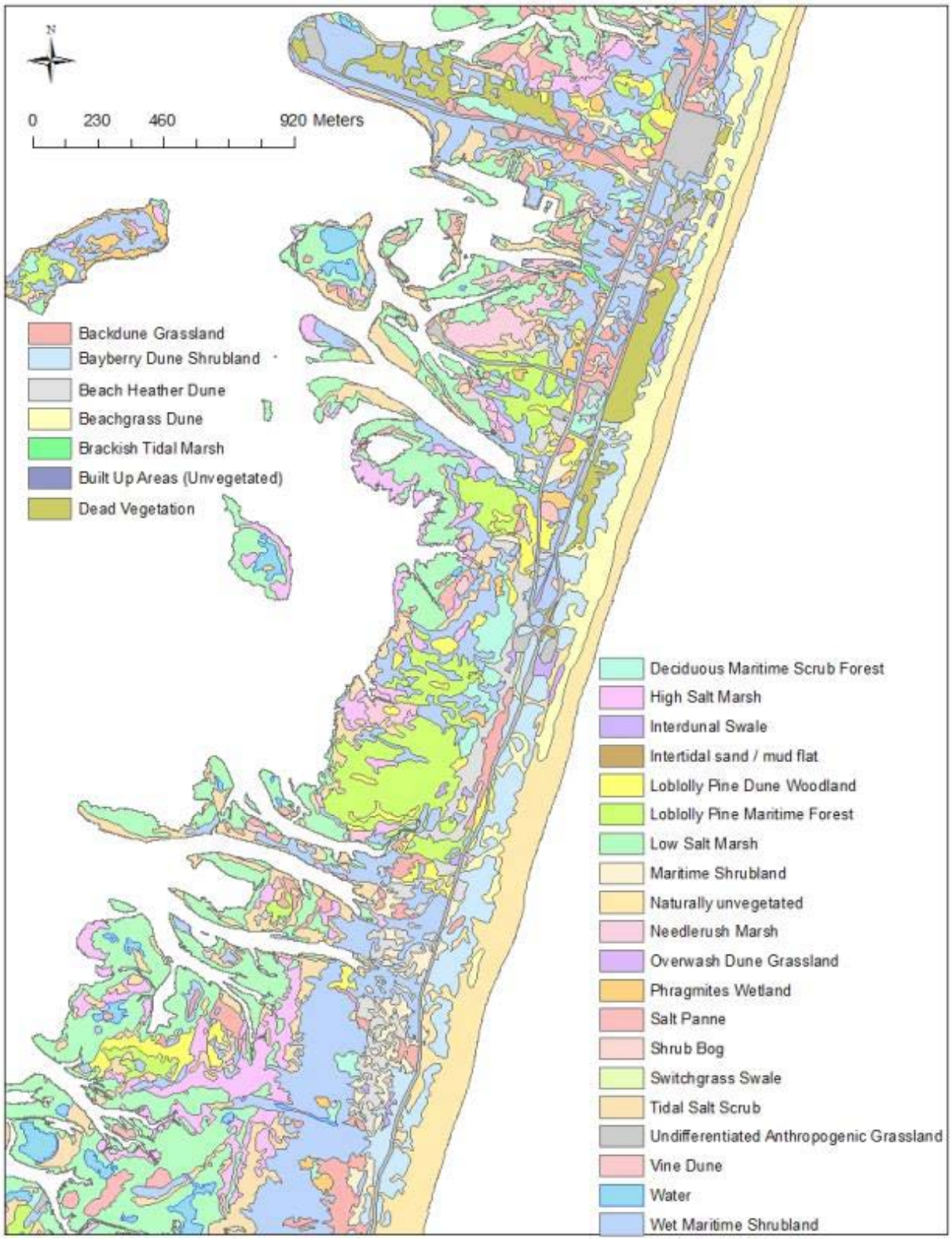


Figure 40. 1994 Vegetation map, Bayside campground and Old Ferry Landing.

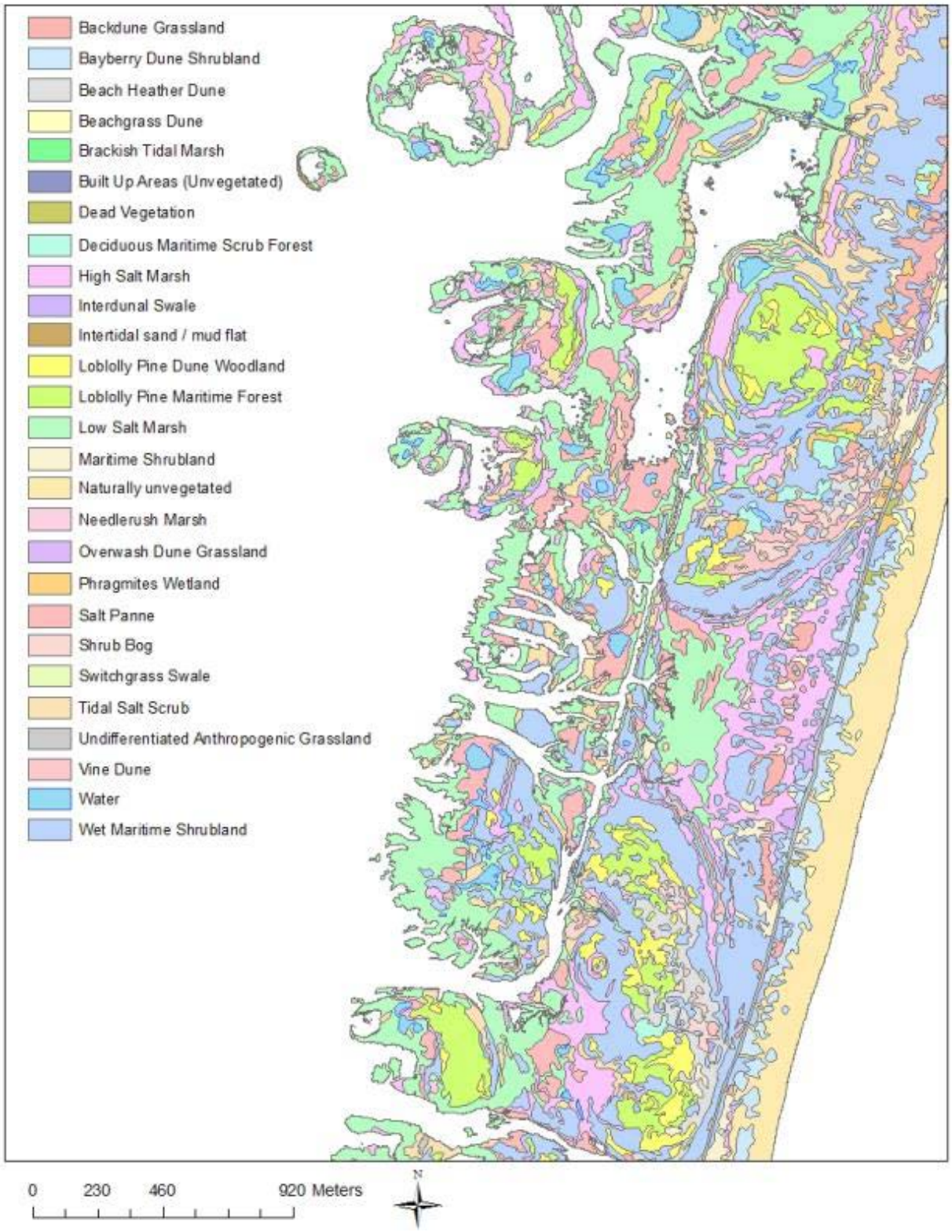


Figure 41. 1994 Pine Tree Campground area.

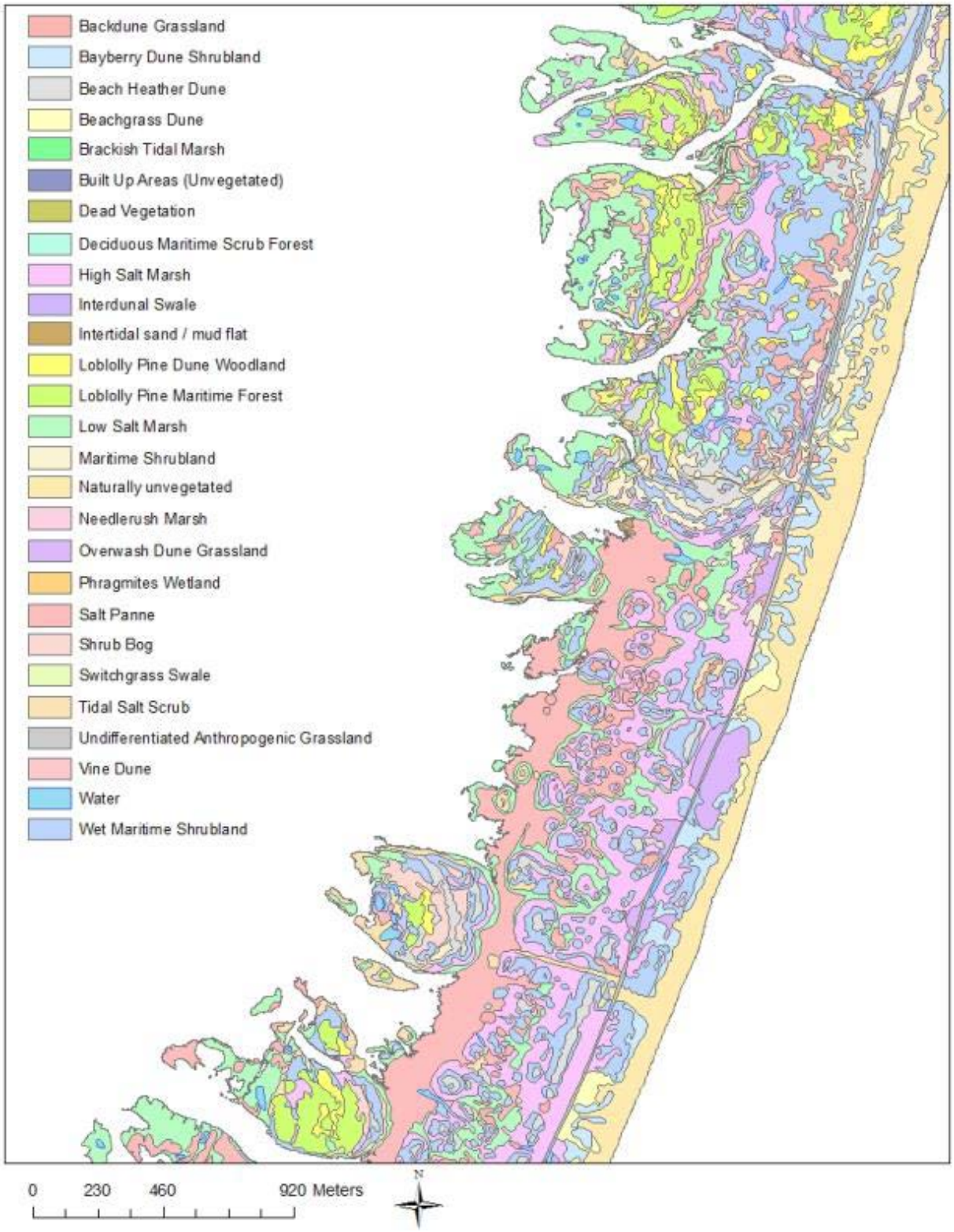


Figure 42. 1994 Vegetation map, Fox Hill Level area.

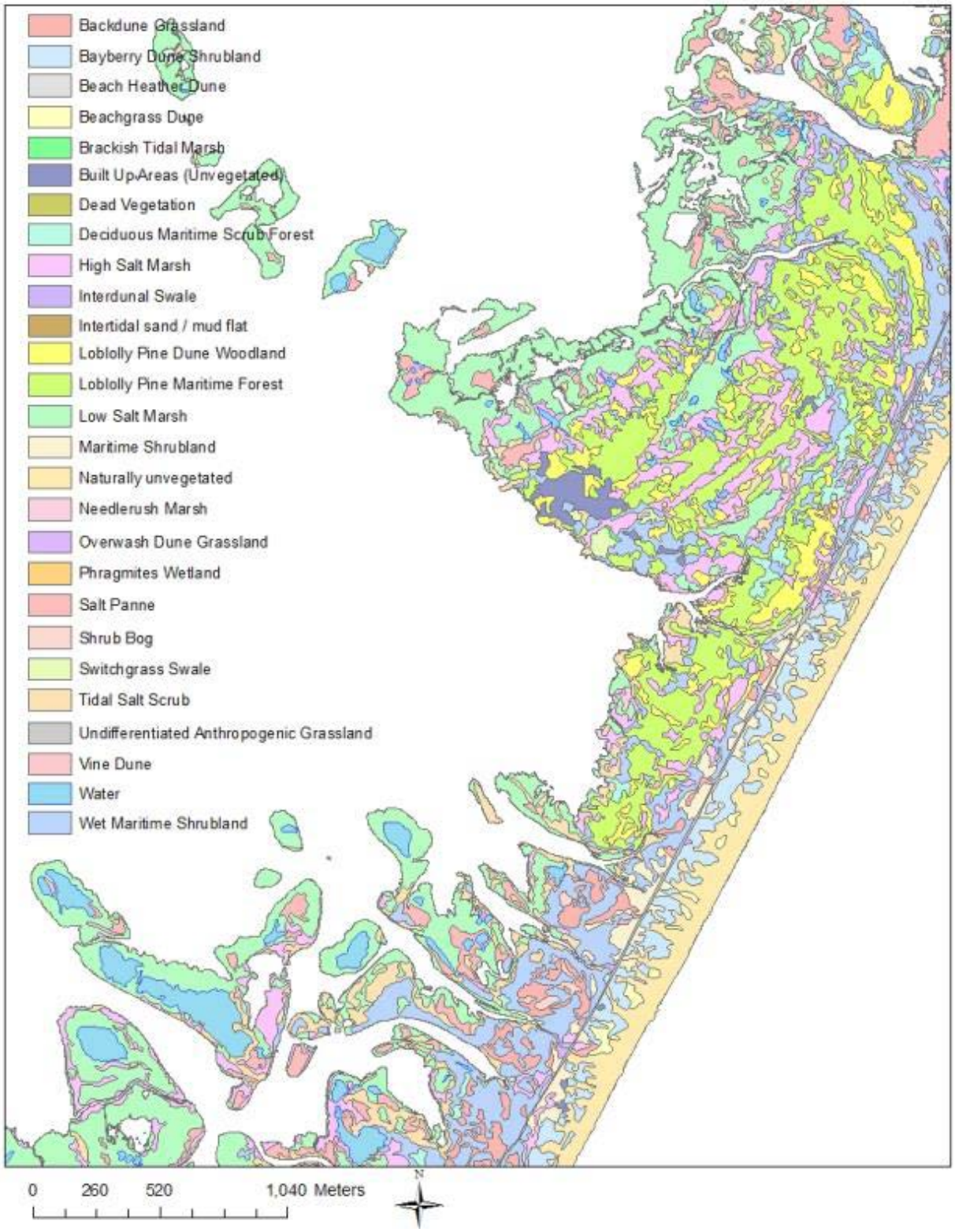


Figure 43. 1994 Green Run area.

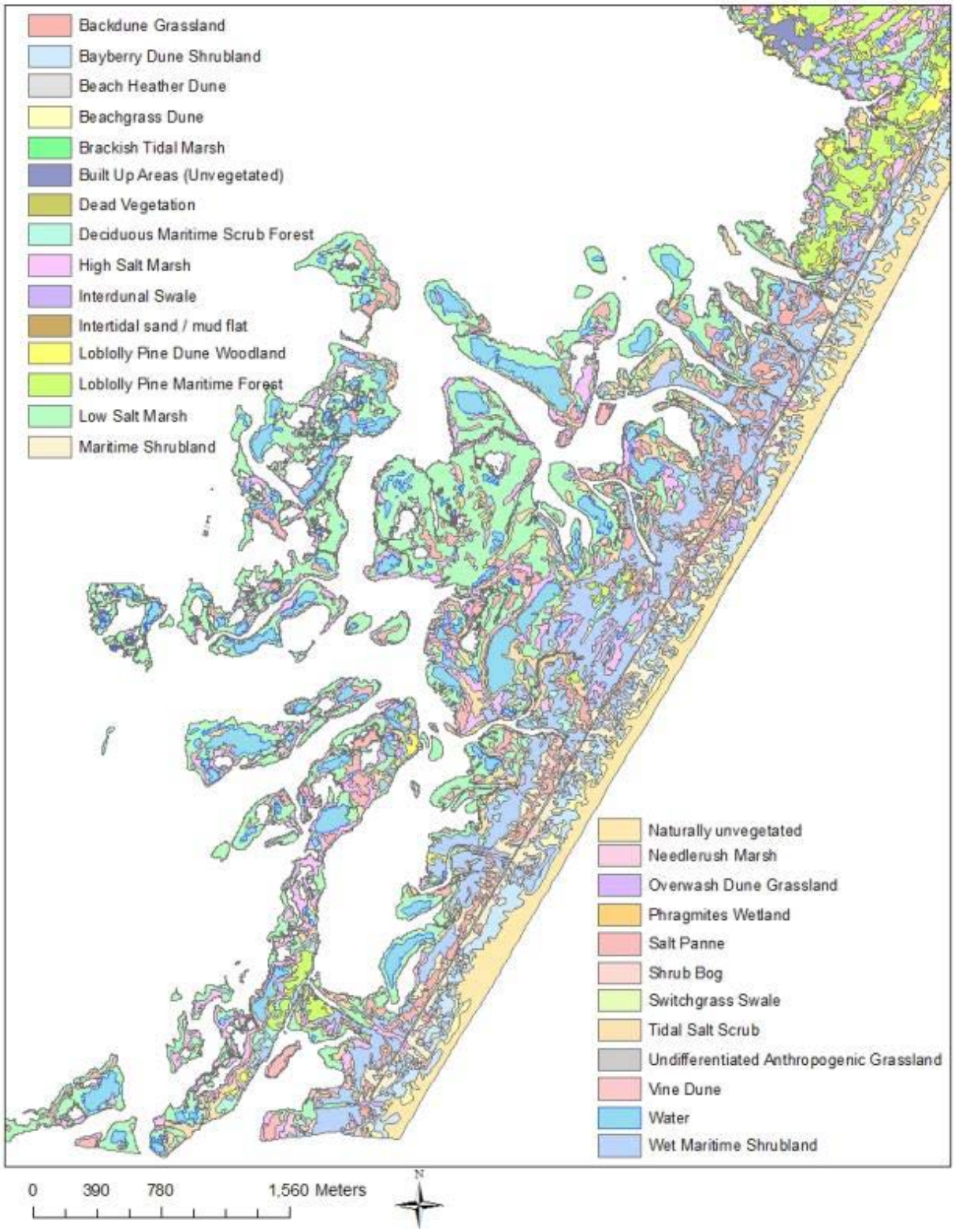


Figure 44. 1994 Vegetation map, southern end of ASIS.

Vegetation Classification and Characterization, 2009 Results

No additional plots were collected subsequent to the 1994 field effort, but associations that had been classified in the USNVC since that time were identified at ASIS by NPS Biologist Chris Lea. In addition, USNVC classification splits from existing associations, as well as scientific name changes, resulted in some changes to the original classification (Table 5). Table 6 indicates nine new associations not recognized in the 1994 effort. Table 4 indicates the number of polygons and number of mapped hectares in the 2009 map (Figures 45-52).

Table 4. 2009 Vegetation map, number of polygons and number of hectares mapped.

Map Unit Common Name	Map Unit Scientific Name	Number of polygons	Total mapped hectares
Backdune Grassland	*Morella (pensylvanica, cerifera) / Schizachyrium littorale - Eupatorium hyssopifolium* Shrub Herbaceous Vegetation	262	81.1
Bayberry Dune Shrubland	*Morella pensylvanica / Diodia teres* Shrubland	281	182.5
Beach Heather Dune	*Hudsonia tomentosa / Panicum amarum var. amarulum* Dwarf-shrubland	367	66.4
Beachgrass Dune	*Ammophila breviligulata - Panicum amarum var. amarum* Herbaceous Vegetation	101	111.6
Brackish Tidal Marsh	*Typha angustifolia - Hibiscus moscheutos* Herbaceous Vegetation	3	0.2
Deciduous Maritime Scrub Forest	*Prunus serotina / Morella cerifera / Smilax rotundifolia* Scrub Forest	98	37.3
High Salt Marsh	*Spartina patens - Distichlis spicata - (Juncus roemerianus)* Herbaceous Vegetation	759	313.2
Interdunal Swale	*Schoenoplectus pungens - Fimbristylis (castanea, caroliniana)* Herbaceous Vegetation	74	12
Loblolly Pine Dune Woodland	*Pinus taeda / Hudsonia tomentosa* Woodland	198	65
Loblolly Pine Maritime Forest [1]	*Pinus taeda / Morella cerifera / Osmunda regalis* Forest; *Pinus taeda – Quercus (falcata, nigra) / Morella cerifera / Vitis rotundifolia* Forest	181	183.5
Low Salt Marsh	*Spartina alterniflora - Distichlis spicata* Tidal Herbaceous Vegetation	1751	848.2
Maritime Shrubland	*Morella cerifera / Spartina patens* Shrubland	314	171.7
Needlerush Marsh	*Juncus roemerianus* Herbaceous Vegetation	86	24.5
Overwash Dune Grassland	*Spartina patens - Schoenoplectus pungens - Solidago sempervirens* Herbaceous Vegetation	66	26.1
Phragmites Wetland	*Phragmites australis* Herbaceous Vegetation	63	12.9
(Salt panne)	*Salicornia spp., Sarcocornia perennis, Spartina alternifolia* Herbaceous Vegetation	0	0

Table 4 (continued). 2009 Vegetation map, number of polygons and number of hectares mapped.

Map Unit Common Name	Map Unit Scientific Name	Number of polygons	Total mapped hectares
Shrub Bog	*Morella cerifera - Vaccinium corymbosum* Shrubland	78	19.5
Switchgrass Swale	*(Morella cerifera) - Panicum virgatum - Spartina patens* Herbaceous Vegetation	10	2
Tidal Salt Scrub	*Iva frutescens / Spartina patens* Shrubland	833	217.5
(Undifferentiated Anthropogenic Grassland)	included in "converted" map unit		
Vine Dune	*Smilax glauca - Toxicodendron radicans* Vine-Shrubland	16	5.2
Water	None	411	108
Wet maritime shrubland	*Morella cerifera / Hydrocotyle verticillata* Shrubland	643	411
Converted	None	47	73
Intertidal Sand / Mud Flat	None	40	53.7
Naturally Unvegetated	None	51	250.2

[1] Combined map unit of upland and wetland pine forests indistinguishable on aerial photography

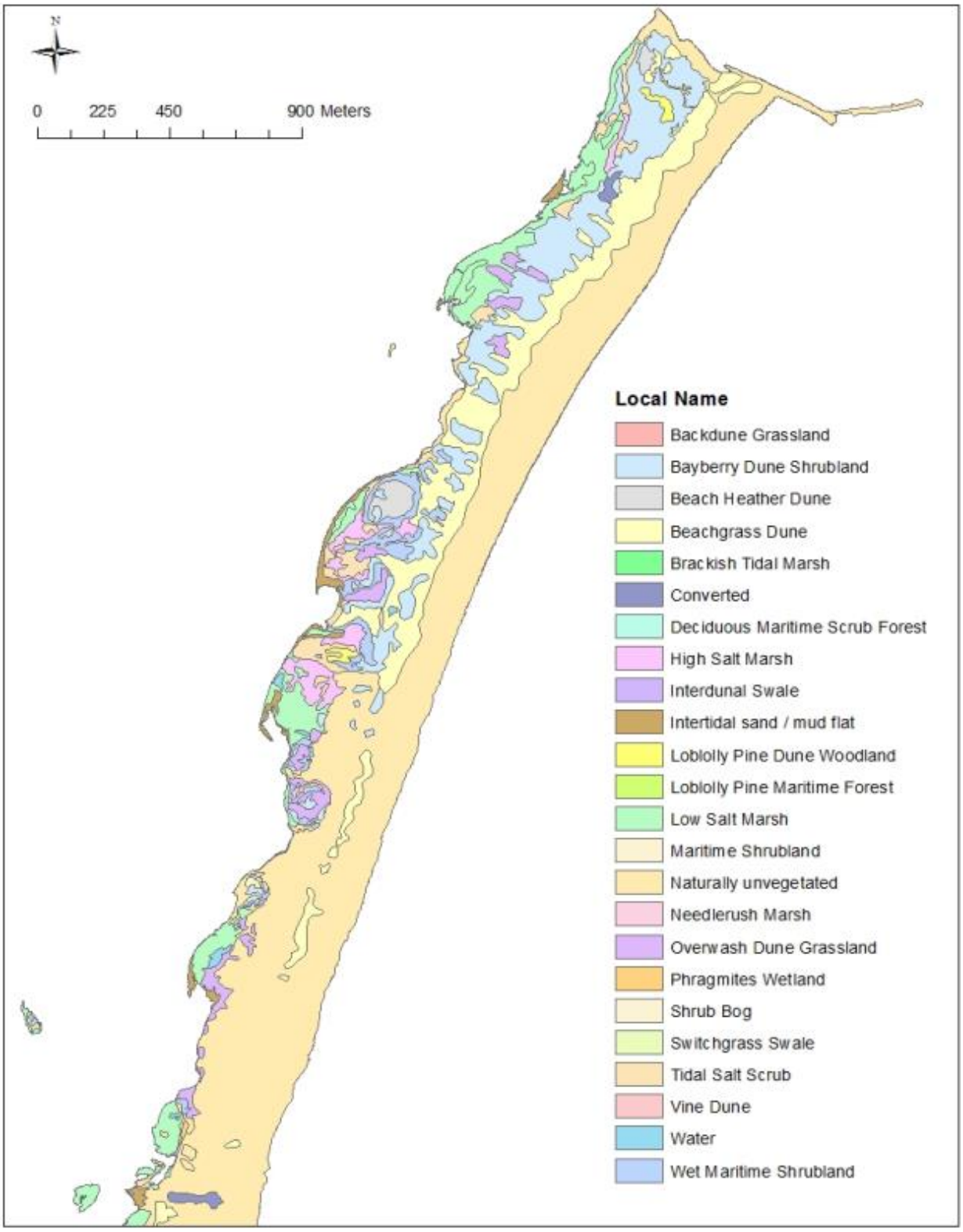


Figure 45. 2009 vegetation map north end of ASIS.

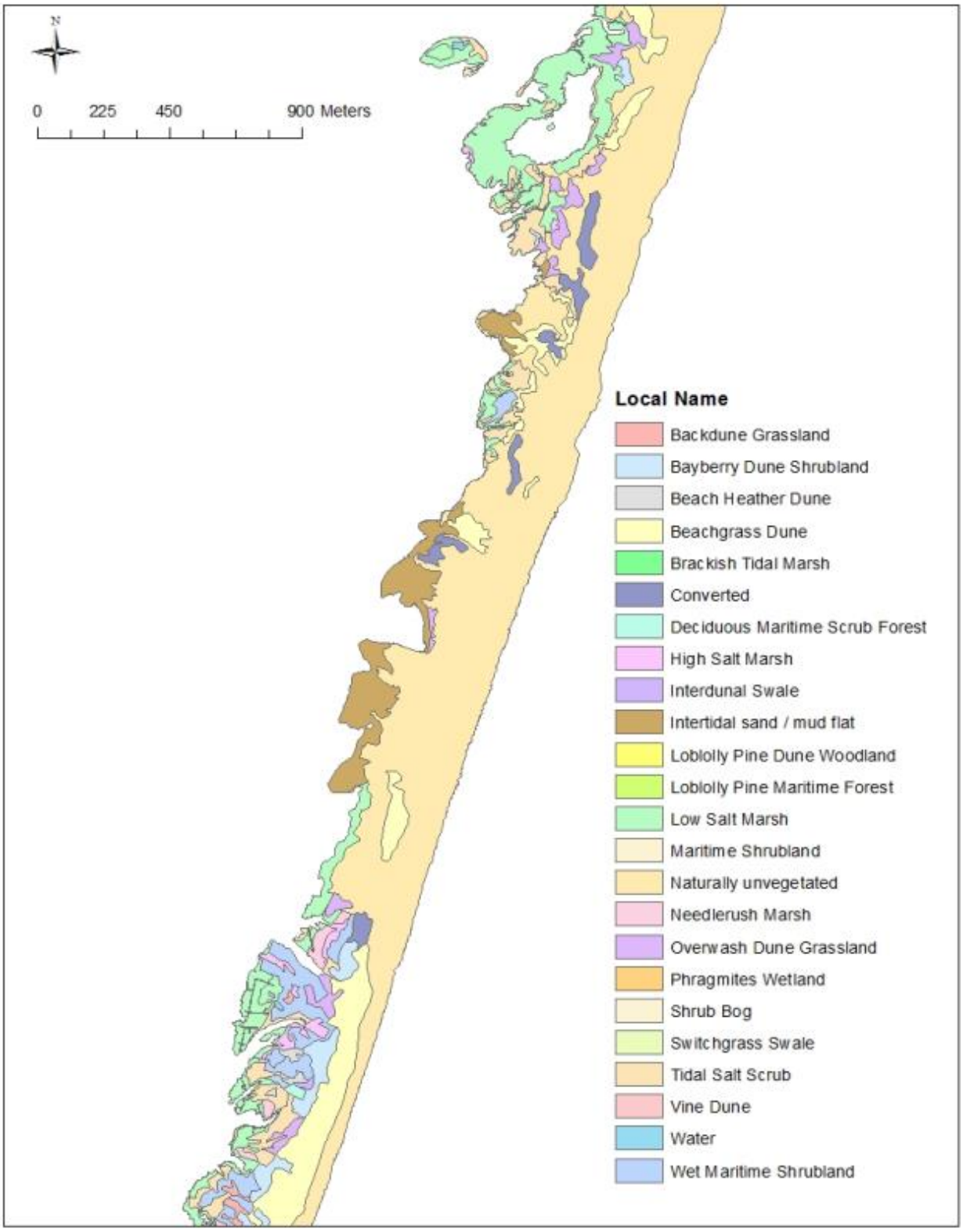


Figure 46. 2009 vegetation map, north of bridge.



Figure 47. 2009 vegetation map Assateague State Park and environs.

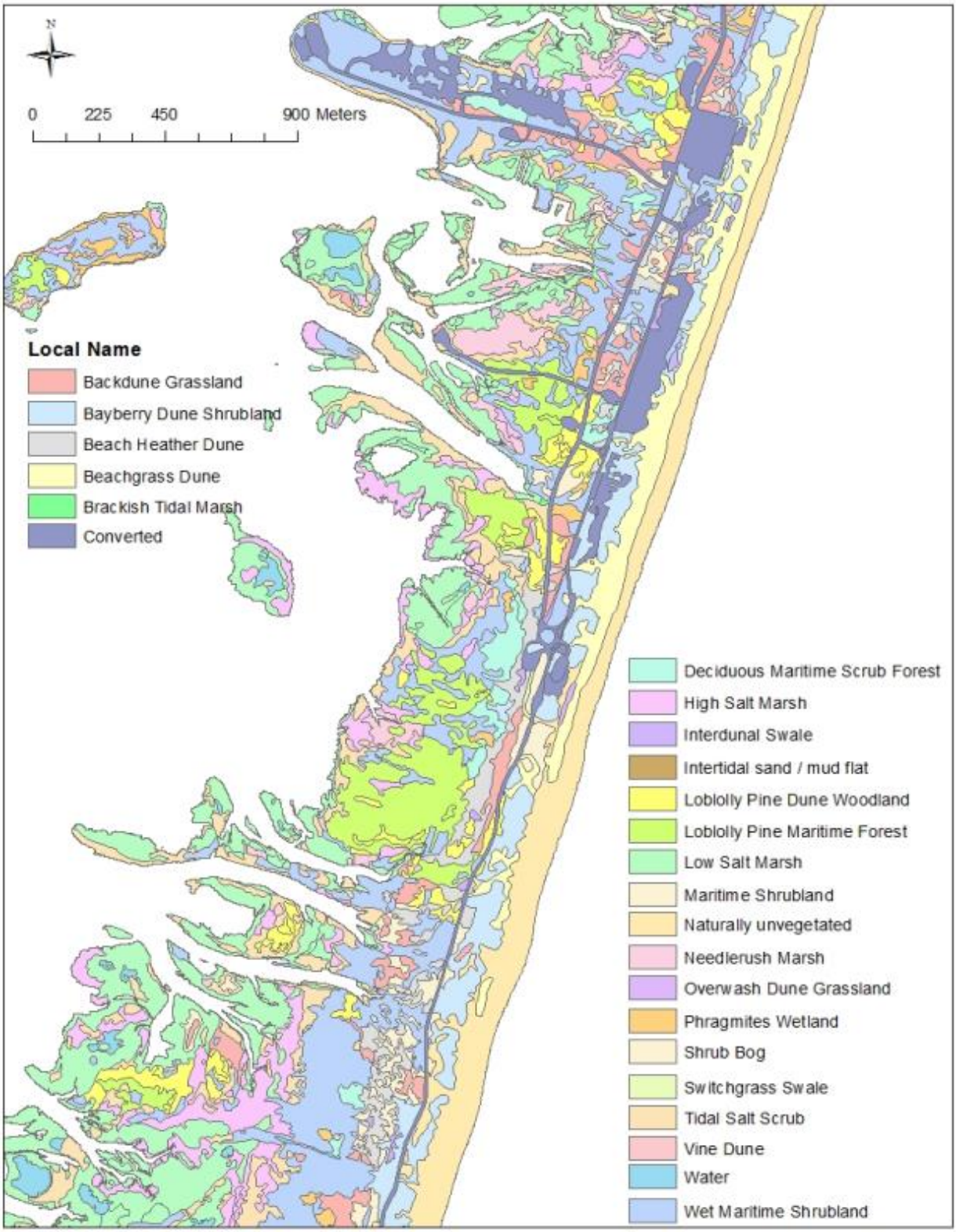


Figure 48. 2009 vegetation map, Bayside Campground and Old Ferry Landing.

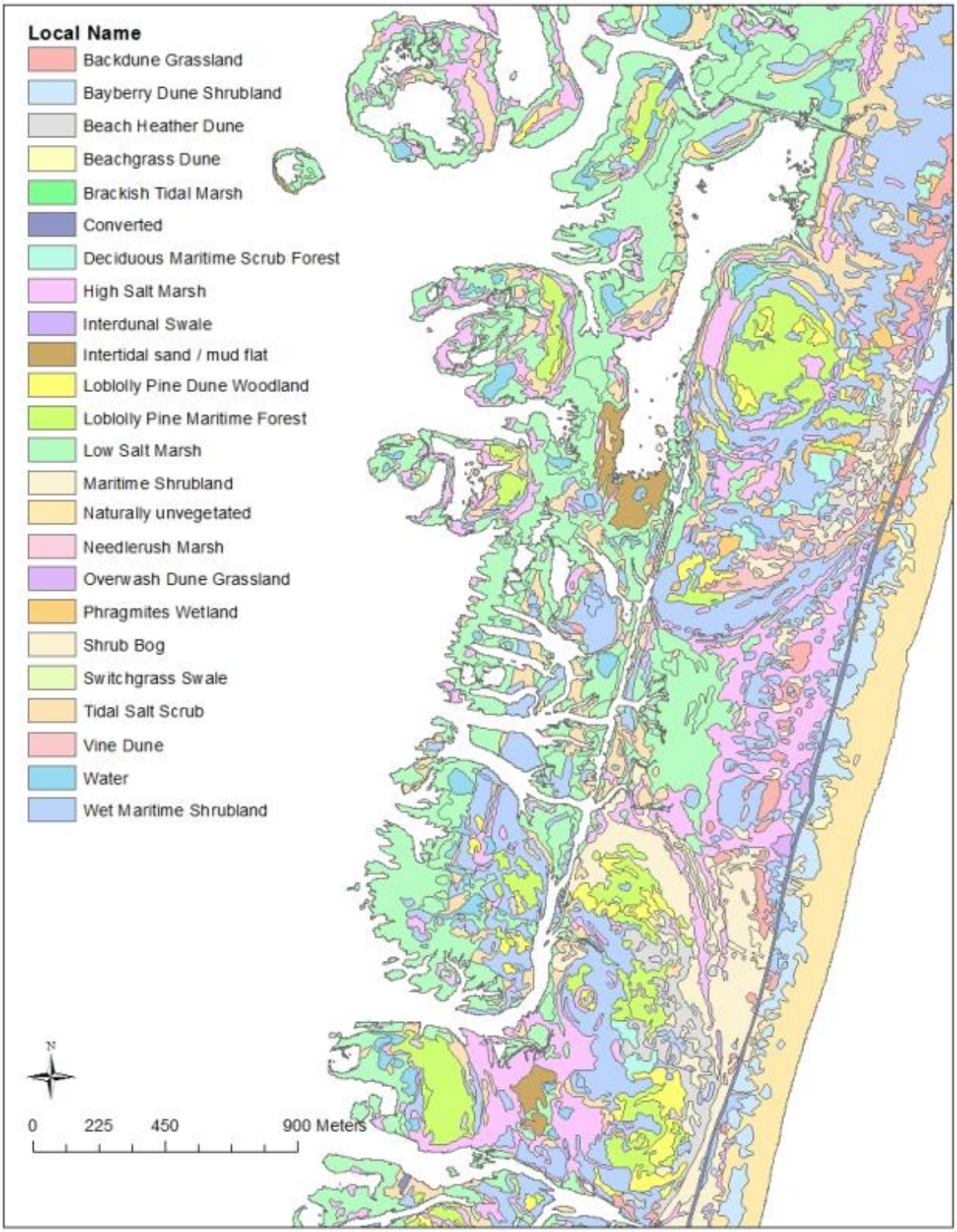


Figure 49. 2009 vegetation map, Pine Tree Campground area.

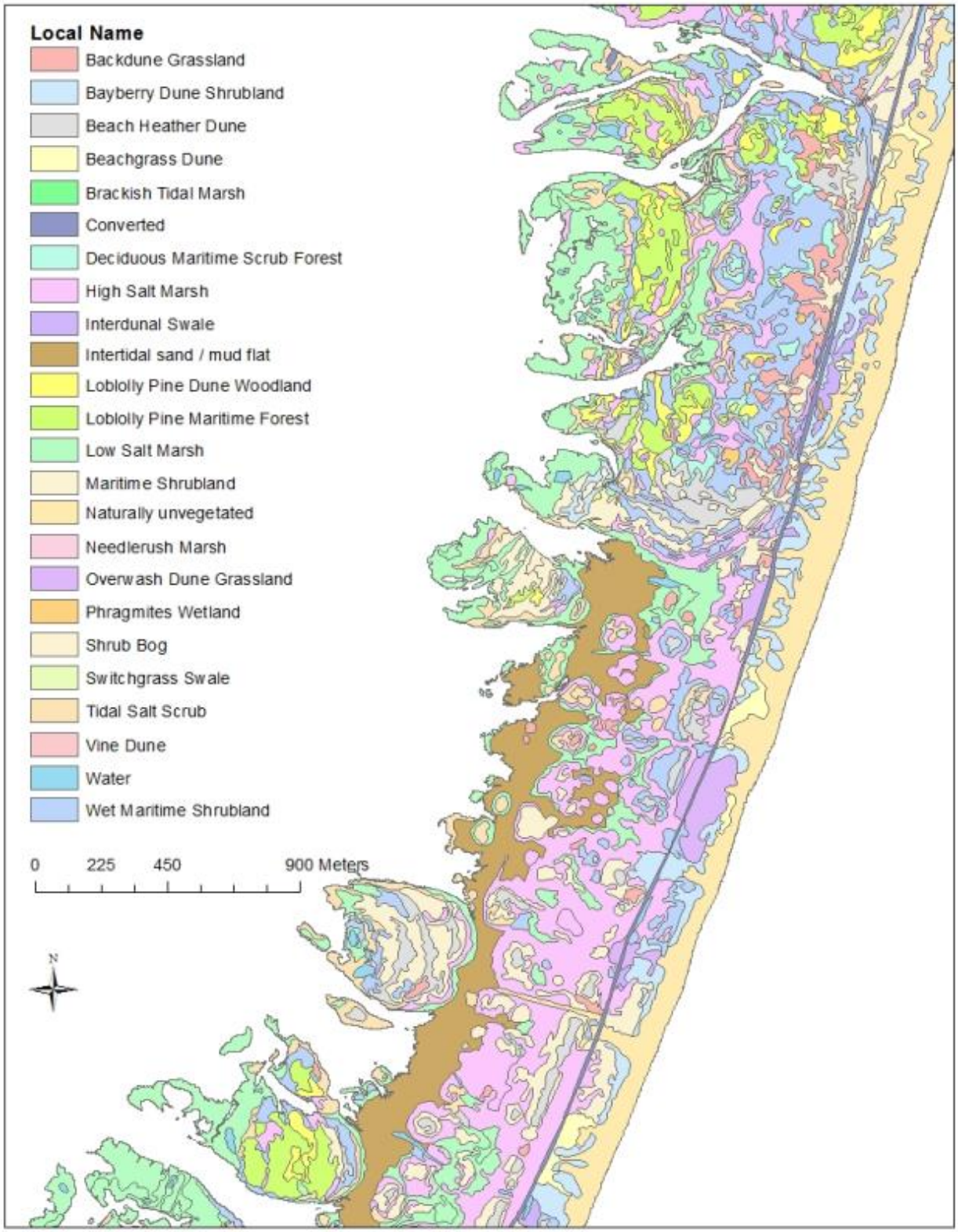


Figure 50. 2009 vegetation map, Fox Hill Levels.

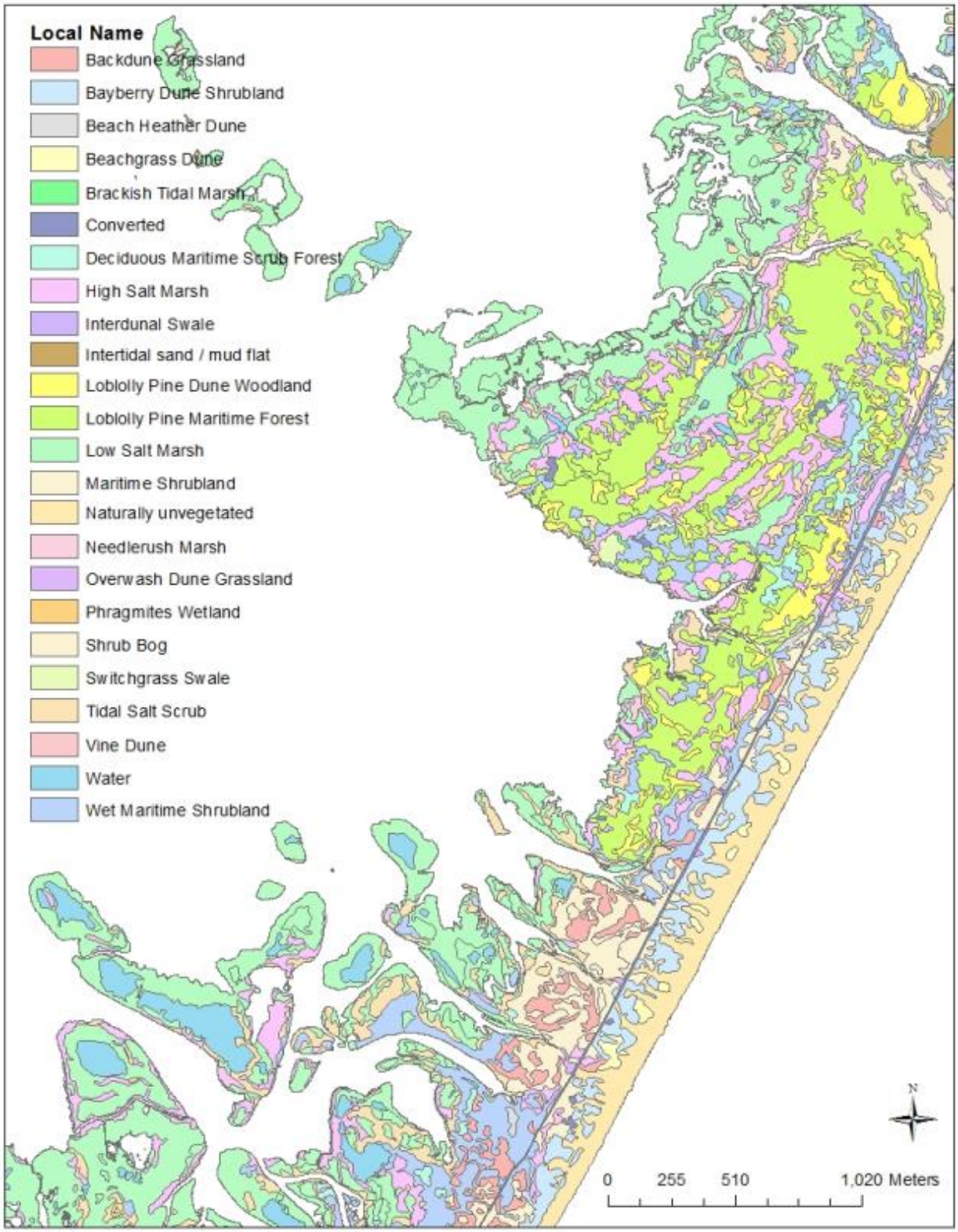


Figure 51. 2009 vegetation map, Green Run area.

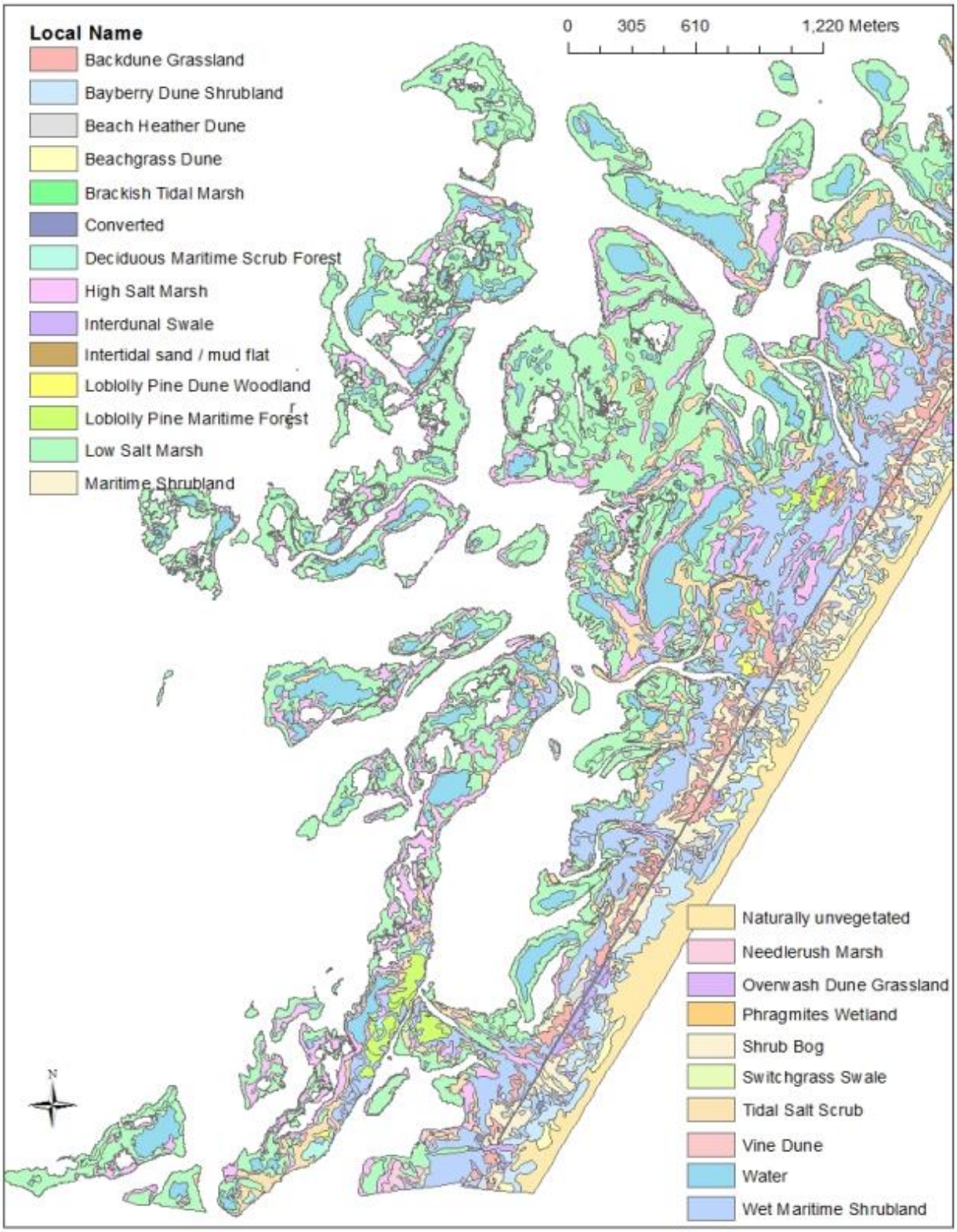


Figure 52. 2009 vegetation map, southern end.

Table 5. Comparison of vegetation and land cover names used in 1994 to those of 2009.

1994 Community / Land Cover Name	1994 Synonym(s)	2009 Common name	2009 Association / Land Cover Name	2009 Association Code
Acer rubrum, Nyssa sylvatica, Magnolia virginiana Forest	Inland Red Maple Swamp	Inland Red Maple Swamp	*Acer rubrum - Nyssa sylvatica - Magnolia virginiana / Viburnum nudum var. nudum / Osmunda cinnamomea - Woodwardia areolata* Forest	CEGL006238
Algae			Unvegetated Panne	
Ammophila breviligulata, Panicum (amarum, amarulum) Herbaceous Vegetation	Dunegrass Community	Beachgrass Dune	*Ammophila breviligulata - Panicum amarum var. amarum* Herbaceous Vegetation	CEGL004043
Baccharis halimifolia, Iva frutescens / Spartina patens Shrubland	Salt Shrub	Tidal Salt Scrub	*Iva frutescens / Spartina patens* Shrubland	CEGL006848
Built Up Areas			Converted (in part)	
Cakile edentula ssp. edentula, Salsola caroliniana Sparse Vegetation	Beach Community	Upper Ocean Beach	*Cakile edentula ssp. edentula - Chamaesyce polygonifolia* Sparse Vegetation	CEGL004400
Dead Vegetation			(None)	
Hudsonia tomentosa / Panicum (amarum, amarulum) Dwarf-shrubland	Hudsonia Dune	Beach Heather Dune	*Hudsonia tomentosa / Panicum amarum var. amarulum* Dwarf-shrubland	CEGL003950
Juncus dichotomus, Drosera intermedia Herbaceous Vegetation	Bog; Sand Bog	Forked Rush Dune Swale	*Juncus (dichotomus, scirpoides) - Drosera intermedia* Herbaceous Vegetation	CEGL004111
Juncus roemerianus Herbaceous Vegetation	Needlerush Marsh	Needlerush Marsh	*Juncus roemerianus* Herbaceous Vegetation	CEGL004186
Myrica cerifera, Baccharis halimifolia / Spartina patens Shrubland	Maritime Shrubland	Maritime Shrubland	*Morella cerifera / Spartina patens* Shrubland	CEGL003839
Myrica cerifera / Hydrocotyle spp. Shrubland	Maritime Shrub	Wet Maritime Shrubland	*Morella cerifera / Hydrocotyle verticillata* Shrubland	CEGL003840
Myrica (cerifera, pensylvanica), Vaccinium corymbosum Shrubland	Shrub Bog	Shrub Bog	*Morella cerifera - Vaccinium corymbosum* Shrubland	CEGL003906
Myrica pensylvanica / Schizachyrium scoparium ssp. littorale, Eupatorium hyssopifolium Sparse Shrubland	Maritime Grassland	Backdune Grassland	*Morella (pensylvanica, cerifera) / Schizachyrium littorale - Eupatorium hyssopifolium* Shrub Herbaceous Vegetation	CEGL004240

Table 5 (continued). Comparison of vegetation and land cover names used in 1994 to those of 2009.

1994 Community / Land Cover Name	1994 Synonym(s)	2009 Common name	2009 Association / Land Cover Name	2009 Association Code
Myrica pensylvanica / Diodia teres Shrubland	Maritime Shrubland	Bayberry Dune Shrubland	*Morella pensylvanica / Diodia teres* Shrubland	CEGL003881
Naturally Unvegetated			Naturally Unvegetated	
Panicum virgatum, Spartina patens Herbaceous Vegetation	Switchgrass, Salt Hay Herbaceous Vegetation	Switchgrass Swale	(*Morella cerifera) - Panicum virgatum - Spartina patens* Herbaceous Vegetation	CEGL004129
Phragmites australis Herbaceous Vegetation	Reed-grass Marsh	Phragmites Wetland	*Phragmites australis* Eastern North America Temperate Semi-natural Herbaceous Vegetation	CEGL004141
Pinus taeda / Hudsonia tomentosa Woodland	Loblolly Pine Woodland	Loblolly Pine Dune Woodland	*Pinus taeda / Hudsonia tomentosa* Woodland	CEGL006052
Pinus taeda / Myrica cerifera / Osmunda regalis Forest	Estuarine Fringe Loblolly Pine Forest	Loblolly Pine Wetland Forest	*Pinus taeda / Morella cerifera / Osmunda regalis var. spectabilis* Forest	CEGL006137
Pinus taeda / Myrica cerifera / Vitis rotundifolia Forest	Coastal Loblolly Pine Forest	Loblolly Pine Maritime Forest	*Pinus taeda – Quercus (falcata, nigra) / Morella cerifera / Vitis rotundifolia* Forest	CEGL006040
Prunus serotina / Myrica cerifera / Smilax rotundifolia Forest	Maritime Forest	Maritime Deciduous Scrub Forest	*Prunus serotina / Morella cerifera / Smilax rotundifolia* Scrub Forest	CEGL006319
Salicornia spp., Sarcocornia perennis, Spartina alternifolia Herbaceous Vegetation	Salt Panne	Salt Panne	*Salicornia (virginica, bigelovii, maritima) - Spartina alterniflora* Herbaceous Vegetation	CEGL004308
Scirpus pungens, Fimbristylis castanea Herbaceous Vegetation	Interdunal Swale	Interdunal Swale	*Schoenoplectus pungens - Fimbristylis (castanea, caroliniana)* Herbaceous Vegetation	CEGL004117
Smilax glauca, Toxicodendron radicans Shrubland	Vine Dune	Vine Dune	*Smilax glauca - Toxicodendron radicans* Vine-Shrubland	CEGL003886
Spartina alterniflora / Ascophyllum nodosum Herbaceous Vegetation	Low Salt Marsh	Low Salt Marsh	*Spartina alterniflora - Distichlis spicata* Tidal Herbaceous Vegetation	CEGL006586
Spartina patens, Distichlis spicata , Borrichia frutescens Herbaceous Vegetation	High Marsh	High Salt Marsh	*Spartina patens - Distichlis spicata - (Juncus roemerianus)* Herbaceous Vegetation	CEGL004197

Table 5 (continued). Comparison of vegetation and land cover names used in 1994 to those of 2009.

1994 Community / Land Cover Name	1994 Synonym(s)	2009 Common name	2009 Association / Land Cover Name	2009 Association Code
Spartina patens, Scirpus pungens , Solidago sempervirens (Upland) Herbaceous Vegetation	Overwash Community	Overwash Dune Grassland	*Spartina patens - Schoenoplectus pungens - Solidago sempervirens* Herbaceous Vegetation	CEGL004097
Typha angustifolia, Hibiscus moscheutos Herbaceous Vegetation	Brackish Tidal Marsh	Brackish Tidal Marsh	*Typha angustifolia - Hibiscus moscheutos* Herbaceous Vegetation	CEGL004201
Undifferentiated Dry Grasses			Converted (in part)	
Water			Water	

Table 6. Additional associations classified in 2009.

2009 Common name	2009 Association Name	2009 Association Code
Spikerush Lawn Tidal Marsh	*Eleocharis rostellata - Spartina patens* Herbaceous Vegetation	CEGL006611
Brackish Tidal Shrubland	*Morella cerifera - Baccharis halimifolia / Eleocharis fallax* Shrubland	CEGL006846
Brackish Meadow	*Panicum virgatum - Spartina patens* Herbaceous Vegetation	CEGL006150
Loblolly Pine Tidal Woodland	*Pinus taeda / Morella cerifera / Spartina patens* Tidal Woodland	CEGL006849
Transitional Tidal Marsh	*Schoenoplectus americanus - Spartina patens* Herbaceous Vegetation	CEGL006612
Giant Cordgrass Marsh	*Spartina cynosuroides* Herbaceous Vegetation	CEGL004195
Brackish Interdunal Swale	*Spartina patens - Eleocharis parvula* Herbaceous Vegetation	CEGL006342
Eastern Reed Tidal Marsh	*Phragmites australis* Tidal Herbaceous Vegetation	CEGL004187
Loblolly Pine Plantation	*Pinus taeda* Planted Forest	CEGL007179

Accuracy Assessment Results, 1994

Positional Accuracy

GPS readings of 105 points collected to assess positional accuracy of the map line work ranged in error from 0.12 m to 15.16 m (Table 7). 90% of points identified on the polygon line work were within 8.2 meters of true position as measured on the ground. Six points had errors of less than 1m; 14 points had errors less than 2m. The greatest number of points (44) had errors ranging from 2-5m, and 40 had errors greater than 5m, with two of those falling more than 10m from their mapped locations. Figure 53 illustrates the offset of polygons mapped in 1994. Positional accuracy point 106 had a recorded error of 3.32m.



Figure 53. Positional accuracy of polygons on 1994 map illustrated on 1993 photo (left) and against 2008 photo.

Table 7. Error measurements of positional accuracy assessment points, in meters.

Point number	Ground easting (UTM meters)	Ground Northing (UTM meters)	Error (meters)
140	479082.099	4212744.924	0.12
151	478086.979	4209531.434	0.43
39	485955.117	4228409.518	0.53
139	479089.483	4210627.541	0.73
42	485721.269	4228092.738	0.78
8	490466.261	4239949.37	0.83
117	481179.922	4213771.532	1.03
43	485724.259	4227165.835	1.12
80	483643.938	4222987.528	1.16
141	478827.114	4210428.638	1.28
90	483134.917	4224733.906	1.41
96	482715.836	4216991.192	1.42
35	486423.816	4227995.11	1.48
36	486371.66	4229503.728	1.52
73	483965.404	4219739.682	1.56
56	484889.258	4224296.961	1.58
15	488526.192	4234402.677	1.69
54	485067.249	4223562.495	1.76
159	485065.163	4227427.817	1.82
5	491266.702	4241345.415	1.92
57	484836.064	4222663.65	2.09
47	485460.153	4226071.545	2.17
61	484676.035	4224127.826	2.2
88	483223.659	4220687.458	2.39
68	484421.152	4221785.276	2.43
156	477483.567	4211696.27	2.45
16	488490.661	4234023.197	2.57
142	478823.27	4209928.979	2.66
144	478653.366	4209482.785	2.75
71	484205.453	4222592.673	2.97
138	479156.068	4212904.072	3.12
77	483892.916	4225692.504	3.26
106	481696.149	4215082.694	3.32
55	484928.75	4224819.398	3.43
19	488100.238	4232664.94	3.43
44	485598.931	4225414.322	3.45
112	481412.649	4216741.475	3.54
91	483132.613	4219624.683	3.63
11	489420.617	4237420.945	3.74

Table 7 (continued). Error measurements of positional accuracy assessment points, in meters.

Point number	Ground easting (UTM meters)	Ground Northing (UTM meters)	Error (meters)
85	483436.208	4221244.236	3.77
84	483484.935	4218434.258	3.79
158	484412.9	4228201.187	3.82
86	483340.215	4221772.8	3.87
18	488016.266	4232189.874	3.9
76	483910.477	4221244.711	3.92
2	491743.306	4241775.51	3.98
105	481725.738	4217332.669	4.01
50	485240.13	4226496.125	4.03
60	484679.993	4226362.542	4.04
17	488198.8	4233489.032	4.04
121	480430.831	4212778.971	4.14
72	484047.031	4224510.07	4.18
94	482873.705	4219358.802	4.26
103	482207.384	4217252.394	4.46
79	483762.317	4225155.616	4.5
46	485486.294	4226797.72	4.6
107	481683.945	4214411.71	4.76
111	481422.182	4216108.406	4.77
12	489399.865	4237020.394	4.77
150	478152.694	4213049.503	4.81
101	482305.311	4217960.911	4.81
155	477578.76	4211120.575	4.82
119	480700.267	4212961.847	4.9
108	481649.834	4216574.447	4.95
89	483371.989	4217991.679	5.03
59	484765.72	4225749.722	5.07
109	481453.441	4216387.077	5.11
135	479360.016	4217145.137	5.14
102	482305.815	4216718.05	5.15
126	480086.795	4211627.294	5.3
83	483502.732	4218848.405	5.31
148	478281.328	4214026.79	5.33
147	478340.52	4208877.067	5.35
82	483538.324	4223803.074	5.68
128	479849.738	4213985.488	5.84
104	482047.97	4216387.765	5.86
14	489225.454	4237578.115	6.51
124	480310.594	4212010.436	6.52
67	484439.802	4221203.305	6.56

Table 7 (continued). Error measurements of positional accuracy assessment points, in meters.

Point number	Ground easting (UTM meters)	Ground Northing (UTM meters)	Error (meters)
127	480002.247	4212518.928	6.75
130	479553.214	4211935.496	6.76
157	476861.938	4208894.375	6.94
136	479318.554	4210781.508	7.07
153	477766.248	4212597.455	7.1
122	480426.894	4213627.128	7.19
81	483557.404	4224281.534	7.19
63	484669.336	4225303.498	7.23
118	480720.226	4213575.431	7.24
99	482467.748	4218417.335	7.37
146	478571.188	4211199.428	7.43
93	482960.303	4218033.599	7.48
145	478603.245	4209156.815	7.75
123	480376.821	4216033.214	8.13
69	484388.902	4225026.078	8.18
120	480513.324	4215759.887	8.32
3	491637.913	4241629.827	8.37
13	489390.082	4238480.812	8.41
132	479450.185	4211177.247	8.75
22	487817.359	4232247.149	9.16
51	485185.441	4223995.983	9.31
10	490116.798	4239014.685	9.83
41	485875.81	4226322.807	9.96
154	477740.143	4209307.09	11.91
116	481261.524	4213829.91	15.16

Thematic Accuracy, 1998 Results

Thematic accuracy assessment for the vegetation association map was calculated with a contingency matrix (Table 8). There are two sources of potential thematic error in mapping. The first is user's error, also known as errors of commission, indicating the percentage of polygons on the map that were mislabeled. This number is conveyed in the column totals of the contingency matrix. The second, producer's error, is also known as errors of omission. This error indicates the percentage of polygons of that type that were under mapped. Errors of omission indicate that in addition to the polygons on the map with the correct label, there are others that should also have the same label.

With one exception, all vegetation classified at the association level was intended to be mapped as such. The two major forest types in the park dominated by *Pinus taeda* (coastal loblolly pine forest and estuarine fringe loblolly pine forest) were indistinguishable on the aerial photographs, so no attempt had been made to map these two associations separately. Our initial calculations were based on a simple binary choice: accuracy assessment points were identified as either correct or incorrect,

regardless of ambiguities in interpretation of vegetation keys, vegetation descriptions, scale of the vegetation patch, or potential errors or inaccuracies in GPS measurements. Using these strict criteria, the over-all accuracy of the 1994 vegetation map was calculated to be 34.1%, with a Kappa statistic of 0.31. User's accuracy (column totals) was highest (>60%) for needlerush marsh (96%), *Phragmites* wetland (91%), switchgrass swale (86%), and deciduous scrub forest (73%). Salt panne (100%) was based on a single point only. Producer's accuracy (row totals) was highest for needlerush marsh (87%), the combined upland / wetland pine forest map unit (loblolly pine maritime forest / estuarine fringe loblolly pine forest) (80%), low salt marsh (80%), *Phragmites* wetland (70%), as well as the non-vegetated map unit, water (67%).

Within classes, twelve associations were predictably confused with one or two other associations on the map:

a) The single combined map unit, loblolly pine and estuarine fringe pine forest, (24 correct points) was most frequently mapped incorrectly as loblolly pine dune woodland (17 points).

b) Loblolly pine dune woodland (7 correct points) was most frequently mapped incorrectly as vine dune (8 points) or or beach heather dune (6 points).

c) Bayberry dune shrubland (9 correct points) was incorrectly mapped as overwash dune grassland (6 points).

d) Wet maritime shrubland (5 correct points) was incorrectly mapped as deciduous maritime scrub forest and *Phragmites* wetland, at 5 points each.

e) Maritime shrubland was mapped incorrectly more frequently as wet maritime shrubland (12 points as opposed to 8 correctly mapped points).

f) Twelve points mapped as backdune grassland were divided equally between correct points and maritime shrubland.

g) Beach heather dune was confused equally with backdune grassland (13 points each), and an additional 11 points of this association were mapped incorrectly as vine dune.

h) Low salt marsh (24 correct points) was mapped incorrectly nearly as frequently as salt panne (22 points).

i) Interdunal swale (6 points) was also mapped incorrectly as switchgrass swale (5 points).

Three non-vegetated map units were confused with other non-vegetated map units: the naturally occurring unvegetated areas class (14 correct points) was mapped more frequently as intertidal sand / mud flat (21 points); the unit undifferentiated dry grasses was mapped as dead vegetation 18 times, with only 5 correct points; the built up areas map class was not mapped correctly at any accuracy assessment points, but at 16 points it was mapped as undifferentiated dry grasses.

Taking into account the ambiguities encountered in the field (identity of the vegetation, including those caused by points located on polygon boundaries, as well as GPS error), a second choice for the vegetation type, or for vegetation in close proximity, was often recorded. In a second contingency matrix (Table 9), either the first or second choice was recorded as correct when in agreement with the map unit. Over-all accuracy was slightly higher at 43.7%. By class, user's accuracy exceeded 60% in nine map units: deciduous maritime scrub forest (82%), needlerush marsh (97%), *Phragmites* wetland (92%), beachgrass dune (68%), switchgrass swale (88%), tidal salt scrub (71%), overwash dune grassland (63%), salt panne (100%, based on 3 points), and one non-vegetated map unit (water) (77%). Producer's accuracy exceeded 60% in eight map units: the combined upland / wetland pine forest map unit (loblolly pine maritime forest / estuarine fringe loblolly pine forest) (93%), bayberry dune shrubland (63%), needlerush marsh (97%), *Phragmites* wetland (80%), low salt marsh (87%), beachgrass dune (63%), and two non-vegetated map units: water (87%) and naturally occurring unvegetated areas (83%).

Table 8. Contingency matrix and calculated errors for the thematic accuracy assessment of the 1994 vegetation association map of ASIS; binary.

		1	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	27	30	31	32	33	34	Total	Accuracy Rate
1	**Loblolly Pine Maritime Forest**	24	1	1	1				1	1											1								30	60%
3	**Loblolly Pine Dune Woodland**	17	7			2		1	1	1											1								30	23%
4	**Deciduous Maritime Scrub Forest**	3	2	11		5		2	3	1	2																1		30	37%
5	**Bayberry Dune Shrubland**			1	9			1	1		2	2					6			3					3			2	30	30%
6	**Wet Maritime Shrubland**	2		1	4	5		2	12	1		1			1	1													30	16%
7	**Vine Dune**		8		1			3	1		3	11																3	30	0%
8	**Shrub Bog**	6						13	8		2	1																	30	43%
9	**Maritime Shrubland**				1	1	1	5	8	1	6	1				1		1	3		1								30	27%
10	**Tidal Salt Scrub**	1		1					8	13					1	4					1						1		30	43%
11	**Backdune Grassland**	1	1		1		1	5			6	13																1	30	20%
12	**Beach Heather Dune**	1	6		2	1	1	3			3	13																	30	43%
13	**Needlerush Marsh**									1			26			2								1					30	87%
14	**Brackish Tidal Marsh**								1				1			3					4								9	0%
15	**Phragmites Wetland**					5		1			1				21				1					1					30	70%
16	**Low Salt Marsh**								1	1						24					2				2				30	80%
17	**Beachgrass Dune**				3												17			2					7		1		30	57%
18	**Switchgrass Swale**	3						1	5		2							12	5		2								30	40%
19	**Interdunal Swale**	1	2		3		1				5	2				1	2	1	6		2						3	1	30	20%
20	**Overwash Dune Grassland**				6						2	1				2	2		2	9					5			1	30	30%
21	**High Salt Marsh**	1				1			2	3						10			2		9			1	1				30	30%
22	**Salt Panne**															22					1	1		4	2				30	3%
27	**Intertidal Sand / Mud Flat**															6	1							2	21				30	0%
30	**Water**															7								20	3				30	67%
31	**Naturally Unvegetated**																			2				13	14			1	30	47%
32	**Dead Vegetation**				1					1	3																18	7	30	0%
33	**Undifferentiated Anthropogenic Grassland**					1		1	4			1							2						1		1	19	30	3%
34	**Built Up Areas (Unvegetated)**	10			1												5			1	2				11				30	0%
	Total points	70	27	15	33	21	4	38	56	24	37	46	27	0	23	83	33	14	21	18	26	1	0	42	70	0	25	35		
	Accuracy rate	34%	26%	73%	27%	24%	0%	34%	14%	54%	16%	28%	96%	0%	91%	29%	52%	86%	29%	50%	34.6%	100%	0%	48%	20%	0%	4%	0%		
	TOTAL ACCURACY																													34.1%
	KAPPA INDEX																													0.31

Table 9. Contingency matrix and calculated errors for the thematic accuracy assessment of the 1994 vegetation association map of ASIS; first and second choices.

		1	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	27	30	31	32	33	34	Total	Accuracy Rate
1	**Loblolly pine Maritime Forest**	28		1	1																								30	93%
3	**Loblolly Pine Dune Woodland**	17	8			2		1		1											1								30	27%
4	**Deciduous Maritime Scrub Forest**	3	2	14		3		1	3	1	2																1		30	47%
5	**Bayberry Dune Shrubland**				19			1	1		1	1					1			3					3				30	63%
6	**Wet Maritime Shrubland**	2		1	4	5		2	12	1		1			1	1													30	17%
7	**Vine Dune**		8		1			3	1		3	11																3	30	0%
8	**Shrub Bog**	5						15	8		2																		30	50%
9	**Maritime Shrubland**				1	1	1	5	9	1	6	1				1		1	2		1								30	30%
10	**Tidal Salt Scrub**	1		1					7	15					1	3					1						1		30	50%
11	**Backdune Grassland**	1	1		1		1	5			10	9								1								1	30	33%
12	**Beach Heather Dune**	1	6		2	1	1	3			1	15																	30	50%
13	**Needlerush Marsh**												29			1													30	97%
14	**Brackish Tidal Marsh**								1				1			3					4								9	0%
15	**Phragmites Wetland**					3		1							24				1					1					30	80%
16	**Low Salt Marsh**								1							26					1				2				30	87%
17	**Beachgrass Dune**				3												19								7		1		30	63%
18	**Switchgrass Swale**	2						1	4		2							14	5		2								30	47%
19	**Interdunal Swale**	1	2		3		1				4	2				1	2	1	7		2						3	1	30	23%
20	**Overwash Dune Grassland**				6						2	1				1	1		2	12					4			1	30	40%
21	**High Salt Marsh**					1				1						8			2		17				1				30	57%
22	**Salt Panne**															22					1	3		3	1				30	10%
27	**Intertidal Sand / Mud Flat**															6								2	22				30	0%
30	**Water**															1								26	3				30	87%
31	**Naturally Unvegetated**																			2				2	25			1	30	83%
32	**Dead Vegetation**				1					1	3																18	7	30	0%
33	**Undifferentiated Anthropogenic Grassland**					1		1	4										2						1		5	16	30	17%
34	**Built Up Areas**	10			1												5			1	2				11				30	0%
	Total points	71	27	17	43	17	4	39	51	21	36	41	30	0	26	74	28	16	21	19	32	3	0	34	80	0	29	30	789	
	Accuracy rate (omission)	39%	30%	82%	44%	29%	0%	38%	18%	71%	28%	37%	97%	0%	92%	35%	68%	88%	33%	63%	53%	100%	0%	76%	31%	0%	17%	0%		
	TOTAL ACCURACY																													40.2%
	KAPPA INDEX																													41.0%

Thematic Accuracy, 2009 Results

The accuracy assessment completed in 2009 resulted in an over-all accuracy of 58% with a Kappa statistic of 0.57 when using a simple binary right-or-wrong calculation (Table 10). Map units achieving a user's accuracy above 60% included bayberry shrubland (64%), beach heather dune shrubland (82%), needlerush marsh (100%), brackish tidal marsh (100%), loblolly forest (82%), loblolly dune woodland (87%), low salt marsh (64%), unvegetated panne (76%), water (100%), and converted (100%). Map units predictably mapped incorrectly as another type included barrier island bog (5 correct points, mapped also as switchgrass swale with 4 points); eastern reed marsh (6 correct points, also mapped as wax-myrtle shrub swamp 5 times), and intertidal sand / mud flat (mapped as low salt marsh 4 times, not mapped correctly at any points). Map classes exceeding 60% producer's accuracy included: beachgrass dune (85%), shrub bog (71%), beach heather dune, (94%), *Phragmites* wetland (86%), needlerush marsh (83%), bracksh tidal marsh (67%), deciduous maritime scrub (63%), tidal salt scrub (83%), naturally unvegetated (77%), unvegetated panne (72%), and converted (100%).

A second contingency matrix (Table 11) that also included second choices and adjacent vegetation where it was in close proximity to the accuracy assessment point resulted in an over-all accuracy of 71%, with a Kappa statistic of 0.71. Accuracy by type included eighteen map units achieving greater than 60% user's accuracy: wax-myrtle shrub flats (75%), beachgrass dune (74%), wax-myrtle shrub swamp (71%), bayberry shrubland (82%), beach heather dune shrubland (95%), switchgrass swale (64%), needlerush high marsh (100%), high salt marsh (63%), brackish tidal marsh (100%), loblolly pine forest / loblolly wetland forest (93%), loblolly pine dune woodland (91%), maritime deciduous scrub forest (71%), low salt marsh (88%), brackish tidal shrubland (67%), tidal salt shrubland (65%), unvegetated panne (94%), water (100%), and converted (100%). Map classes achieving greater than 60% producer's accuracy included: beachgrass dune (88%), wet maritime shrubland (87%), bayberry dune shrubland (67%), shrub bog (67%), beach heather dune (97%), *Phragmites* wetland (92%), needlerush marsh (94%), high salt marsh (67%), brackish tidal marsh (100%), loblolly pine forest / loblolly wetland forest (63%), loblolly pine duen woodland (95%), deciduous maritime scrub (77%), low salt marsh (69%), tidal salt shrub (93%), loblolly pine tidal woodland (100%), naturally unvegetated (79%), unvegetated panne (84%), intertidal sand / mud flat (100%), and converted (100%).

Table 10. Contingency matrix and calculated errors for the thematic accuracy assessment of the 2009 vegetation assdociation map of ASIS; binary.

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	Total	Accuracy Rate
1	**Maritime Shrubland**	7		7	1		2		3				2						1												2		1							26	27%
2	**Beachgrass Dune**		22		1																														3					26	85%
3	**Wet Maritime Shrubland**	1		15									5									2				2					1								26	58%
4	**Bayberry Dune Shrubland**	1	9		14			1	2																										1					28	50%
5	**Vine Dune**							1																																1	0%
6	**Shrub Bog**						5					1							1																					7	71%
7	**Beach Heather Dune**							31															2																	33	94%
8	**Overwash Dune Grassland**		3		4				2								1																		4					14	14%
9	**Interdunal Swale**						1		2																		1													4	0%
10	**Forked Rush Dune Swale**									1																														1	0%
11	**Switchgrass Swale**						4			4		6							2																					16	38%
12	***Phragmites* Wetland**												6														1													7	86%
13	**Needlerush High Marsh**													15														3												18	83%
14	**Eastern Reed Tidal Marsh**												3																											3	0%
15	**Giant Cordgrass Marsh**																															1								1	0%
16	**High Salt Marsh**											1					10											3			4								18	56%
17	**Brackish Tidal Marsh**																	2										1												3	67%
18	**Backdune Grassland**	1			2			2	5										11																					21	52%
19	**Salt Panne**																1											1							1					3	0%
20	**Upper Ocean Beach**		1																																				1	0%
21	**Loblolly Pine Forest Maritime Forest**			1				1											1			23	1			4	1						8						1	41	56%
23	**Loblolly Pine Dune Woodland**							1															20								1									22	91%
24	**Brackish Meadow**											3					2		1																					6	0%
25	**Inland Red Maple Swamp**												1									1				3														5	0%
26	**Deciduous Maritime Scrub Forest**												1						1							5					1									8	63%
27	**Brackish Interdunal Swale**								1	2							1										2					1								7	29%
28	**Low Salt Marsh**									1							2			4								16								2	4			29	55%
29	**Spikerush Lawn Tidal Marsh**																														1									1	0%

Table 10 (continued). Contingency matrix and calculated errors for the thematic accuracy assessment of the 2009 vegetation association map of ASIS; binary.

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	Total	Accuracy Rate
30	Transitional Tidal																															1								1	0%
31	Brackish Tidal Shrubland	6		5																											5	1	2							19	26%
32	Tidal Salt Scrub												1				1															10								12	83%
33	Loblolly Pine Tidal Woodland																																4							4	100%
34	Loblolly Pine Plantation																		1																						1	0%
35	Naturally Unvegetated		3																																10					13	77%
36	Unvegetated panne																1			2								1								13	1			18	72%
37	Intertidal Sand / Mud Flat																																			1				1	0%
38	Water																					2														1		4		7	57%
39	Converted																																						2	2	100%
	Total points	16	38	28	22	0	12	38	15	8	0	11	19	15	0	0	19	2	19	6	0	28	23	0	0	14	5	26	0	0	9	20	15	0	19	17	5	4	3	455	58%
	Accuracy rate	44%	58%	54%	64%	0%	42%	82%	13%	0%	0%	55%	32%	100%	0%	0%	53%	100%	58%	0%	0%	82%	87%	0%	0%	36%	40%	65%	0%	0%	56%	50%	27%	0%	53%	76%	0%	100%	67%		
	TOTAL ACCURACY																																								58%
	KAPPA INDEX																																								0.57

Table 11. Contingency matrix and calculated errors for the thematic accuracy assessment of the 2009 vegetation association map of ASIS; first and second choices.

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	Total	Accuracy Rate
1	**Maritime Shrubland**	12		4			2		3				1						1												1		1								25	48%
2	**Beachgrass Dune**		28		1																													3						32	88%
3	**Wet Maritime Shrubland**			20									1									1				1														23	87%
4	**Bayberry Dune Shrubland**	1	5		18			1	1																									1						27	67%
5	**Vine Dune**																																							0	0%
6	**Shrub Bog**						6					2							1																					9	67%
7	**Beach Heather Dune**							36															1																	37	97%
8	**Overwash Dune Grassland**		1		1				3																									3						8	38%
9	**Interdunal Swale**						1		2																		1													4	0%
10	**Forked Rush Dune Swale**									1																															1	0%
11	**Switchgrass Swale**						3			4		7							2																					16	44%
12	**Phragmites Wetland**												11														1													12	92%
13	**Needlerush Marsh**													15														1												16	94%
14	**Eastern Reed Tidal Marsh**												3																											3	0%
15	**Giant Cordgrass Marsh**																															1								1	0%
16	**High Salt Marsh**											1					12											2				3								18	67%
17	**Brackish Tidal Marsh**																	2																						2	100%
18	**Backdune Grassland**	1			2				5										11																					19	58%
19	**Salt Panne**																1			1														1						3	33%
20	**Upper Ocean Beach**		1																																				1	0%
21	**Loblolly Pine Maritime Forest**			1															1			26	1			3	1					8								41	63%
23	**Loblolly Pine Dune Woodland**																						21								1									22	95%
24	**Brackish Meadow**											1					2		1																					4	0%
25	**Inland Red Maple Swamp**												1									1																		2	0%
26	**Deciduous Maritime Scrub Forest**												1						1							10					1									13	77%
27	**Brackish Interdunal Swale**								1	2							1										2					1								7	29%
28	**Low Salt Marsh**									1							2			3								22									4			32	69%
29	**Spikerush Lawn Tidal Marsh**																																							0	0%
30	**Transitional Tidal Marsh**																															1								1	0%
31	**Brackish Tidal Shrubland**	2		3																											6	1	2						14	43%

Table 11 (continued). Contingency matrix and calculated errors for the thematic accuracy assessment of the 2009 vegetation association map of ASIS; first and second choices.

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	Total	Accuracy Rate
32	Tidal Salt Scrub												1																			13								14	93%
33	Loblolly Pine Tidal Woodland																																4								4	100%
34	Loblolly Pine Plantation																		1																						1	0%
35	Naturally Unvegetated		3																																11					14	79%
36	Unvegetated Panne																1			2																16				19	84%
37	Intertidal Sand / Mud Flat																																				1			1	100%
38	Water																																			1		4		5	80%
39	Converted																																						3	3	100%
	Total points	16	38	28	22	0	12	38	15	8	0	11	19	15	0	0	19	2	19	6	0	28	23	0	0	14	5	26	0	0	9	20	15	0	19	17	5	4	3	455	
	Accuracy rate	75%	74%	71%	82%	0%	50%	95%	20%	0%	0%	64%	58%	100%	0%	0%	63%	100%	58%	17%	0%	93%	91%	0%	0%	71%	40%	88%	0%	0%	67%	65%	27%	0%	58%	94%	20%	100%	100%		
	TOTAL ACCURACY																																								71%
	KAPPA INDEX																																								0.71

Comparison of 1998 and 2009 accuracy assessment results

Overall accuracy of the corrected vegetation map increased from 34% in 1998 to 58% (Kappa 0.55) in 2009 using a simple binary, right-or-wrong approach (Table 12). When considering second as well as first choices, overall accuracy increased to 71% (Kappa 0.71) from 40% (Kappa 0.41) in 1998. Map classes with poor user's accuracy in 1998 that exceeded 60% in 2009 using the binary approach included: loblolly pine maritime forest (82%), loblolly pine dune woodland (87%), bayberry dune shrubland (64%), beach heather dune (82%), brackish tidal marsh (100%), low salt marsh (65%), water (100%), and converted (67%). Additional map classes that exceeded 60% using first and second choices included wet maritime shrubland (71%), maritime shrubland (75%), and high salt marsh (63%).

The same comparisons made for poor producer's accuracy using a binary approach in 1998, achieving 60% or greater in 2009 included: loblolly pine dune woodland (91%), deciduous maritime scrub forest (63%), shrub bog (71%), tidal salt scrub (83%), beachgrass dune (85%), naturally unvegetated (77%), and converted (100%). Additional classes achieving 60% or greater producer's accuracy using first and second choices included: bayberry dune shrubland (67%) and intertidal sand / mud flat (100%).

Table 12. Comparison of accuracy assessment results between 1998 and 2009.

1998 Accuracy					2009 Accuracy				
	Binary		1st / 2nd Choices			Binary		1st / 2nd Choices	
1994 name	**User**	**Producer**	**User**	**Producer**	**2009 Name**	**User**	**Producer**	**User**	**Producer**
Loblolly Pine Maritime Forest	34%	60%	39%	93%	Loblolly Pine Maritime Forest	82%	56%	93%	63%
Loblolly Pine Dune Woodland	26%	23%	30%	27%	Loblolly Pine Dune Woodland	87%	91%	91%	95%
Deciduous Maritime Scrub Forest	73%	37%	82%	47%	Deciduous Maritime Scrub Forest	36%	63%	71%	77%
Bayberry Dune Shrubland	27%	30%	44%	63%	Bayberry Dune Shrubland	64%	50%	82%	67%
Wet Maritime Shrubland	24%	16%	29%	17%	Wet Maritime Shrubland	54%	58%	71%	87%
Vine Dune	0%	0%	0%	0%	Vine Dune	0%	0%	0%	0%
Shrub Bog	34%	43%	38%	50%	Shrub Bog	42%	71%	50%	67%
Maritime Shrubland	14%	27%	18%	30%	Maritime Shrubland	44%	27%	75%	48%
Tidal Salt Scrub	54%	43%	71%	50%	Tidal Salt Scrub	50%	83%	65%	93%
Backdune Grassland	16%	20%	28%	33%	Backdune Grassland	58%	52%	58%	58%
Beach Heather Dune	28%	43%	37%	50%	Beach Heather Dune	82%	94%	95%	97%
Needlerush Marsh	96%	87%	97%	97%	Needlerush Marsh	100%	83%	100%	94%
Brackish Tidal Marsh	0%	0%	0%	0%	Brackish Tidal Marsh	100%	67%	100%	100%
Phragmites Wetland	91%	70%	92%	80%	Phragmites Wetland	32%	86%	58%	92%
Low Salt Marsh	29%	80%	35%	87%	Low Salt Marsh	65%	57%	88%	69%
Beachgrass Dune	52%	57%	68%	63%	Beachgrass Dune	58%	85%	74%	88%
Switchgrass Swale	86%	40%	88%	47%	Switchgrass Swale	55%	38%	64%	44%
Interdunal Swale	29%	20%	33%	23%	Interdunal Swale	0%	0%	0%	0%
Overwash Dune Grassland	50%	30%	63%	40%	Overwash Dune Grassland	13%	14%	20%	38%
High Salt Marsh	35%	30%	53%	57%	High Salt Marsh	53%	56%	63%	67%
Salt Panne	100%	3%	100%	10%	Salt Panne	0%	0%	17%	33%
Intertidal Sand / Mud Flat	0%	0%	0%	0%	Intertidal Sand / Mud Flat	0%	0%	20%	100%

Table 12 (continued). Comparison of accuracy assessment results between 1998 and 2009.

1998 Accuracy					2009 Accuracy				
	Binary		1st / 2nd Choices			Binary		1st / 2nd Choices	
1994 name	**User**	**Producer**	**User**	**Producer**	**2009 Name**	**User**	**Producer**	**User**	**Producer**
Water	48%	67%	76%	87%	Water	100%	57%	100%	80%
Naturally Unvegetated	20%	40%	31%	83%	Naturally Unvegetated	53%	77%	58%	79%
Dead Vegetation	0%	0%	0%	0%	N/A	N/A	N/A	N/A	N/A
Undifferentiated Anthropogenic Grassland	4%	3%	17%	17%	(part of "Converted" class)	67%	100%	100%	100%
Built Up Areas (Unvegetated)	0%	0%	0%	0%	Converted				
Sand Bog	N/A	N/A	N/A	N/A	Forked Rush Dune Swale	0%	0%	0%	0%
Inland Red Maple Swamp	N/A	N/A	N/A	N/A	Inland Red Maple Swamp	0%	0%	0%	0%
Beach Community	N/A	N/A	N/A	N/A	Upper Ocean Beach	0%	0%	0%	0%
(Not recognized)					Eastern Reed Tidal Marsh	0%	0%	0%	0%
(Not recognized)					Giant Cordgrass Marsh	0%	0%	0%	0%
(Not recognized)					Brackish Interdunal Swale	40%	29%	40%	29%
(Not recognized)					Spikerush Lawn Tidal Marsh	0%	0%	0%	0%
(Not recognized)					Transitional Tidal Marsh	0%	0%	0%	0%
(Not recognized)					Brackish Meadow	0%	0%	0%	0%
(Not recognized)					Brackish Tidal Shrubland	56%	26%	67%	43%
(Not recognized)					Unvegetated Panne	76%	72%	94%	84%
(Not recognized)					Loblolly Pine Tidal Woodland	27%	100%	27%	100%
TOTAL ACCURACY	34%		40%		TOTAL ACCURACY	58%		71%	
KAPPA	0.31		0.41		KAPPA	0.57		0.71	

Wetlands

Over 62% of Assateague Island National Seashore is classified as wetland using the Cowardin et al. (1979) classification of wetlands and deepwater habitats. Table 13 lists all associations and their corresponding wetland classification; N/A denotes non-wetland habitat. The estuarine system includes wetland associations that are influenced by tidal flooding, and includes salt marsh associations and tidally flooded mud and sand flats. Areas classified as palustrine are seasonally flooded by freshwater; these include wet shrublands and herbaceous swales. Figures 54-58 illustrate the mapped extent of wetlands. There is more palustrine habitat than is denoted on the map, however, because the Loblolly Pine Maritime Forest map unit encompasses both wetland and palustrine forest, but this map unit as a whole was not mapped here as wetland.

Table 13. Relationship of Associations to Cowardin et al. (1979) System Name.

Association Common Name	Association Scientific Name	Cowardin System Name
Backdune Grassland	*Morella (pensylvanica, cerifera) / Schizachyrium littorale - Eupatorium hyssopifolium* Shrub Herbaceous Vegetation	N/A
Bayberry Dune Shrubland	*Morella pensylvanica / Diodia teres* Shrubland	N/A
Beach Heather Dune	*Hudsonia tomentosa / Panicum amarum var. amarulum* Dwarf-shrubland	N/A
Beachgrass Dune	*Ammophila breviligulata - Panicum amarum var. amarum* Herbaceous Vegetation	N/A
Brackish Tidal Marsh	*Typha angustifolia - Hibiscus moscheutos* Herbaceous Vegetation	Estuarine
Deciduous Maritime Scrub Forest	*Prunus serotina / Morella cerifera / Smilax rotundifolia* Scrub Forest	N/A
High Salt Marsh	*Spartina patens - Distichlis spicata - (Juncus roemerianus)* Herbaceous Vegetation	Estuarine
Interdunal Swale	*Schoenoplectus pungens - Fimbristylis (castanea, caroliniana)* Herbaceous Vegetation	Palustrine
Loblolly Pine Dune Woodland	*Pinus taeda / Hudsonia tomentosa* Woodland	N/A
Loblolly Pine Maritime Forest	*Pinus taeda – Quercus (falcata, nigra) / Morella cerifera / Vitis rotundifolia* Forest	N/A
Loblolly Pine Wetland Forest	*Pinus taeda / Morella cerifera / Osmunda regalis* Forest	Palustrine
Low Salt Marsh	*Spartina alterniflora - Distichlis spicata* Tidal Herbaceous Vegetation	Estuarine
Maritime Shrubland	*Morella cerifera / Spartina patens* Shrubland	N/A

Table 13 (continued). Relationship of Associations to Cowardin et al. (1979) System Name.

Association Common Name	Association Scientific Name	Cowardin System Name
Needlerush Marsh	*Juncus roemerianus* Herbaceous Vegetation	Estuarine
Overwash Dune Grassland	*Spartina patens - Schoenoplectus pungens - Solidago sempervirens* Herbaceous Vegetation	N/A
Phragmites Wetland	*Phragmites australis* Herbaceous Vegetation	Palustrine
(Salt panne)	*Salicornia spp., Sarcocornia perennis, Spartina alternifolia* Herbaceous Vegetation	Estuarine
Shrub Bog	*Morella cerifera - Vaccinium corymbosum* Shrubland	Palustrine
Switchgrass Swale	(*Morella cerifera) - Panicum virgatum - Spartina patens* Herbaceous Vegetation	Palustrine
Tidal Salt Scrub	*Iva frutescens / Spartina patens* Shrubland	Estuarine
(Undifferentiated Anthropogenic Grassland)	included in "converted" map unit	N/A
Vine Dune	*Smilax glauca - Toxicodendron radicans* Vine-Shrubland	N/A
Water	None	N/A
Wet maritime shrubland	*Morella cerifera / Hydrocotyle verticillata* Shrubland	Palustrine
Converted	None	N/A
Intertidal Sand / Mud Flat	None	Estuarine
Naturally Unvegetated	None	N/A

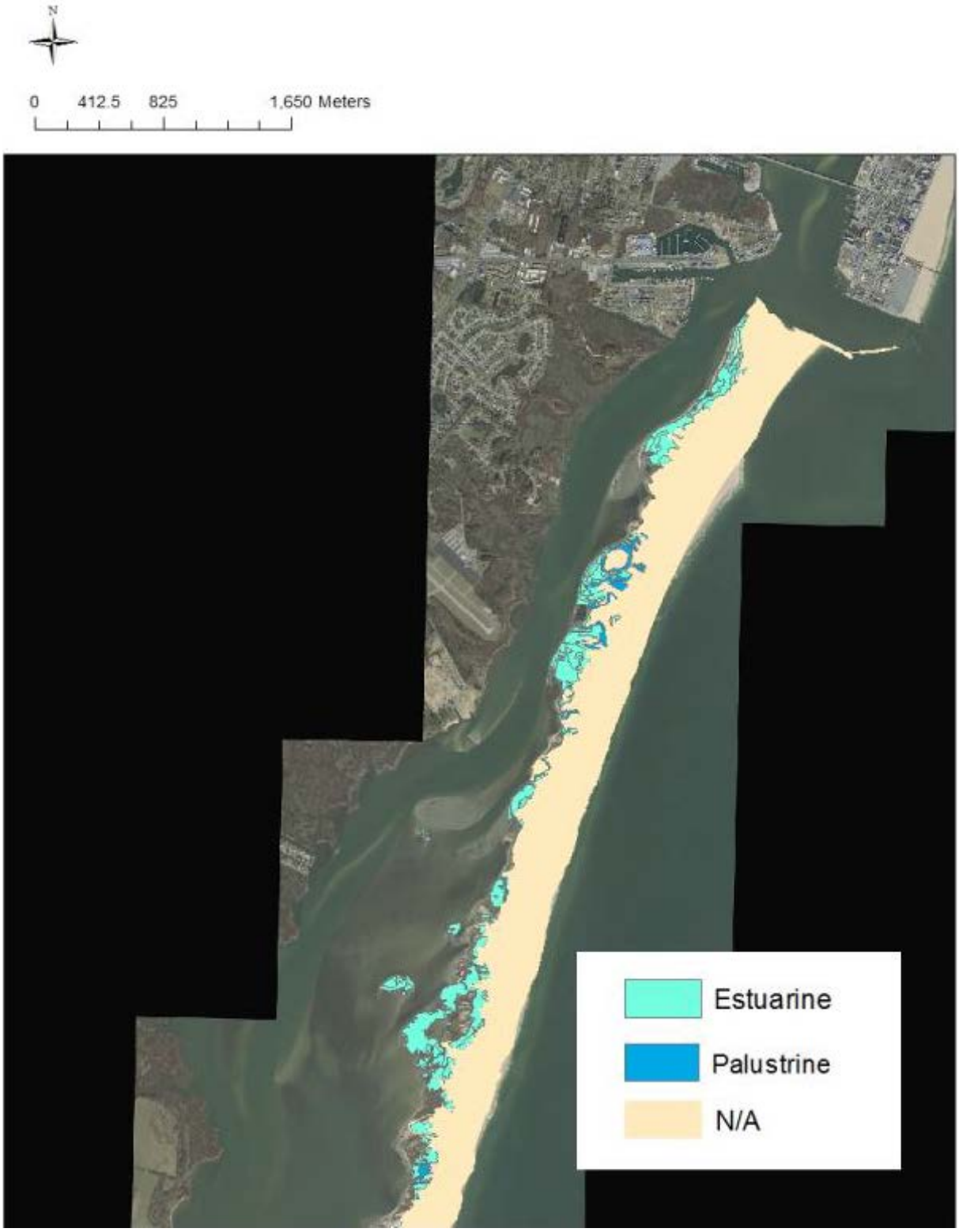


Figure 54. Wetland Systems (Cowardin et al.1979) north end.

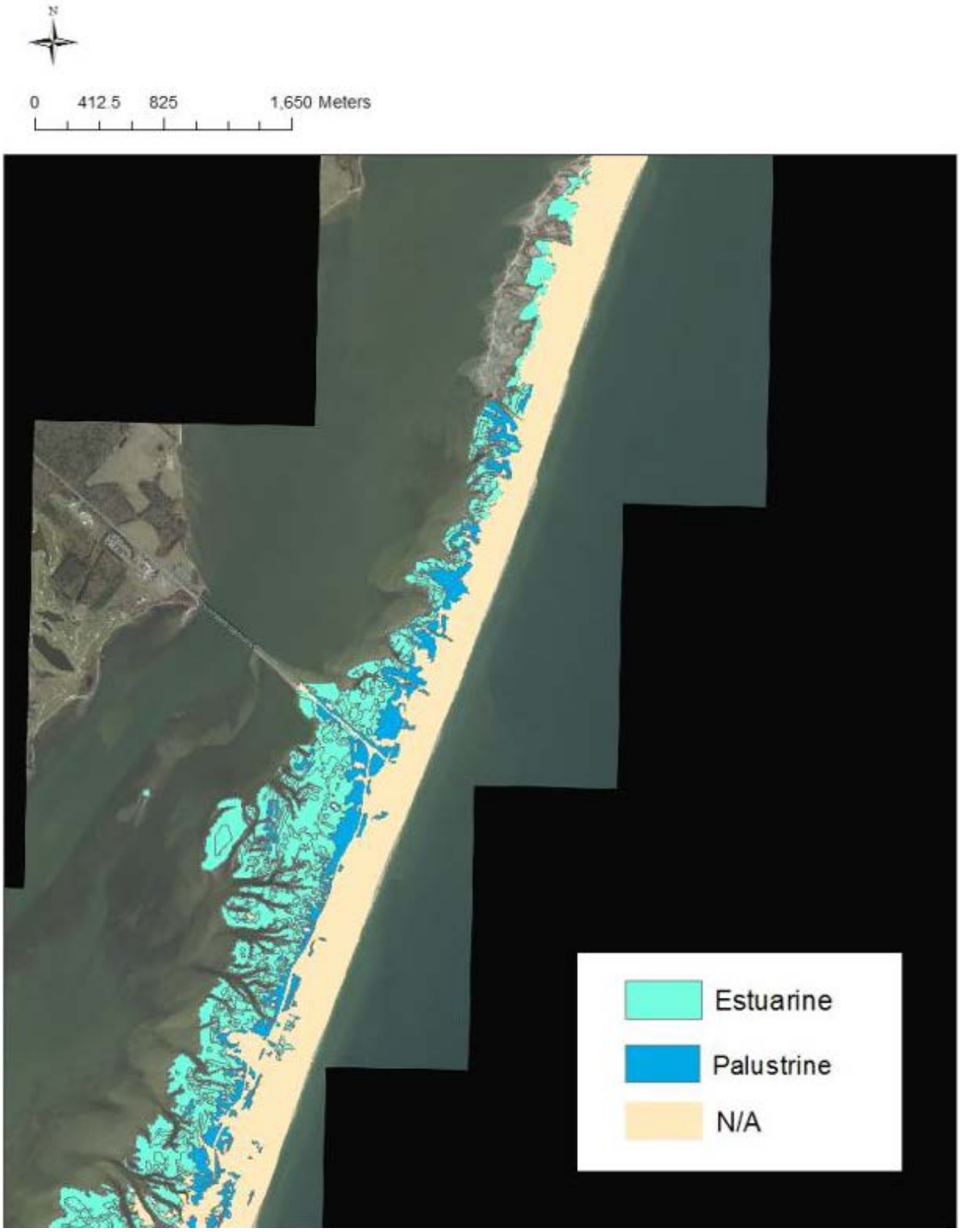


Figure 55. Wetland Systems (Cowardin et al.1979), at bridge.

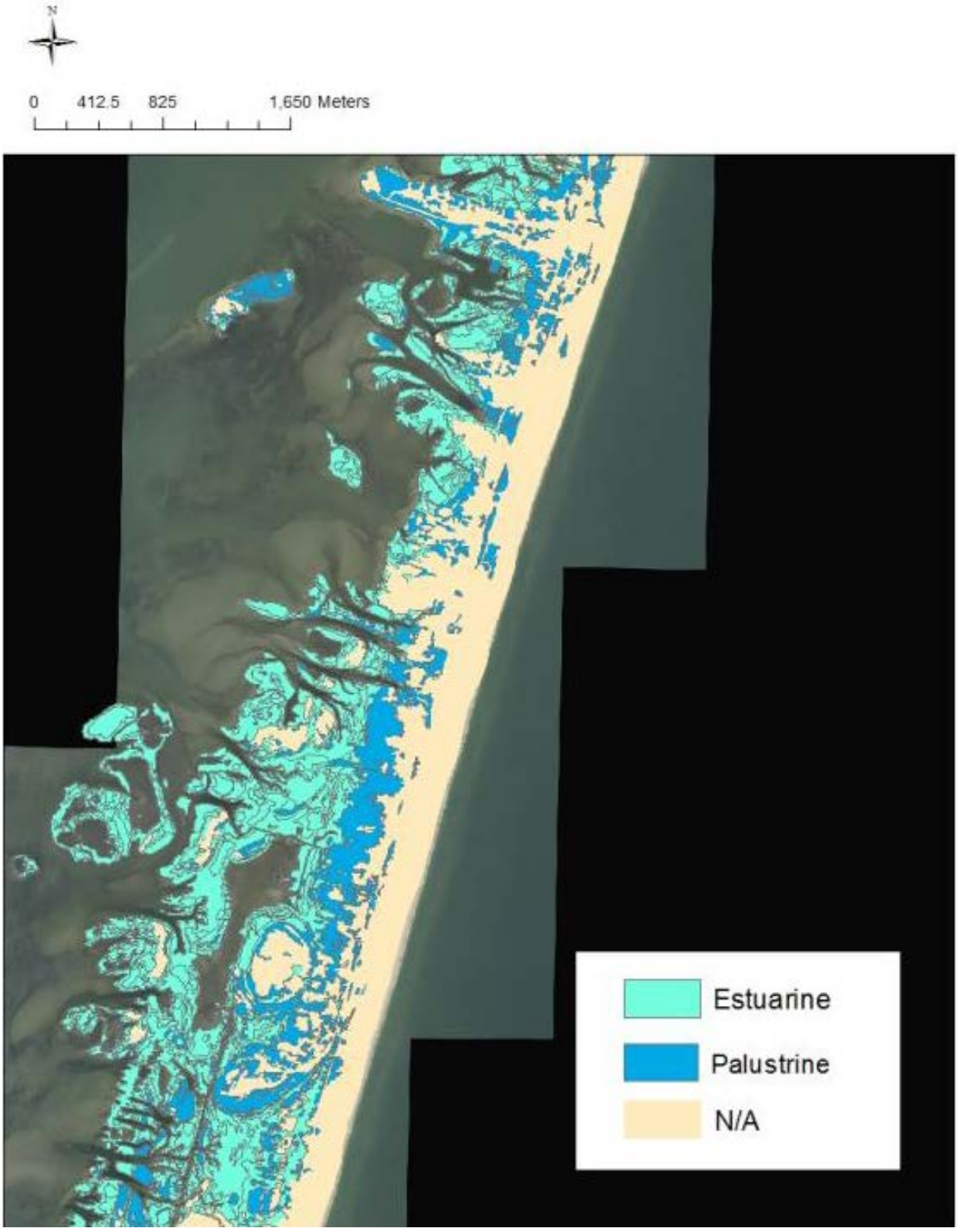


Figure 56. Wetland Systems (Cowardin et al.1979) campground and south.

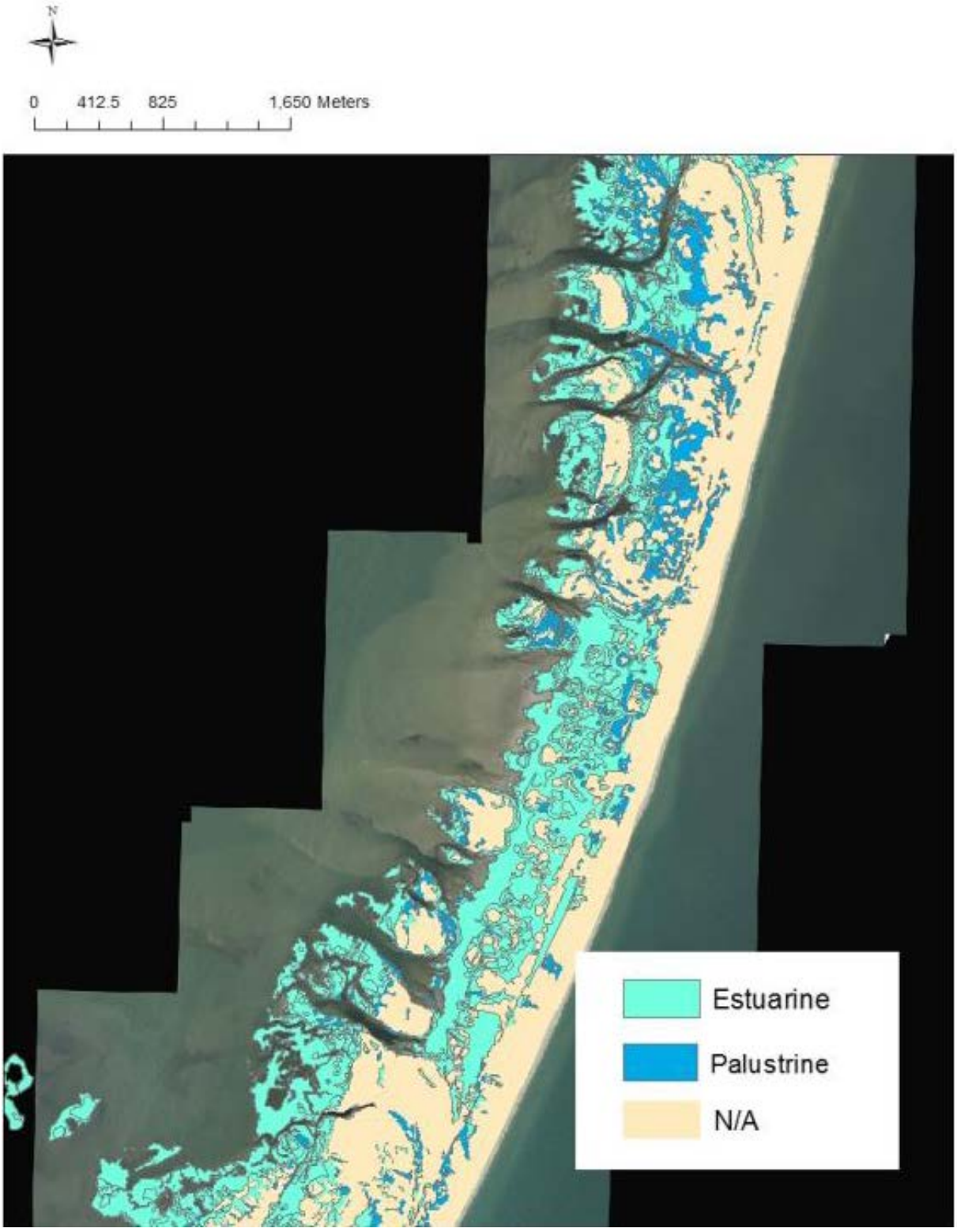


Figure 57. Wetland Systems (Cowardin et al.1979) Fox Hill area.

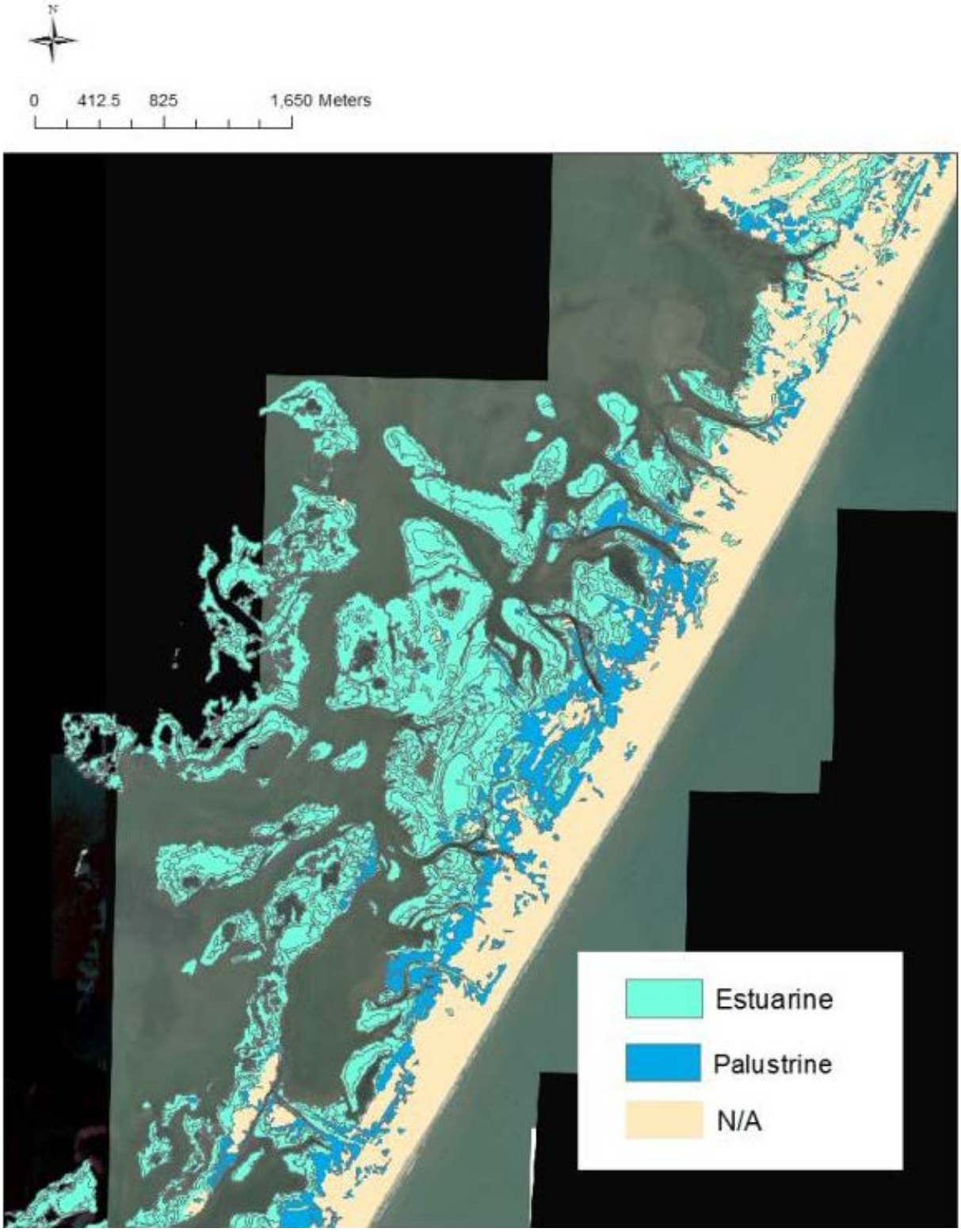


Figure 58. Wetland Systems (Cowardin et al.1979) south end.

Discussion

Classification

One of our greatest obstacles at the time we began this project was the nascent state of the US National Vegetation Classification. Few of the vegetation types we encountered at Assateague Island National Seashore had been previously classified using the USNVC, but the timing of this pilot project was such that mapping and classification efforts were of necessity conducted simultaneously. Not surprisingly, the lack of an existing classification proved to be an impediment to mapping, as well as to identifying areas for sampling vegetation classification plots.

Rather than targeting a single coastal park for vegetation mapping and classification, it would have been more strategic to combine the classification efforts of all of the coastal parks in the northeast at once. Fire Island National Seashore, Gateway National Recreational Area, and Cape Cod National Seashore were classified and mapped subsequent to the effort at Assateague, yet there are many similarities in the vegetation, particularly at the Alliance level. Having had a more comprehensive set of coastal vegetation data would have likely produced a more robust classification, with greater confidence in the types. It would also have allowed the vegetation ecologists sufficient time to more fully collaborate with the mappers to identify photo signatures. Although the mappers were highly skilled at identification of plants from aerial photography, the photo signature key was generally to species as opposed to vegetation type. This approach led to some inaccuracies in interpretation, such as the focus on patches of *Hudsonia tomentosa* as a species rather than as a component of two distinct vegetation types. As a result, the Loblolly Pine Dune Woodland was undermapped, and the Beach Heather Dune was over-mapped.

Mapping

There has been substantial change in vegetation mapping technology since the inception of this project, most notably in air photo scanning, orthophoto rectification, in digital vs manual photointerpretation, Lidar technology, and in GPS technology, among others. The technical limitations of the time resulted in less detailed orthophotography than is typically available today. The resolution of the scanned, digitized 1993 photography was considerably more coarse than that of the original diapositives, resulting in a loss of important detail during the map editing done in preparation for the second accuracy assessment. In addition, registration of the originally scanned line work was off by over 10m in some cases. Editing line work was beyond the scope of this project, but judicious editing of line work would likely have increased accuracy in some cases. Although the original diapositive film was available for use during re-mapping, it proved to be exceptionally time consuming to manually locate the areas of interest on the hard copy film to compare to the digital photos. Their use was largely abandoned, except for limited checking of the shrub bog vegetation, where we relied on the orange signature of *Vaccinium corymbosum* visible only at high magnification to identify this type. The true-color digital photographs from 2008 were of considerably higher resolution and mitigated some of the lack of detail in the 1993 photos during most of the remapping effort. We also had access to leaf-off 1999 digital aerial photography that aided in the differentiation between two important and very abundant shrubs at Assateague Island

National Seashore: the deciduous shrub *Morella penyslvanica*, and the evergreen *Morella cerifera*. This information facilitated our ability to increase accuracy in Wetland Maritime Shrubland.

There are other non-technical factors that posed a challenge in vegetation mapping here. A confounding factor in assessing map accuracy is the extremely dynamic nature of the environments of barrier islands, which often undergo significant change from year to year. The mid-Atlantic region has always experienced numerous coastal storms that cause considerable overwash and beach erosion, particularly on the northern end of the island. The second accuracy assessment, conducted a full fifteen years after the original mapping effort and eleven years after the initial accuracy assessment, could not be expected to fully differentiate the effects of real change from inaccuracy in mapping.

Another factor unique to only a small subset of barrier islands, is the significant grazing pressure exterted on the vegetation by the feral horses on the island. Population control measures were begun in 1994, but the population initially grew and peaked in 2001 before declining once again. We were unable to differentiate between map accuracy and real vegetation change as a result of this grazing.

We noted two issues that might have been less problematic with some adjustment during the initial design phase.

- The field form designed for the 1998 accuracy assessment provided for only minimal data collection – GPS location, dominant species, and minimal information on environmental setting. No ground photos were taken. The field identity of the association was determined by use of a key, but it is not possible for a key to cover every possible variation within a type. To most effectively use the accuracy assessment data to inform the remapping effort, the original field identification must be reliably correct. We reviewed each of the forms to detemine that interpretation of the type in the field was consistent with the intended conscription of the type. However, review of these forms was hampered by a general lack of sufficient information to allow full confirmation of the field identification assigned by the ecologist.

- The original accuracy assessment points were not “buffered” (deliberately placed away from vegetation boundaries). As a result, a number of points were placed on ecotones rather than within a polygon, resulting in ambiguity in the identity of the vegetation at the point. The points of the second accuracy assessment were buffered, but the two different approaches complicated a direct comparison of the results.

The goal of the second accuracy assessment was to increase the accuracy of the original vegetation map. We largely succeeded, for several reasons. We expected, and achieved, increases in accuracy of map classes that had initially been interpreted differently than the intended vegetation concepts, such as Loblolly Pine Dune Woodland, Beach Heather Dune, and to a lesser extent, Bayberry Dune. Limiting the minimum mapping unit to 0.5 ha in Loblolly Pine Maritime Forest, and mapping patches of beach heather occurring in association with an open loblolly pine canopy as a single unit, increased the accuracy of both the Loblolly Pine Dune Woodland and the Beach Heather Dune.

Accuracy also increased in Bayberry Dune Shrubland, presumably as a result of a less strict interpretation of this type as having a highly variable canopy closure, rather than a closed shrubland.

An increase in accuracy due to differences in original interpretation was also noted in the converted class, which was defined more broadly by the ecologists than by the mappers. Two original map classes, built up areas and undifferentiated dry grasses (the latter largely confined to roadsides and other weedy areas), were mapped as a single unit in the second map.

An increase in accuracy was achieved in Beachgrass Dune through the use of hillshaded Lidar data (Brock et al. 2007). Without the hillshade, dune formations were mostly indistinguishable from flat sandy areas, even in stereo. During the second mapping effort, we modeled, rather than photointerpreted the Beachgrass Dune, since the vegetation itself was largely undetectable on photography. Beachgrass stabilizes sand, and results in retention of the dune as unvegetated areas erode. We assumed dune crests were vegetated and that flat sandy areas were not.

There were also notable decreases in accuracy in some classes, which may represent error in interpretation, or more likely, represents a real change since the original photos were flown. Interdunal Swale, a small-patch type that achieved low accuracy in the first mapping effort, decreased to zero in re-mapping. This small-patch type is variable within a single growing season, and the aerial photo signature is very similar, if not indistinguishable, from small-patch vegetation types dominated by forbs and grasses such as switchgrass swale. It is therefore not surprising that mapped accuracy of this type was very low. However, decrease in accuracy noted in overwash dune grassland may reflect real change. Overwash dune grassland is expected to change markedly over time as storms cause breaching of dunes, killing extant vegetation and creating new bare habitat for grassland to emerge.

Project Deliverables

Table 14 summarizes the individual products that were delivered to the National Park Service as part of this project. While every effort was made to locate all relevant data sources, some accompanying information is not available. For example, we are not sure if a flight line and photo index were developed when the 1993 aerial photographs were taken, and we were not able to locate it if it does exist. In addition, this project has a long history that includes a second mapping and accuracy assessment, so there are two sets of vegetation maps and two sets of accuracy assessment data.

Table 14. Summary of products resulting from the vegetation classification and mapping of vegetation at Assateague Island National Seashore.

Product	FGCD-complaint spatial metadata
Aerial photos (Flight line map and photoindex not available)	Yes
Photomosaic in digital format	Yes
Annotated field forms with vegetation plot sampling data	Not applicable
Vegetation plot sampling data in the PLOTS 2.0 database	Not applicable
GPS locations of vegetation plots	Yes
Annotated field forms with thematic accuracy assessment data, 1998	Not applicable
Annotated field forms with thematic accuracy assessment data, 2009	Not applicable
2009 thematic accuracy assessment data in the PLOTS 2.0 Database	Not applicable
GPS locations of thematic accuracy assessment sampling points, 1998	Yes
Digital photos representative of all vegetation types	Not applicable
Final map of vegetation associations in digital format	Yes
Final report in digital format	Not applicable

Associations of Special Concern

Assateague Island, which includes Chincoteague National Wildlife Refuge on the Virginia portion , is one of the largest protected barrier islands in the northeast. Many of the associations of barrier islands are rare as a result of limited natural habitat, but also because of the threats imposed to barrier islands by development pressure and heavy recreational use. Assateague Island National Seashore is home to thirteen associations ranked G2G3 or higher (Table 15). All of these associations are restricted to coastal dune systems and rely on naturally maintained coastal processes for their continued existence. It is likely that Assataeague Island is home to many of the largest and most high-quality examples of these associations anywhere, so their protection here is crucial to their long-term survival range-wide.

Table 15. Global conservation ranks for rare or threatened associations (Global rank of G2G3 or higher) at Assateague Island National Seashore See Appendix H for explanations of conservation rank codes.

Common name	Association Name	Association Code	Global Rank
Beachgrass Dune	*Ammophila breviligulata - Panicum amarum* var. *amarum* Herbaceous Vegetation	CEGL004043	G2
Beach Heather Dune	*Hudsonia tomentosa / Panicum amarum* var. *amarulum* Dwarf-shrubland	CEGL003950	G2G3
Forked Rush Dune Swale	*Juncus (dichotomus, scirpoides) - Drosera intermedia* Herbaceous Vegetation	CEGL004111	G2G3
Wet Maritime Shrubland	*Morella cerifera / Hydrocotyle verticillata* Shrubland	CEGL003840	G2G3
Backdune Grassland	*Morella (pensylvanica, cerifera) / Schizachyrium littorale - Eupatorium hyssopifolium* Shrub Herbaceous Vegetation	CEGL004240	G2
Bayberry Dune Shrubland	*Morella pensylvanica / Diodia teres* Shrubland	CEGL003881	G2
Loblolly Pine Dune Woodland	*Pinus taeda / Hudsonia tomentosa* Woodland	CEGL006052	G1G2
Loblolly Pine Maritime Forest	*Pinus taeda – Quercus (falcata, nigra) / Morella cerifera / Vitis rotundifolia* Forest	CEGL006040	G2
Loblolly Pine Wetland Forest	*Pinus taeda / Morella cerifera / Osmunda regalis* Forest	CEGL006137	G3
Deciduous Maritime Scrub Forest	*Prunus serotina / Morella cerifera / Smilax rotundifolia* Scrub Forest	CEGL006319	G1G2
Interdunal Swale	*Schoenoplectus pungens - Fimbristylis (castanea, caroliniana)* Herbaceous Vegetation	CEGL004117	G1G2
Vine Dune	*Smilax glauca - Toxicodendron radicans* Vine-Shrubland	CEGL003886	G1G2
Overwash Dune Grassland	*Spartina patens - Schoenoplectus pungens - Solidago sempervirens* Herbaceous Vegetation	CEGL004097	G2G3

Conclusion

All vegetation restricted to barrier islands faces an uncertain future in the face of rising sea levels and increased storm intensity brought on by climate change. Barrier islands are dynamic environments that naturally change in response to the complex processes of erosion, overwash, and accretion, but we should anticipate that the balance of erosion and accretion will change, bringing about changes in shoreline position, as well as segmentation of these narrow landforms caused by storm breaches (Titus et al. 2009).

The National Fish, Wildlife and Plants Climate Adaptation Strategy (2012) recommends seven major goals to address the impacts of climate change, including conservation and connection of habitat, as well as reduction of non-climate stressors. Although opinions vary over specific actions to mitigate climate change, maintenance or improvement of ecological integrity is a decidedly low-risk approach, and is one that is already under way on a number of fronts at Assateague Island National Seashore. Ecological integrity is defined as a measure of the structure, composition, and function of an ecosystem as compared to its past range of variation (Mitchell et al. 2014). Ecological Integrity Assessment (EIA) methodology (Faber-Langendoen 2011) provides a framework and standardized approach to understanding reference or target conditions, selecting metrics, determining assessment points that indicate a change and/or need for management action, and data collection to determine integrity scores.

Understanding and managing the impact of horse grazing and trampling is critical to maintaining or improving the ecological integrity of all vegetation on Assateague Island National Seashore. Associations are habitats for many species, including vascular plants, nonvascular plants, vertebrates, invertebrates, and microbes. As “coarse filters,” proper protection and management at the association level can, by extension, conserve a large suite of associated species that are cryptic or not readily observable. Assateague Island National Seashore is a significant natural area that supports over 30 different associations, about half of which are highly restricted in range. Many of these examples are likely to be the largest and highest quality existing anywhere, including loblolly pine dune woodland, beach heather dune, backdune grassland, interdunal swale, and perhaps others. The impacts of grazing and trampling by horses is not well understood in these associations, but interventions such as limited exclosures and monitoring of fenced vs unfenced examples over time would reveal whether more intensive exlusion of horses may be warranted.

The impacts of horses on dunes and salt marshes are already relatively well documented. De Stoppelaire et al. (2004) reported significant differences in vegetation cover and elevation of dunes between fenced and unfenced plot pairs. The beach grass *Ammophila breviligulata* was dominant in fenced plots, and the dunes supporting fenced plots were an average of 0.63m higher than unfenced plots, indicating that horse grazing can have a substantial impact on sand dune integrity. Sand dunes act as protective buffers against coastal storms, which are expected to intensify in the coming years. Limiting grazing pressures on the dunes will contribute to their greater stability and increase the effectiveness of the dunes as buffers against erosion and salt-water incursion into the interior of the island.

The effects of grazing on salt marshes can also be significant. A simulation study of grazing of salt marshes on Cumberland Island, Georgia, also a barrier island inhabited by feral horses, revealed that a population of over 73 horses on the 36,415 acres that make up the island could result in marsh degradation that may not recover if intensive grazing continues (Turner 1988). Natural resource managers at Assateague Island National Seashore have succeeded in limiting the number of horses to 100 as of 2014. Assuming similar ratios to those of Cumberland Island, 100 horses is within, but approaching, the limit that can be sustained by the 48,000 acres of Assateague Island National Seashore without salt marsh degradation. The success of limiting the number of horses is a positive development that will increase the ecological integrity of the island as a whole, and contribute to the island's resilience in the face of climate change.

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Appendix A. Full photointerpretation report of original map (Aerial Information Systems, Inc., 1994)

Introduction

The National Park Service (NPS) in conjunction with the National Biological Service (NBS) has created a program to "develop a uniform hierarchical vegetation methodology" at a national level and to create a geographic information system (GIS) database for the parks under its management. The purpose of the data is to document the state of vegetation within the NPS/NBS service area during the 1990's thereby providing a baseline study for further analysis at the Regional or Service wide level. Aerial Information Systems (AIS) was subcontracted by Environmental Systems Research Institute (ESRI), the prime contractor, to perform the photointerpretation for the program. The Nature Conservancy (TNC) was subcontracted by ESRI to conduct the field sampling effort and to support the development of the National Standard Classification.

Several parks, representing different regions, environmental conditions, and vegetation types, were chosen to be part of the prototype phase of the program. The initial goal of the prototype phase is to "develop, test, refine, and finalize the standards and protocols" to be used during the production phase of the project. This includes the development of a standardized vegetation classification system for each park and the establishment of photointerpretation, field, and accuracy assessment procedures.

Assateague Island National Seashore was designated as one of the prototype parks. The Monument represents a barrier island environment with a diverse set of vegetation types, including upland forest and woodland communities, interdunal shrub thickets and grasslands, a variety of freshwater wetland communities, dune grasslands and salt marsh. For this park, AIS was responsible for the photointerpretation and rectification of the vegetation units and TNC directed the field sampling effort and the classification assignments. Working with the field biologists from TNC, AIS photointerpreted the vegetation units from stereo paired, color-infrared photography.

Assateague Island National Seashore - General Description

Assateague Island National Seashore is a barrier island that spans the entire length of Chincoteague Bay in the south and Sinepuxent Bay in the north encompassing both the northern portions of Virginia and southern Maryland. The island is approximately 50 miles long and varies in width from one-half mile in the north to two miles in the middle and southern part of the island. The northern two-thirds of the island is administered by the U.S. National Park Service as Assateague Island National Seashore. The southern third, south of the Virginia state line, is administered by the U.S. Fish and Wildlife Service as Chincoteague National Wildlife Refuge. A small two mile stretch of the island within the National Seashore comprising approximately 680 acres is owned and administered by the Maryland Department of Natural Resources as Assateague State Park. The study area for mapping the vegetation is the National Seashore and State Park area north of the Virginia/Maryland state line.

The island was designated a National Seashore in 1965. The National Seashore is primarily administered to provide for recreational use and enjoyment consistent with the maintenance and

perpetuation of the seashore's natural communities. Activities include birding, picnicking, camping, swimming, surf fishing, canoeing, boating, hiking, bicycling, clamming, crabbing, and shell collecting. Part of the ocean side beach area is designated an Off Road Vehicle zone.

Assateague Island is bounded on the east by the Atlantic Ocean, on the west by Chincoteague and Sinepuxent Bay. Outlets to the sea include the Ocean City inlet to the north and the Chincoteague inlet between Tom's Cove Hook and Wallops Island to the south. Differences in the natural character of the island are mainly exhibited over a east-west (ocean to bay) cross section of the island. Varying widths and local topography combine to play a significant role in the establishment of extensive upland forests especially in the southern portions of the island. The major geomorphologic features from east to west are:

- Active beach and coastline including both foreshore and backshore environments where occasional plants such as *Cakile edulenta* occur in sparse pioneer communities.
- Primary and foredune areas that are either continuous or broken and may be stabilized by beach grasses such as *Ammophila breviligulata*.
- Interdunal areas that consist primarily of sandy swale/hummock relief, with increasing topographic variability in the wider portions of the island.
- Barrier flats and overwash areas that support a variety of communities but usually grading into saltmarsh habitat to the west.

The main road runs primarily through the interdunal areas and is accessible only by four wheel drive vehicles south of the Life of the Dunes nature trail. Dune crossing markers denote areas accessible to the beach or mark roads that travel across the island to the back bay areas. North of Assateague State Park, travel is restricted to National Park vehicles usually along the immediate beach; no roads exist in this area.

The following is a brief and general description of the major regions and their associated vegetation types.

Active Beach and Coastline

These are areas affected by wave action which changes on a seasonally, sporadic (storm), daily or even hourly basis. Backshore portions of the beach environment may occasionally support the development of annual herbaceous communities such as *Cakile edulenta, Ammophila breviligulata* or *Panicum spp.* Pioneer communities noted on the island however were never visible on the aerial photography since they always occurred in densities well below 2%. Foreshore areas usually contain no vegetation except occasional areas of algae washed up from the water.

In the northern portion of the island, the beach and interdunal areas have been subjected to overwash from recent storms. Overwash areas occur when storm waves travel inland beyond the non-vegetated beach area and deposit their particulate load onto the surrounding landscape. This results in the

partial or total destruction of the existing plant community. Overwash areas are characterized as areas of dead mature vegetation and the presence of pioneering plant species.

Primary Dune

Primary dune development varies along the entire extent of the island. Along the northern portions of the island north of the Sinepuxent campsite, recent storm activity has all but obliterated the primary dune. Small remnant dunes in this area support some herbaceous vegetation; *Ammophila breviligulata*, *Spartina patens*, *Panicum spp.* are among the noted species visible.

Within the state park system, the primary dune has been stabilized; *Ammophila breviligulata* has been planted on the top third of the dune and vegetative densities are often over 40%. The stable dune averages over 15 to 20 feet in height preventing any sea wash or storm surge on its lee side. This has resulted in a sharp decrease of interdunal species such as *Hudsonia tomentosa* and *Myrica pensylvanica*. South of the state park, where the primary dune is no longer maintained, many breeches occur along its length, increasing in size and number toward the state line. On these breached primary dunes, *Ammophila breviligulata* and some *Panicum spp.* are found, however in densities usually below 40%. *Myrica pensylvanica* also occurs on the lee side of these dunes usually as individuals below .5 meters. *Ammophila breviligulata* is an important dune stabilizing plant in this portion of the island and nearly all remnant dunes contain at least some plants.

Interdunal Swales and Dunes

Between the primary dune and barrier flats is the interdunal area. This region is composed of swales and secondary dune formations. The swales are low lying, elongated wetland areas, found in the lee of the primary dune and interspersed throughout the interdunal area. Dunes are usually below 10 feet, and vary considerably in slope and aspect.

Secondary dunes within this region are typically occupied by upland dwarf shrubs and shrub species; mainly *Hudsonia tomentosa* and *Myrica pensylvanica*. Densities vary depending on the size, elevation and orientation of the dune; upland herbaceous understories are usually associated with these dry areas and include *Ammophila breviligulata*, *Panicum spp.*, *Solidago sempervirens* and other forbs.

Interdunal swales are often occupied by fresh or brackish water species such as *Scirpus* spp., *Juncus* spp., and *Spartina patens*. Occasionally the interdunal swales express themselves as a shrub bog community containing an overstory of shrubs such as *Myrica cerifera* and *Vaccinium corymbosum* with an understory of wetland graminoids.

Interdunal areas are best developed in the central portions of the island where it is the widest, especially in the Fox Hills where dunes exceed 15 feet. Large stands of *Hudsonia tomentosa*, *Smilax* spp. and other vines along with upland grasses form unique communities on portions of these dunes.

Pinus taeda woodland communities are also found primarily on the larger well-developed dunes in this zone, often occurring with *Hudsonia tomentosa* as the typical understory type.

Barrier Flats and Depositional Areas

This is a region of minor topographical relief primarily to the west of the interdunal zone. Plant communities vary depending on slight variations in topography that may determine whether or not the area is wet, distance from salt-water influence, and soil type. This region is least developed in the north; the primary expression being the upper and lower salt marsh communities.

This region is best developed in the central and southern portions of the island where island width exceeds a half of a mile. In low lying wet areas that have little or no saline intrusion, extensive stands of *Myrica* spp. thickets occur, often in uninterrupted zones of several miles in length. Shrubs in these thickets are tall, averaging over 5 meters in height and densities are often over 80%. Large stands of *Pinus taeda* forests occur usually west of the thicket zone in areas, which vary in water regimes from upland to seasonally flooded. Some stands of pine reach heights over 90' and occur in densities greater than 80%.

Within the thicket zone, many herbaceous wetland communities usually under one hectare in size can be found with species from both the salt-marsh community (*Spartina patens*) and freshwater swales (*Scirpus* spp.). Adjacent to the *Myrica* spp. thicket community, usually on its east side, small areas of *Amelanchier canadensis* and *Myrica* spp. form unique associations that often occur in mapping units below 1/4 hectare. Small stands of *Phragmites australis* are found either as pure herbaceous stands or in wet areas in association with *Myrica cerifera*. These communities seem to occur most commonly in disturbed situations along or near the interdunal road especially in the area where the primary dune is maintained.

Salt marsh grasses and brackish shrub ecotones occur in varying widths and composition to the west of the thicket zone along the entire length of the island. High marsh communities often grade into thicket zones forming an ecotonal band composed of *Iva frutescens*, *Baccharis halimifolia* and *Spartina patens*. In areas, which are subject to daily tidal influence, low marsh communities of *Spartina alterniflora* occur, and are best developed in the southern portions of the island and on the small islands in Chincoteague Bay. Within the *Spartina alterniflora* salt marsh communities evaporative pannes containing *Salicornia* spp. are found usually in densities below 40%.

West of the maintained dune along the state park portions of the island, plant communities that occupy the barrier flats and depositional areas (*Myrica* spp. thickets especially) are gradually overtaking the typical interdunal vegetation found closer to the coast.

Summary of Mapping Effort at Assateague Island National Seashore

The following section is a short outline, listed in chronological order, of the vegetation mapping effort at Assateague Island National Seashore. For a detailed description of the tasks listed, refer to sections IV, V, and VI.

- October 1994
  Initial Meeting at Assateague Island National Seashore

- March 1995

Meeting at AIS to discuss the Standard Interpretive Conventions for mapping vegetation layers - development of photointerpretation methodology.

- June 1995
  - Project Set-Up
    - Develop flight line index, photo layout
    - Set-up of photo overlays
    - Delineation of study area boundary
  - Field Reconnaissance
    - Field preparation
    - Visit representative sites from each alliance
    - Keying out photo signature to sites
  - Mapping Criteria
    - Field Notes - photographs - GPS
    - Establish P.I. mapping criteria
    - Develop of P.I. signature key
- June - August 1995
  - Photointerpretation of Vegetation
    - Training key photointerpreters
    - Photointerpretation
    - Refinements to mapping and PI procedures
    - Quality Control
- July 1995
  - Field Verification
    - Field preparation
    - On-site verification of photointerpretation (linework and codes) and "question" polygons
- August 1995
  - Field Revisions
  - NBS/ESRI/TNC/AIS Technical Exchange Meeting at ESRI
  - Summary of Photointerpretation and Mapping at ASIS
- July - August 1996
  - Data Conversion
    - Manuscript map preparation
    - Polygon Label ID
    - Attribute Input
    - Scanning & vectorization
    - Georeferencing and rectification of data

Edit plot QC
Final Processing

- August 1996
  Final Alliance Assignment
    Conversion of photo primitives to alliance classification
    Edit plot QC

- September 1996
  Delivery of Data Files to ESRI

Photointerpretation

The following section describes the tasks performed and methodologies used by AIS during the photointerpretation effort for Assateague Island National Seashore.

Initial Meeting

A two-day meeting was held in late October 1994 at the park headquarters. Its purpose was to bring together the project team members (AIS, TNC, and ESRI personnel) with park personnel and other interested parties to discuss the vegetation mapping program and specific interests of the park. A presentation given by the park personnel described the history of the island, including past disturbances (natural and manmade) and current conditions. A tour of the island was conducted to familiarize the project team members with the existing vegetation types and topography.

During the meeting, the project imagery, basemaps, existing vegetation maps and other pertinent collateral were reviewed and evaluated. The team members discussed possible mapping and field sampling techniques. This included the optimum time to conduct the field efforts, from a photointerpretation and field sampling perspective. The amount of park support, e.g., personnel, transportation, lodging, etc. was also discussed.

Standardized Mapping Procedures Meeting

One of the most important mandates of the Vegetation Mapping Program was the consistent capture and classification of vegetation types through the use of photointerpretation and field sampling methodologies. Because Assateague Island was the first park to be mapped under the Vegetation Inventory Mapping Program, standardized mapping criteria needed to be developed before the project could move forward.

In March 1995, a two-day meeting was held at AIS and ESRI to discuss the Standard Interpretive Conventions for the Vegetation Inventory Mapping Program. Attending was Ralph Root, Maury Nyquist, Gary Waggonner and Mike Story from NBS/TTC, Kathy Goodin and Patrik Bourgeron from TNC, Randy Vaughan and Joe Vieria from ESRI, and Eric Harnden, Deborah Johnson, John Menke, Lisa Cotterman, Edward Reyes and Denise Karavidas from AIS.

At the meeting, AIS gave a presentation describing a multi-layered approach to photo interpreting the vegetation. This technique used a set of basic physiognomic criteria to describe rudimentary aspects of the vegetation based on photo signature and available supplemental information. The vegetative

units would be described by their basic physiognomic and spatial properties (photo primitives). The photo primitives consisted of stature type (tree, shrub or herbaceous), average height, density and floristic composition.

These attributes would be mapped for multiple layers of vegetation, overstory, midstory and understory, when visible on the photo. The tallest life form would be placed in layer one, with the next tallest in layer two, until all life forms had been assigned to the appropriate layer. If a polygon only contained overstory vegetation, with no understory visible, the overstory vegetation would be identified as layer one regardless of the life form.

After further discussion of other mapping options the layered-mapping approach was chosen as the photointerpretation methodology for Assateague Island.

Project Set-up

Upon receipt of the project materials, they were organized and prepared for the mapping effort. Color-infrared (CIR), 1:12,000 scale, stereo-paired imagery dated October 1993 was used for the photointerpretation effort. A flight line index was created, showing the relationship of the photos to the study area. The photos were compared to one another to ensure there were no gaps in the imagery and that there was full coverage of the study area.

A total of 25 photos (non-stereo pairs) were needed to provide full photo coverage of the study area. Each photo was prepared with three mylar overlays; one for the vegetation delineations, one for the floristics codes, and one for the height and density codes. The photo overlays were pin-registered to the photos and labeled appropriately. A photointerpretation boundary was determined for each photo, defining the area of interpretation. These boundaries were drafted onto the photo overlays and edgematched with adjacent photos to ensure full coverage.

Digital orthophoto images of the 1994 CIR's were used as the project base. U.S.G.S. topographic maps had been considered, but they did not reflect the current coastline of the island. The digital images were identical to the hardcopy CIR's used for the photointerpretation effort. A total of nine photo mosaics were used (approximately three photos per mosaic) to cover the entire island. They were corrected for both the x and y coordinates but not the z coordinates, therefore there was no elevational data associated with them.

A digital shoreline of the island, registered to the digital CIR images, had been created by the park service. This shoreline was to be used to define the marine land - water interface of the completed vegetation coverages. The shoreline was joined to the final vegetation coverage during the data conversion process.

Field Reconnaissance

A field reconnaissance visit was conducted in June 1995. The purpose was to familiarize the photointerpreters with the vegetation types and their photo signatures before the actual mapping process. The field crew consisted of John Menke, AIS, Joe Vieria, ESRI, Ashton Berdine, TNC and Lesley Sneddon, TNC.

Before the field reconnaissance, several in-house preparations were made. Each photo was setup with a field reconnaissance mylar overlay. Registration features, e.g., roads and trails were drafted onto the overlays. Each photo was reviewed and field sites were chosen representing different signature types, environmental conditions and topography. The sites were drafted onto the overlays with notations as needed. Multiple sites were chosen to provide alternatives if one or more sites were inaccessible.

The field crew conducted on-site field investigations over a five-day period. During the reconnaissance visit, the photointerpreters worked with the field biologists and park personnel to identify the vegetation species found at the park. The data was annotated directly onto a photo overlay, thereby correlating the field site to a specific location and photo signature. A field notebook was used to record pertinent information, e.g., past disturbances, recent climatic and microclimatic conditions, general topography, etc. Ground photos were taken and referenced back to the aerial photos. Random field sites were input into a Global Positioning System (GPS) database.

Development of Mapping Criteria

Since Assateague Island was the first park mapped for the Vegetation Inventory and Mapping program a standardized program-wide mapping criteria had to be developed. Mapping criteria is a set of documented working decision rules used to facilitate the maintenance of accuracy and consistency of interpretation in the database. They assist the user in understanding the characteristics, definition, and context for each vegetation category.

The mapping criterion for Assateague Island is composed of three parts: the standardized program-wide general mapping criteria, the park specific mapping criteria and the photo signature key. The following is a detailed description of the criteria used during the photointerpretation of the island.

- Photo Signature Key

  The photo signature key (see Attachment A) is an important tool used to maintain consistency of interpretation. It correlates the physical descriptions of the photo signature (color, texture, height, and tone) with the appropriate vegetation type. The key also describes other useful information, i.e., the probable location of the vegetation type, associated landforms, associated vegetation species and probable alliance classes for each signature.

  The photo signature key for Assateague Island was developed after the field reconnaissance visit. The data gathered in the field was analyzed. The photos and field overlays were reviewed and consistent correlations between signature and vegetation types were noted. Upon completion, the signature key was submitted to the TNC field team for comment and review.

- General Mapping Criteria

  The mapping criteria listed below was developed during the Assateague Island mapping effort. The criteria will serve as the standard for future photointerpretation efforts in the

Vegetation Mapping and Inventory program to ensure a consistent standard of mapping on a nationwide basis.

- Stature

  Stature describes the basic life or growth form of the vegetation. The code refers to the broad physiognomic divisions of vegetation.

  - There were three classes of life forms identified during the photointerpretation effort; trees, shrubs and herbaceous. The life form codes are identified by the color Pentel used to code the floristic composition and characteristics on the photo overlays.

    Green Pentel = Trees
    Red Pentel = Shrubs
    Blue Pentel = Herbaceous
    Black Pentel = Land Use/Non-vegetated

  - Trees are defined as single-stemmed woody plants, generally greater than five meters in height except in successional areas where maximum growth has not been attained or where dwarfed by environmental factors.

  - Shrubs are defined as multi-stemmed woody plants, generally under 5 meters in height.

  - •Herbaceous vegetation is defined as plants containing little or no woody portions. This category includes the grasses, other grass-like plants, and forbs.

  - •Trees, shrubs and herbaceous vegetation are coded as separate layers within a mapped unit (polygon).

  - •Vegetation layers are determined by height and life form. Layer one will always be the tallest life form within a polygon, layer two will be the next tallest. If two or more life forms are the same height within a polygon, then trees take precedence over shrubs, shrubs take precedence over herbaceous.

  - •The life form assigned to a species is determined by the life form of the mature plant under optimal environmental conditions. For example, pine seedlings will be mapped as trees, not herbaceous, krummholz pines in subalpine environments will be mapped as trees, not shrubs.

  - •Typically, a life form has to compose at least 5% of the vegetation cover within a polygon before it can be mapped. For instance, if a polygon contains 50% shrub cover, 25% herbaceous cover and 3% tree cover, the trees will not be listed in the height, density or floristic composition characteristics.

- Height

Height describes the average height of the life form in each layer.

- Each layer will be assigned one height category, except as noted below.
- If height differences between the same life form does not skip an entire height class category, then the height category for each layer will be determined by the average (not the mean) height of the vegetation for that layer. To determine the average height of the vegetation, determine which percentage of the vegetation is at what height. If 10% of the trees are 100' tall and 50% are 120' tall, then they will fall into a height class category of 6 (35-50m). If 80% of the trees are 100' tall and 20% are 120' tall, then the height category assigned to the polygon will be a 5 (15-35 m).
- The same species will be mapped as a single layer within a polygon regardless of height differences between them. For instance, if a polygon contains Pinus palustris seedlings <.5m tall and mature P. palustris trees 30 m tall, they will be mapped as one layer. Within the layer, the dominant cover type will determine the height assignment, i.e., if the 30m tall trees compose >50% of the tree cover, then the height code for the trees will be 30m.

- Density

Density refers to the spacing of plants in the landscape. It represents the total coverage based on the percentage of crown or canopy cover. This figure is a qualitative estimate based on the aerial photography. Two methods are used to determine densities from aerial photographs; Absolute and Relative (Continual) Density. Absolute density refers to the sum total of the visible plant and non-vegetative cover within a given mapping unit. The total density cover for all visible over-, mid-, and understory vegetated and non-vegetated surfaces must equal 100% present. The unvegetated areas are not delineated unless they can be delineated at the project minimum mapping unit (mmu). Vegetation not visible on the aerial photograph is not considered as part of the total plant density. For example; in a closed canopy forest the understory grasses and shrubs are not visible, therefore only the tree overstory is visible and the density code is based on the total tree cover present.

Relative density is used when the aerial photography allows the interpreter to see the understory vegetation due to the environmental conditions at the time of the photography or when detailed field notes are available. When mapping relative density, it is possible to arrive at total vegetation cover percentages well over 100%. For example; using winter photography to capture leaf-off conditions, a closed-canopy deciduous forest (over 60% crown cover) is visible along with the shrub and grass understories. In addition to the 60-100% tree cover, shrub and grass understory may make up an additional 60-100% understory cover, totaling at least 120% vegetation cover for that mapping unit.

Absolute crown density is normally the most accurate way of estimating plant coverage and will be used to determine the percentage of vegetation cover within a polygon unless noted otherwise in the park specific mapping criteria. In certain park specific situations where

understory needs to be mapped, relative density estimates will be addressed if there is sufficient data. At the very least, aerial photography showing leaf-off conditions is necessary when mapping relative crown density.

- Closed/Continuous >60% = Canopies overlapping, touching or nearly touching in most of the mapping unit.
- Discontinuous 40%-60% = Canopies rarely touching, however spacing is fairly minimal, especially when plants are not evenly distributed throughout the polygon.
- Dispersed 25%-40% = An open or parkland situation where large spaces occur between trees and shrubs, or where grasses are fairly sparse throughout the mapping unit.
- Sparse 10%-25% = Trees or shrubs are widely spaced scattered throughout the polygon, or are clumped in very small areas making up a small percentage of the entire vegetative cover.
- Rare 2%-10% = Trees or shrubs occur only occasionally and usually do not make up enough percentage to be considered evenly dispersed. Grasses coverage at this level is hard to detect on small scale aerial photography.
- To determine the absolute density, assign percentages to the different life forms visible on the aerial photo, including non-vegetated areas. The total percent cover of trees, shrubs, herbaceous and non-vegetated should add up to 100%. Convert the absolute density percentages into the appropriate density class.
- Non-vegetated areas are not coded in the database unless they meet the minimum mapping resolution for the park and can be mapped as a stand-alone polygon. Otherwise, it is assumed that all vegetation polygons contain non-vegetated areas.
- Consider the coverage pattern of the vegetation before assigning a density code to the polygon. Estimating densities is more straightforward when plants occupying a particular stratum are evenly distributed throughout the mapping unit. However when polygons contain populations of plants that are clumped or occurring only in portions of the polygon, the photointerpreter must consider the area not occupied by plant cover when determining coverage density. To insure consistency, it is helpful to count the plants in polygons with clumped and unevenly distributed vegetation and then compare them to similar sized polygons with an even distribution of plant cover.
- The vegetation stature type and scale of the aerial photography will determine the visibility of individual plants. Trees are usually visible as individuals and with larger scale photography so are shrubs. However, grasses are rarely seen as individual plants, regardless of the scale of the photography.

- The date of the aerial photography will also influence the densities assigned to vegetation types, especially herbaceous species. Subsequent field verification must take into consideration the following factors that can cause seeming discrepancies between the densities listed on the photo and those visible in the field.

- Seasonality - the density of most herbaceous plants is variable due to their annual growth cycle. Depending on the season the aerial photography was taken, a mapped unit could show a different density on the aerial photographs than is observed during an on-site visit at a different time of the year.

- Different years - Depending on the environmental conditions at the time of the photography (wet vs. drought years, flooding, etc.) a mapped unit could show a different density than is observed during the on-site field visits.

- Dry grasses tend to be less dense than they appear on the aerial photographs. To accurately depict the densities, the percent cover for dry grasses should be adjusted downward. This means that if the percent cover falls at the lower end of a density category, the polygon should be assigned the next density class down. For example, if the percent cover = 25%, the polygon should be assigned a density code of 4 (10-25%) instead of 3 (25-40%). If the percent cover falls within the middle of a density category, the polygon should be assigned that density class, i.e., the percent cover = 35%, the polygon is assigned a code of 3.

- Floristic Composition

  Floristic composition refers to the most detailed taxonomic name assigned to the vegetation photo signature.

  - A floristics list is developed for every park. This list consists of floristic composition that can be identified through photointerpretation techniques. It does not represent the complete listing of all vegetation species found at that park.

  - Up to three floristic designations per layer can be coded into the database.

  - The floristic characteristics are listed using the same order and color codes as the life forms contained within the polygon. If a polygon contains trees, shrubs and grass, the tree floristics are listed first in green Pentel, then shrubs in red Pentel, and finally herbaceous in blue Pentel. Within each life form, the dominant floristic type is listed first, then the next dominant, etc.

  - The most detailed floristic designation should be used whenever possible. If a species does not have an identifiable photo signature, the next level of detail can be used. Generic descriptions such as dry graminoid, shrubs, etc., should only be used when a more specific identification is impossible.

- Aggregation

  Aggregation of multiple vegetative classes is necessary when below minimum mapping unit (mmu) vegetation types are present within a polygon.

  - Like life forms should be aggregated together; trees should be aggregated with other trees, shrubs with shrubs and herbaceous with herbaceous vegetation types.

  - Wet vegetation types should be aggregated with other wet vegetation types, regardless of life form class. For example, on Assateague Island, *Baccharis halimifolia* and *Iva frutescens* sometimes form a below mmu band of vegetation between the marsh grasses and the *Myrica* spp. shrub thicket. Since *Baccharis halimifolia and Iva frutescens* are wet vegetation type, they were aggregated into the marsh grasses rather than the *Myrica* spp. shrub thicket.

  - If a below mmu is completely surrounded by another vegetation type, form class, the below mmu is aggregated with the surrounding vegetation.

- Park Specific Mapping Criteria

  The park specific mapping criteria addressed items of specific interest to the park that were not covered under the general mapping criteria.

  - The minimum mapping unit (mmu) was established at 1/4 hectare. (The program standard is usually 1/2 hectare).

  - The mapping scale at Assateague Island was 1:12,000.

  - After analyzing the field data, a general correlation could be made between island topography and vegetation types. As a result, the island was broken down into nine unique physiographic areas with a description of the typical vegetation types for each area. The regions are listed below:

    - North (overwash area) - Bay Side
    - North (overwash area) - Interdunal
    - North (overwash area) - Beach
    - Mid (maintained primary dune) - Bay Side
    - Mid (maintained primary dune) - Interdunal
    - Mid (Maintained primary dune) - Beach
    - South (non-maintained primary dune) - Bay Side
    - South (non-maintained primary dune) - Interdunal
    - South (non-maintained primary dune) - Beach

  - *Hudsonia tomentosa* - Park personnel were very interested in the location of *Hudsonia tomentosa* areas. Therefore, the 1/4 hectare mmu was disregarded and *Hudsonia*

tomentosa was mapped wherever it occurred as a mappable unit, i.e., large enough to be represented by a polygon.

- *Ammophila breviligulata* - This species of grass is an important component in the stabilization of the sand dunes. The fall photography that was used during the photointerpretation effort did not show a signature for *Ammophila breviligulata* but according to the park personnel, it is always present on the primary dunes. The primary dunes were visible under stereo viewing of the imagery; therefore the *Ammophila breviligulata* was mapped in those locations. Every attempt was made to create a reasonable polygon to capture this vegetation type.

- *Phragmites australis* - *Phragmites australis* is an invasive exotic grass that is considered a pest at the park. In order to facilitate the parks efforts to control the grass, they wanted to know everywhere it occurred. Therefore, *Phragmites australis* was listed in the floristic composition category wherever it was observed, even if it did not meet the minimum 5% cover requirement. This should be taken into consideration when doing the crosswalk from the photo primitives to the National Classification. The density classes and order of floristic listing is very important in order to accurately assign the correct alliance class.

Photointerpretation of Vegetation

Photointerpretation is the process of identifying map units based on their photo signature. All land cover features have a photo signature. These signatures are defined by color, texture, pattern, and tone on the aerial photography. By observing the context and extent of the photo signatures associated with specific vegetation types, the photointerpreter is able to identify and delineate the boundaries of the vegetation. Additional collateral sources, e.g., existing vegetation maps, supplemental photography, soil data, etc., can be of great utility to the photointerpreter. Understanding the relationship between the vegetation and the context in which they appear is very useful in the interpretation process. Familiarity with regional differences also helps interpretation by establishing a context for a specific area.

Before the actual photointerpretation effort, a number of in-house meetings were held to familiarize the key interpreters with the island. The findings of the field reconnaissance trip, mapping criteria, photo signature key, and the P.I. methodology were discussed. Three photos, representative of different areas on the island, were mapped and reviewed. Refinements to the methodology and criteria made as necessary.

Once the initial photos had been interpreted and reviewed, the P.I. effort went into production mode. The vegetation was mapped using the Layer Mapping methodology. The stereo-paired CIR diapositives were viewed through a stereoscope and the vegetation boundaries were drafted onto a mylar photo overlay. The codes for each polygon were written on separate overlays; one for the height and density codes, another for the floristic composition codes. If there were multiple layers of vegetation present within a polygon (overstory, midstory, understory), height, density and floristic composition codes were assigned for each layer. Attribute assignments were based on the mapping

criteria and photo signature key descriptions. To further ensure consistency of the photointerpretations, the interpreters worked as a team, reviewing each other's work and discussing mapping and criteria questions. Refinements to the methodology and criteria were made as necessary.

Each photo was edgematched to the adjacent photos to ensure a seamless coverage in the database. Delineations and codes were compared and discrepancies between photos were resolved and corrected on the appropriate mylar overlays. Any uncertain interpretations were flagged on the mylar overlay for review during the quality control task.

Quality Control of Photointerpretations

A separate quality control step was performed for each photo upon completion of the photointerpretation. The photos and their delineation and code attribute overlays were given to senior interpreters for review and comment. The interpreted overlays were checked for completeness, consistency, and adherence to the mapping criteria and guidelines. For those polygons flagged by the photointerpreter, the reviewer either assigned the appropriate vegetation code or left the polygon flagged for field verification.

Field Verification

The purpose of the field verification visit was to answer questions raised during the photointerpretation process and to verify the overall accuracy of the interpretations (This should not be confused with the accuracy assessment. That is a separate task). The verification effort served as a final quality control measure to ensure the data was as error free as possible.

The field verification trip occurred in July 1995. John Menke, AIS, working with Lesley Sneddon and Ashton Berdine, TNC, conducted on-site visits to map units flagged during the photointerpretation effort. Random sites were also checked to verify the accuracy of the photointerpretations. Field notes and revisions to the data were made directly to the photo overlays.

Field Revisions

Any revisions to the data as a result of the field verification effort were made during this task. This included changes in the delineations, e.g., aggregation or further division of mapped units, or attribute assignment. Changes were made directly on the photo overlay. After the revisions were completed, the photos were edgematched for linework and codes to ensure a seamless data coverage.

Technical Exchange Meeting

A technical exchange meeting was held at ESRI on August 1995. The purpose of the meeting was to review the Assateague mapping and discuss how to proceed with the data conversion effort. Attending were Maury Nyquist, Ralph Root, Mike Story and Gary Waggonner, NBS/TTC, Randy Vaughan and Anthony Curtis, ESRI, Eric Harnden, Debbie Johnson, John Menke, AIS, and Dennis Grossman, Lesley Sneddon, TNC. The process of converting the photo primitives to the national standard was discussed. AIS gave a presentation demonstrating the proposed data conversion procedure.

Data Conversion

Converting the vegetation delineations to a digital format involved several steps that fall within four main procedures. The first step was the preparation of manuscript maps and attribute code files. The second was the input of the spatial data or geographic locations of the mapped features. The third was the populating of the attribute tables or the information that describes the geographic features. Finally the fourth procedure involved making the data usable for analysis within the GIS. The following are descriptions of the broad tasks that apply to the data conversion of vegetation for Assateague Island National Seashore.

Manuscript Map Preparation

The manuscript maps were used to input the spatial component of the vegetation mapping units. A manuscript map suitable for automation was created for each photo. These manuscript maps were produced by pin-registering a clean sheet of mylar to each photo. The vegetation delineations were transferred to the new overlay in ink. The manuscript maps were carefully edited to ensure completeness and correctness. The editing included comparing the manuscripts with the original delineations on the aerial photos. Each manuscript map was edgematched to the adjoining sheet assuring a seamless data flow across photo boundaries. Edgematching included both spatial configuration and location, as well as attribute assignment.

Quality Assurance of The Manuscript Map

All final manuscript maps underwent a quality assurance review. The manuscript maps were compared to their corresponding photo overlays to ensure that all line-work had been transferred correctly. Particular attention was given to the quality of the line delineations with respect to gaps and other irregularities.

Sequence Number Assignment

A sequential identification number overlay was produced for each photo containing the labels for every polygon represented on the manuscript map. The identification number labels were used to tie the spatial file represented by the manuscript map to the keypunched attribute file. A clean sheet of mylar was pin-registered to each manuscript map, and the polygons were numbered in sequence. This was repeated for each photo in the study area.

Polygon Attribute Encoding

To expedite the encoding of the vegetation attributes for each polygon, two Quattro Pro files were created for each photo containing a field each for the photo number, polygon sequence number, land use code, layer number, stature type, height, density, and floristic composition attributes. The manuscript map, sequence number overlay and attribute overlay were pin-registered together and laid on a light table. The coder, following the numbers on the sequence number overlay, entered the vegetation attributes for each polygon. During this task the coder also conducted quality assurance on the numbering done earlier. Any errors found on the sequence number overlay were corrected at this time ensuring that each polygon had a unique identifier.

Under normal circumstances, the next step would be the joining of the attribute and spatial data together in the computer and the production of edit check plots, to QC the accuracy of the attribute

input. However, due to the small size of the polygons and the large amount of data an alternative method of QC, double key-entering, was used. The attributes were key-entered again for each photo into a separate set of files. The original master file for each photo was digitally compared to the second file, item by item, and any discrepancies between the two were listed on a spreadsheet. The discrepancies were resolved by reviewing the original photo overlays and the appropriate corrections were made to the spreadsheet. The corrections were then entered into the master file. This was repeated for each photo in the study area.

Spatial Data Input/Scanning

The manuscript maps were scanned and converted into ARC/INFO coverages (a single coverage for each photo) at ESRI. Prior to any production scanning, test scans of small areas of the data maps were conducted to determine the optimum raster to vector conversion settings. The critical settings that determine the output resolution and completeness are the TOLERANCE and THRESHOLD. The TOLERANCE, which governs the output resolution and is comparable to fuzzy tolerance, would be set to .01 inches (10 feet at 1:12,000 scale). The THRESHOLD is a reflectance measure. It is dependent on the physical characteristics of the data maps and their contents and would be determined through testing. Once the THRESHOLD was derived, production scanning of all manuscript maps began.

Assigning Polygon Identifiers

The vegetation polygons were assigned a unique identifier for each manuscript map. These numbers were sequenced 1 through "n" (4-digit item width) and drawn on a sequence number overlay sheet registered to the manuscript. These two sheets were registered together and placed on the digitizing board. The polygon identifiers were sequentially input as label points. To ensure that all labels were placed, the processor marked off each label as it was digitized.

Delineation and Label I.D. Edit Plot Quality Assurance

ESRI produced plots of the converted data and sequence numbers (label I.D.s) for each photo. The plots were delivered to AIS where they were reviewed. The plots were checked for cartographic quality of the arcs defining the polygon features and the accuracy of the label I.D. assignments. The plots were overlaid to the manuscript maps to verify that the scanned data was not distorted beyond .02 map inches. Other problems were noted on the plots, such as overshoots and undershoots, missing lines and premature convergence of polygon boundary lines that intersected arcs at acute angles and incorrect sequence number assignments.

The corrected plots were delivered back to ESRI. Processors conducted interactive ARCEDIT sessions to make the necessary corrections to the coverages.

Creation of Topology

Topology is the mathematical procedure for explicitly defining spatial relationships. In the case of maps, topology defines connections between features, identifies adjacent polygons, and can define one feature such as an area, as a set of other feature types (i.e., lines). A topological database has several advantages: efficient data storage, faster processing, and the ability to perform analysis, such as modeling transportation networks or overlaying geographic features on one another.

Once the manuscript map's polygon boundaries and label points had been input into the computer, the ARC/INFO software CLEAN command was used to create the "coverage topology." The CLEAN fuzzy tolerance was set to .002 inches to preserve the required data resolution. When other coordinate edits were made to a coverage after the CLEAN command was run, topology was recreated utilizing the BUILD command.

Label Entry Error Processing

Label errors were identified by using the LABELERRORS command in ARC through an ARCEDIT session. Any label errors identified were corrected by entering the missing label number and placing it within the correct polygon. Once all the errors were corrected, the coverage was ready for the polygon rectification process.

Georeferencing and Digital Registration of Data

The georeferenceing and digital registration of the data was a multi-step process. The data had to be transformed into real world coordinates and the data had to be adjusted to fit the orthophoto image. These steps were all performed digitally using ARCEDIT.

Conversion to "Real-World" Coordinates

This task involved the transformation of the database from "digitizer inches" into "real world" coordinates. The initial vector file contained coordinates stored as digitizer inches that do not allow the data to be used effectively. To utilize geographic data, it must be converted into a common coordinate system. The coordinate system used was the Universal Transverse Mercator (UTM), Zone 18, NAD83 Coordinate System. All coordinates were in meter units.

The first step was the creation of a master tick file, linking features on the orthophoto to the same features in the delineation coverages. Wherever possible, easily identified points were chosen to ensure a more accurate transformation. Four to six points were chosen per coverage and labeled with a tick number I.D. The points were then transformed into real world coordinates, x and y values only (the orthophotos did not have a z value).

Compare Transformed Delineation Coverages to Digital Image

The transformed coverages were then compared to the digital orthophotos. Digital rectification had been chosen instead of manual rectification because it was assumed that a minimal amount of adjustment would need to be performed once the coverages were transformed. This was based on the fact that the photointerpretations were created from the same images as the digital orthophotos. Also, the island had very little elevational change.

However, upon comparison of the transformed coverages to the orthophoto, it was apparent that the data did not fit the image well. Although the island was flat, distortions on the photo due to distance from the nadir could have created some problems. In addition, there were also some minor problems with the digital image; gaps in the data, overlaps in the data, mismatches between mosaicked photos, and improper color balance between images.

As a result, interactive ARCEDIT sessions were conducted to register the data to the digital image. These sessions were composed of several adjustment steps, described below.

Coarse Adjustment

The first series of ARCEDIT sessions consisted of coarse adjustments. Coarse adjustments are used to register data over large areas. For Assateague, this step was performed on a coverage- wide basis. On-screen, a series of links (80 - 100 links per photo) between the delineations and the orthophoto were created. The ADJUST command was performed and the linework for the entire coverage was adjusted. The coarse adjust corrected some of the registration problems but more local adjustments were still required.

Local Adjustment

The second series of ARCEDIT sessions were the local adjusts. This adjustment was performed over a smaller area and was used to fine tune the registration of the data to the digital orthophoto. A window was created on-screen and enlarged for a selected area. As with the coarse adjust, a number of links were created. A LIMITADJUSTBOX was then defined encompassing all of the links. The ADJUST command was performed and the linework within the defined area was adjusted. This was repeated as necessary across the entire coverage. Although this step greatly improved the rectification of the linework to the digital orthophoto there were still areas requiring further adjustment.

Specific Adjustment

The third ARCEDIT session was the specific adjust. The data was again compared to the orthophoto image on a polygon-by-polygon basis. Special attention was given to obvious feature boundaries such as land use/vegetation and land/water interfaces. If necessary a specific adjust was performed. The vertices of the line segments were modified (moved, added, or deleted) until the linework conformed to the orthophoto image. In some instances, entire line segments were deleted and redigitized on-screen. This process was repeated until all of the coverages were completed.

Joining of Attribute and Spatial Data

The Quattro Pro code files were converted into INFO files. Once converted they were related to the feature attribute table, by the sequence number found in both files. An INFO item, named "sequence number" was added to the feature attribute table. The sequence number for each polygon was calculated to equal its coverage I.D. number. The ARC/INFO command JOINITEM was used to join the code file to the feature attribute table. Each spreadsheet file was joined with its corresponding coverage. Each variable interpreted off the aerial photography was assigned a unique Item (field). A total of 25 coverages were created.

Code Verification

Code verification involved running each coverage attribute file through a series of ARC/INFO commands that checked for invalid codes. These commands produced listings that aided in identifying abnormal codes. The errors that were checked against the vegetation delineation and attribute overlays. Corrections were made to the listings and input into the database.

Edgematching

Since the study area was composed of multiple photos/coverages, the coverages needed to be coordinate edgematched to ensure seamless line coverage across photo boundaries. The 25 coverages

were edgematched using procedures in the ARC editor linking the nodes from one coverage to the nodes of the adjoining coverage. Adjustments were made when necessary. This procedure was done with the digital orthophoto as a backdrop to the vegetation delineations.

Coastline Clip and Elimination of Sliver Polygons

NPS personnel created a digital map of the Assateague Island coastline from the orthophoto imagery that was then converted to an ARC/INFO coverage. The coastline coverage was used as the definitive marine land/water interface. The shoreline coverage was digitally compared to the vegetation coverage. A program was run that "clipped out" areas that were mapped beyond the digital shoreline coverage. During the photointerpretation process, a pseudoboundary was created for marine land/water boundaries. However, due to differences between the NPS and AIS definition of the marine land/water interface there were some discrepancies in the interpretation. As a result, the joined coverages were reviewed for label errors, sliver polygons, and missing vegetation interpretations. Corrections were made directly to the digital files.

Conversion of Photo Primitives to the National Classification

The final product for the Assateague Island mapping effort was an alliance/association vegetation map of the study area. A number of steps were required to convert the vegetation photo primitive codes in the database to the alliance/association classification.

Development of Photo Primitive - Alliance Classification Crosswalk Key Table

The first step in the code conversion process was the creation of a crosswalk table (see attachment B) linking the photo primitive codes (stature, height, density, floristic composition) to the appropriate alliance/association class. The November 1995 version of the Vegetation Classification of Assateague Island National Seashore was reviewed and correlations between the photo primitives and alliance/association classes were noted.

The crosswalk table listed each alliance and the photo primitive code combination(s) associated with it. For each alliance/association class there was at least one combination of photo primitive codes associated with it. When multiple permutations were appropriate, they were listed under the same alliance heading.

Refer to the Assateague Island National Seashore Preliminary Data Information Report (see attachment C) for a detailed description of the height, density and floristic composition codes listed in the table.

Assignment of Alliance/Association Classes

The assignment of alliance/association classes to the vegetation polygons in the database was an iterative process. The database was queried and polygons were selected based on criteria established in the crosswalk table. The selected polygons were then reviewed against the digital orthophoto image to verify the accuracy of the crosswalk table criteria. Adjustments to the criteria were made as needed throughout the alliance assignment process.

After development of the crosswalk table, the vegetation coverage was brought up in an ARCEDIT session with the digital imagery in the background. The first iteration involved selecting polygons

based on the most definable characteristics of the alliance class and correlating them to the photo primitive attributes for Layer 1. For example; the first iteration to select polygons for a *Pinus taeda* Woodland Alliance was defined as follows: Stature = trees, Density = 40-60%, and Floristic Composition = *Pinus taeda*. This set of selected polygons were reviewed against the photo image to check the accuracy of the query.

If necessary, multiple queries were performed until all possible permutations for a given alliance were defined. These queries focused on subtle characteristics of the alliance/ association class, i.e., ecotonal influences, understory vegetation types, density of vegetation, etc. For example; a second query for the *Pinus taeda* Woodland would include the following characteristics:

Layer 1 Stature = trees
Layer 1 Density = 25-40%
Layer 1 Floristics = *Pinus taeda*
Layer 2 Stature = shrubs
Layer 2 Density = 10-25%
Layer 2 Floristics = *Hudsonia tomentosa*

After each query the selected polygons were reviewed on-screen. Once the queries were completed, the final set of polygons were assigned the appropriate alliance/association class. These steps were repeated for each alliance category; up to six iterations were necessary among alliances where boundaries were not well defined.

Once the crosswalk between the photo primitive codes and the alliance classes were completed for the entire coverage, a final alliance plot was created. The plot was compared back to the original CIR photos and photo overlays and reviewed for accuracy and consistency of alliance class assignments. Corrections to the alliance assignments were made to the database. The final coverage was delivered to ESRI for input into the final project database structure.

Attachment A.

Table A-1. National Biological Service / National Park Service Vegetation Inventory and Mapping Program Photointerpretive Signature Key - Assateague National Seashore.

NATIONAL BIOLOGICAL SERVICE/NATIONAL PARK SERVICE VEGETATION INVENTORY AND MAPPING PROGRAM PHOTOINTERPRETIVE SIGNATURE KEY - ASSATEAGUE NATIONAL SEASHORE								
TAXA	**STATURE**	**PHOTO SIGNATURE (10-93) (1:12,000 CIR)**	**LANDFORM/ CONTEXT**	**HEIGHT**	**OCCURRENCE**	**ASSOCIATED TAXA**	**ALLIANCE/ COMMUNITY ELEMENT**	**SPECIAL CONSIDERATIONS**
Acer rubrum	tree	OLOR - bright red CROWN SIZE - medium CROWN SHAPE - narrow TEXTURE - smooth	Wetland forests & thicket zone	15-25 m	Uncommon, usually restricted to stands of 3 or 4 trees	*Pinus taeda*	*Pinus taeda* (Wetland Forest Alliance)	
Algae	non vascular	COLOR - purple (varying hues) CROWN SIZE - N/A CROWN SHAPE - N/A TEXTURE - smooth	Mudflats - tidal areas	N/A	On shallow mudflats below the *S. alterniflora* marsh	*Spartina alterniflora*	Mixed fines	
Ammophila breviligulata	grass	COLOR - light grey - faint; at times not visible CROWN SIZE -N/A CROWN SHAPE - N/A TEXTURE - smooth	Primary dune	.2 - 1 m	Common on both the maintained and remnant primary dune	*Solidago sempervirens* Dry graminoids	*Ammophila breviligulata* Herbaceous Alliance	Densities are often too low to accurately delineate
Pinus taeda	tree	COLOR - pink to reddish pink (variability due in part to irregularities in the photo emulsion) CROWN SIZE - narrow (forest) broad (woodland) CROWN SHAPE - round TEXTURE - mottled (especially in lower densities)	Upland and wetland areas between Entertain and basad wetlands	2 - 30 m	Largest stands established on the widest sections of the island in the southern portions; less common in the north	*Myrica cerifera* (wet) vine species (dry) *Hudsonia tomentosa* (open stands)	*Pinus taeda* Wetland Forest Alliance *Pinus taeda - Q. (nigra, falcate*) Forest Alliance *Pinus taeda* Woodland Alliance	Note: Crown size depends primarily on density; open stands have broader crowns
Prunus serotine / Amelanchier canadensis	tree	COLOR - pink CROWN SIZE - medium (larger than M. cerifera) CROWN SHAPE - irregular TEXTURE - smooth	Forest and thicket edges and less frequently on open sand	3 - 6 m	Uncommon, usually occurring in small patchy units; more widespread in middle portions of the island	*Myrica cerifera* (thicket areas) Upland grasses *& H. tomentosa* (dry areas - usually *P. serotina*)	*Prunus serotina - Amelanchier canadensis - Quercus spp.* Forest Alliance	Signature can at times be confused with *P. taeda*- most units are either substantiated with field notes or mapped with a higher reliance on location
Quercus falcate	Tree	COLOR - red CROWN SIZE -large CROWN SHAPE - rounded TEXTURE - smooth	Upland areas in association with P. taeda woodlands	4 - 25 m	Isolated trees only	*Pinus taeda* forests - usually in more open stands.	*Pinus taeda - Quercus (nigra, falcate)* Forest Alliance	
Baccharis halimifolia	shrub	COLOR - pink - light pink CROWN SIZE - small CROWN SHAPE - narrow - compact TEXTURE - rough - grainy	Wet depressions in the entertain; transitional between thicket & Iva zones on the basad	1 - 2 m	Common in entertain and bay; pure stands are rare	*Myrica cerifera* & wet grasses (*S. patens*) in entertain; *Iva frutescens* in bay side	*Myrica cerifera - Baccharis halimifolia/S. patens* Shrubland Alliance *Baccharis halimifolia - Iva frutescens/S. patens* Shrubland Alliance	In interdunal areas this species can be extremely sparse in association with wet grasses
Hudsonia tomentosa	shrub (dwarf shrub)	COLOR - dark grey - brown CROWN SIZE - very small CROWN SHAPE - round TEXTURE - grainy; contrast with sand is high	Primarily in entertain area on sandy substrates	<.5 m	Common; localized to areas of sand (usually dunes); occasionally associated with *P. taeda* woodlands	*Myrica pensylvanica* Upland grasses Vine species *Pinus taeda*	*Hudsonia tomentosa* Dwarf Shrubland Alliance *Myrica pensylvanica/ Schizachyrium scoparium* Sparse Shrubland Alliance *Pinus taeda* Woodland Alliance	This alliance frequently complexes with the *M. pensylvanica/S. scoparium* sparse shrubland

NATIONAL BIOLOGICAL SERVICE/NATIONAL PARK SERVICE
VEGETATION INVENTORY AND MAPPING PROGRAM
PHOTOINTERPRETIVE SIGNATURE KEY - ASSATEAGUE NATIONAL SEASHORE

TAXA	STATURE	PHOTO SIGNATURE (10-93) (1:12,000 CIR)	LANDFORM/ CONTEXT	HEIGHT	OCCURRENCE	ASSOCIATED TAXA	ALLIANCE/ COMMUNITY ELEMENT	SPECIAL CONSIDERATIONS
Iva frutescens	shrub	COLOR - purple - light purple CROWN SIZE - small CROWN SHAPE - compact TEXTURE - smooth	Transitional areas between high *S. patens* marshlands and *Myrica* thicket zones	.5 - 1.5 m	Common as an ecotonal region; often quite narrow	*Baccharis halimifolia* *Spartina patens*	*Baccharis halimifolia - Iva frutescens/Spartina patens* Shrubland Alliance	Often complexes with S. patens marsh on the lower ends and *Myrica* thicket on the upland side
Myrica pensylvanica	shrub	COLOR - bright red - contrasts with sandy substrate CROWN SIZE - rather large CROWN SHAPE - spreading TEXTURE - smooth	Entertain areas and remnant primary dune areas	.5 - 1.5 m	Common in the entertain areas east of the road. Species abundance not established where it occurs with *Myrica cerifera*	*Myrica cerifera* *Hudsonia tomentosa* *Ammophila breviligulata* Dry grasses	*Myrica pensylvanica - Schizachyrium scoparium* Sparse Shrubland Alliance *Myrica pensylvanica - (Prunus maritima*) Shrubland Alliance	This species is only listed where it is known to occur in the absence of *M. cerifera*
Myrica species	shrub	COLOR - bright red CROWN SIZE - variable; depending on density CROWN SHAPE - variable; depending on density TEXTURE - smooth	Thicket zones west of interdunal areas	1 - 5 m	Used where both species (+hybrids) occur - common in the thicket areas and as understories to *P. taeda*	*Pinus taeda* (understory to) *Baccharis halimifolia* *Spartina patens*	*Myrica cerifera - Baccharis Halimifolia* Shrubland Alliance *Myrica cerifera* (wet) Shrubland Alliance	All thicket zones on the island are coded as *Myrica* species
Vaccinium corymbosum	shrub	COLOR - red-orange CROWN SIZE - small CROWN SHAPE - round TEXTURE - grainy	Interdunal swales and wet depressions	1 - 2 m	Restricted to shrub bogs in the interdunal area	*Myrica cerifera* wet grasses	*Myrica (cerifera, pensylvanica*) - *Vaccinium Corymbosum* (wet) Shrubland Alliance	Mapped units are quite small and are usually restricted to swales surrounded by dry sandy areas
Vine species	shrub (vines & shrubs)	COLOR - bright red (forest understory); brown (interdunal areas) CROWN SIZE - variable CROWN SHAPE - spreading & irregular TEXTURE - mottled	As understory to *P.* taeda forest and on dry interdunal areas	1 - 2 m (except where it climbs)	common in dry areas and in *P. taeda* forests	*Myrica species* *Pinus taeda* Dry grasses *Hudsonia tomentosa*	*Smilax* spp. - *Toxicodendron radicans* Shrubland Alliance *Myrica pensylvanica - Schizachyrium scoparium* Sparse Shrubland Alliance	This category is listed often in dry interdunal areas of sparse shrubs and grasses
Graminoids (dry)	herb	COLOR - light brown - light grey CROWN SIZE - N/A CROWN SHAPE - N/A TEXTURE - often mottled	Dry Interdunal areas	<.5 m	Common in entertain; usually sparse - often with sparse shrub overstory	*Myrica pensylvanica* *Hudsonia tomentosa*	*Myrica pensylvanica - Schizachyrium scoparium* Sparse Shrubland Alliance *Hudsonia tomentosa* Dwarf Shrubland Alliance	Used often in upland areas where grasses cannot be assigned species based on landform or signature
Graminoids (wet)	herb	COLOR - dark brown - reddish CROWN SIZE - N/A CROWN SHAPE - N/A TEXTURE - smooth; (mottled where terrain is complex)	Interdunal areas in depressions and swales	.2 - 1 m	Common in interdunal swales where it forms a dense ground cover	*Scirpus pungens* *Spartina patens* other Cyperaceae species	*Juncus dichotomus* Herbaceous Alliance *Panicum virgatum* (seasonally flooded) Herbaceous Alliance *Scirpus pungens* (seasonally flooded) Herbaceous Alliance	Used often in swales where grasses cannot be assigned species based on landform or signature
Juncus roemerianus	herb	COLOR - dark brown - black CROWN SIZE - N/A CROWN SHAPE - N/A TEXTURE - smooth with definitive edge	Salt marsh areas - toward the higher margins	1 - 2 m	Fairly common; usually in small isolated stands especially in the northern portions of the island	*Spartina patens*	*Juncus roemerianus* Herbaceous Alliance	Signature is quite distinct; except in incidences where it occurs with S. patens
Phragmites australis	herb	COLOR - pink- white CROWN SIZE - N/A CROWN SHAPE - N/A TEXTURE - stippling - grainy	Interdunal areas - disturbed sites, road edges and thickets	1 - 5 m	Common, either in pure stands or in association with thicket shrubs	*Myrica cerifera*	*Phragmites australis* Herbaceous Alliance	Stipple pattern in signature is quite evident; when complexing with shrub layer, it is often as tall as surrounding shrubs

NATIONAL BIOLOGICAL SERVICE/NATIONAL PARK SERVICE
VEGETATION INVENTORY AND MAPPING PROGRAM
PHOTOINTERPRETIVE SIGNATURE KEY - ASSATEAGUE NATIONAL SEASHORE

TAXA	STATURE	PHOTO SIGNATURE (10-93) (1:12,000 CIR)	LANDFORM/ CONTEXT	HEIGHT	OCCURRENCE	ASSOCIATED TAXA	ALLIANCE/ COMMUNITY ELEMENT	SPECIAL CONSIDERATIONS
Spartina alterniflora	herb	COLOR - Highly variable (brown - red) CROWN SIZE - N/A CROWN SHAPE - N/A TEXTURE - Mottled in sparse stands; smooth in dense stands	Lower salt marsh community	.2 - 1 m	Common in the bay side of the island	*Spartina patens* *Salicornia spp.* graminoids (wet)	*Spartina alterniflora* Herbaceous Alliance	Ecotonal areas often complex with other alliances (*S. patens* in particular)
Salicornia spp.	herb (forb)	COLOR - reddish orange CROWN SIZE - N/A CROWN SHAPE - N/A TEXTURE - highly mottled; density is highly variable	Salt pannes - areas of saline accumulation	<.5	Fairly common in the mudflats; usually within the *S. alterniflora* marsh	*Distichlis spicata* *Spartina alterniflora*	*Salicornia* - *Spartina alterniflora* Herbaceous Alliance	Signatures vary considerably due to densities in vegetation
Scirpus pungens	herb	COLOR - dark brown (wet) light pink (overwash) CROWN SIZE - N/A CROWN SHAPE - N/A TEXTURE - Smooth	Interdunal swales, brackish wetlands in forest openings & overwash zones	<.5	Uncommon in interdunal freshwater swales; more commonly associated with *S. patens* brackish conditions.	*Spartina patens* graminoids (wet) other *Cyperaceae* species	*Spartina patens - Scirpus pungens* Herbaceous Alliance *Scirpus pungens* (seasonally flooded) Herbaceous Alliance	Wetland openings in forests that contain a mix of *S. patens* and *S. pungens* have been classified into the *S. patens* alliance
Spartina patens	herb	COLOR - pinkish - white CROWN SIZE -N/A CROWN SHAPE -N/A TEXTURE -highly mottled; patterns & texture vary depending on growth stages & environmental conditions	Interdune low areas (more extensive than swales), forest openings, and high saltmarsh	.3 - 1 m	Common in the high salt marsh, Iva ecotonal areas and low areas of the interdune.	graminoids (wet) *Scirpus pungens* *Iva frutescens* *Baccharis halimifolia*	*Spartina patens* (estuarine) Herbaceous Alliance *S. patens - S. pungens* Herbaceous Alliance *B. halimifolia-I. frutescens* Shrubland Alliance *M. cerifera-B. halimifolia* Shrubland Alliance	*Spartina patens* tends to be found in more complex alliance situations due to its tolerance of both wet and dry conditions
Solidago sempervirens	herb (forb)	COLOR - bright red CROWN SIZE - N/A CROWN SHAPE - N/A TEXTURE - visible as 'pin dots' on aerial photography	Sandy areas adjacent to and on the primary dune	.3 - 1 m	Fairly common in sandy areas; especially in disturbed locations and on dunes	graminoids (dry) *Ammophila breviligulata*	*Ammophila breviligulata* Herbaceous Alliance	This species often indicates the presence of *Ammophila* on the primary dune
Typha angustifolia	herb	COLOR - PI signature not well established CROWN SIZE -N/A CROWN SHAPE -N/A TEXTURE - stippled - somewhat mottled	Isolated to about a dozen known sites on the island.	1 - 4 m	Rare - substantiated by field sites only	graminoids (wet)	*Typha angustifolia* - Hibiscus spp. Herbaceous Alliance	
Panicum virgatum	herb	COLOR - pink signature not well established CROWN SIZE - N/A CROWN SHAPE - N/A TEXTURE - stippled; individual plants noticed within other wetland species	known only on about a dozen sites on the island; stands of this species are limited in extent	1 - 2 m	Rare - usually in interdune areas on the southern third of the island.	graminoids (wet)	*Panicum virgatum* (seasonally flooded) Herbaceous Alliance	Date of existing photography makes this species very difficult to identify

Attachment B.

Crosswalk Table Descriptions

The Crosswalk table is broken down into 16 columns. The column descriptions are as follows.

- **Column 1 - ALLIANCE**
  This column contains the title of the National Classification category.

- **Column 2 - T_HT**
  This column describes the height category for trees present in the alliance/community element class being described. A "zero" in this column indicates that trees are not present in this vegetation class and no attributes will be listed in the T_DEN, T1, T2, or T3 column for that category. A blank in this column indicates that any height category can be present within the vegetation class being described.

- **Column 3 - T_DEN**
  This column describes the density category for trees present in the alliance/community element class being described. If a "zero" is not present in the T_HT column, a blank in the T_DEN column indicates that any density class can be present within the vegetation class being described.

- **Column 4 - T1**
  This column describes the floristic composition code of the dominant tree type present in the alliance/community element class being described.

  This column contains one of the following:

  1. A two-digit code, e.g., 01, 02, etc. - This refers to the floristic composition of the dominant tree type.

  2. A code of 00 - This indicates that no trees can be present in this permutation of the photo primitive codes for this class. If a 00 is present in this column, then 00 should be present in columns T_2 and T_3 for the same permutation.

  3. A blank space - This indicates that any tree floristic code can be present in this column. This is only true if there is not a "zero" in the T_HT category.

- **Column 5 - T2**
  This column describes the floristic composition code of the next dominant tree type present in the alliance/community element class being described.

  This column contains one of the following:

  1. A two-digit code, e.g., 01, 02, etc. - This refers to the floristic composition of the next dominant tree type.

2. A code of 00 - This indicates that there is no co-dominant tree type present in this permutation of the photo primitive codes for the class being described. If a 00 is present in this column, then 00 should also be present in column T_3 for the same permutation.

3. A blank space - This indicates that any tree floristic code can be present in this column. This is only true if there is not a "zero" in the T_HT category.

- **Column 6 - T3**
  This column describes the floristic composition code of the third most dominant tree type present in the alliance/community element class being described.

  This column contains one of the following:

  1. A two-digit code, e.g., 01, 02, etc. - This refers to the floristic composition of the third most dominant tree type.

  2. A code of 00 - This indicates that there is no third most dominant tree type present in this permutation of the photo primitive codes for this class.

  3. A blank space - This indicates that any tree floristic code can be present in this column. This is only true if there is not a "zero" in the T_HT category.

- **Column 7 - S_HT**
  This column describes the height category for shrubs present in the alliance/community element class being described. A "zero" in this column indicates that shrubs are not present in this vegetation class and no attributes will be listed in the S_DEN, S1, S2, or S3 column for that category. A blank in this column indicates that any height category can be present within the vegetation class being described.

- **Column 8 - S_DEN**
  This column describes the density category for shrubs present in the alliance/community element class being described. If a "zero" is not present in the S_HT column, a blank in the S_DEN column indicates that any density class can be present within the vegetation class being described.

- **Column 9 - S1**
  This column describes the floristic composition code of the dominant shrub type present in the alliance/community element class being described.

  This column contains one of the following:

  1. A two-digit code, e.g., 01, 02, etc. - This refers to the floristic composition of the dominant shrub type.

2. A code of 00 - This indicates that no shrubs can be present in this permutation of the photo primitive codes for this class. If a 00 is present in this column, then 00 should be present in columns S_2 and S_3 for the same permutation.

3. A blank space - This indicates that any shrub floristic code can be present in this column. This is only true if there is not a "zero" in the S_HT category.

- **Column 10 - S2**
  This column describes the floristic composition code of the next dominant shrub type present in the alliance/community element class being described.

  This column contains one of the following:

  1. A two-digit code, e.g., 01, 02, etc. - This refers to the floristic composition of the next dominant shrub type.

  2. A code of 00 - This indicates that there is no co-dominant shrub present in this permutation of the photo primitive codes for the class being described. If a 00 is present in this column, then 00 should also be present in column S_3 for the same permutation.

  3. A blank space - This indicates that any shrub floristic code can be present in this column. This is only true if there is not a "zero" in the S_HT category.

- **Column 11 - S3**
  This column contains the floristic composition code of the third most dominant tree type present in the alliance/community element class being described.

  This column contains one of the following:

  1. A two-digit code, e.g., 01, 02, etc. - This refers to the floristic composition of the third most dominant shrub type.

  2. A code of 00 - This indicates that there are no third most dominant shrub types present in this permutation of the photo primitive codes for this class.

  3. A blank space - This indicates that any shrub floristic code can be present in this column. This is true only if there is not a "zero" in the S_HT category.

- **Column 12 - H_HT**
  This column describes the height category for herbaceous vegetation present in the alliance/community element class being described. A "zero" in this column indicates that herbaceous vegetation is not present in this vegetation class and no attributes will be listed in the H_DEN, H1, H2, or H3 column for that category. A blank in this column indicates that any height category can be present within the vegetation class being described.

- **Column 13 - H_DEN**
  This column describes the density category for herbaceous vegetation present in the alliance/community element class being described. If a "zero" is not present in the H_HT column, a blank in the H_DEN column indicates that any density class can be present within this vegetation class.

- **Column 14 - H1**
  This column describes the floristic composition code of the dominant herbaceous vegetation present in the alliance/community element class being described.

  This column contains one of the following:

  1. A two-digit code, e.g., 01, 02, etc. - This refers to the floristic composition of the dominant herbaceous vegetation.

  2. A code of 00 - This indicates that no herbaceous vegetation can be present in this permutation of the photo primitive codes for the class. If a 00 is present in this column, then 00 should be present in columns H_2 and H_3 for the same permutation.

  3. A blank space - This indicates that any herbaceous floristic code can be present in this column. This is only true if there is not a "zero" in the H_HT category.

- **Column 15 - H2**
  This column describes the floristic composition code of the next dominant herbaceous vegetation type present in the alliance/community element class being described.

  This column contains one of the following:

  1. A two-digit code, e.g., 01, 02, etc. - This refers to the floristic composition of the next dominant herbaceous vegetation type.

  2. A code of 00 - This indicates that there is no co-dominant herbaceous vegetation present in this permutation of the photo primitive codes for the class being described. If a 00 is present in this column, then 00 should also be present in column H_3 for the same permutation.

  3. A blank space - This indicates that any herbaceous floristic code can be present in this column. This is only true if there is not a "zero" in the H_HT category.

- **Column 16 - H3**
  This column contains the floristic composition code of the third most dominant herbaceous vegetation type present in the alliance/community element class being described.

  This column contains one of the following:

1. A two-digit code, e.g., 01, 02, etc. - This refers to the floristic composition of the third most dominant herbaceous vegetation type.
2. A code of 00 - This indicates that there are no third most dominant herbaceous vegetation types present in this permutation of the photo primitive codes for this class.
3. A blank space - This indicates that any herbaceous floristic code can be present in this column. This is true only if there is not a "zero" in the H_HT category.

Table A-2. Preliminary National Biological Service / National Park Service Vegetation Inventory and Mapping Program Photo Primitive to National Classification Crosswalk Key - Assateague Island National Seashore.

NATIONAL BIOLOGICAL SERVICE/NATIONAL PARK SERVICE VEGETATION INVENTORY AND MAPPING PROGRAM PHOTO PRIMITIVE to NATIONAL CLASSIFICATION CROSSWALK KEY - ASSATEAGUE ISLAND NATIONAL SEASHORE *** PRELIMINARY ***															
ALLIANCE	**T_HT**	**T_DEN**	**T1**	**T2**	**T3**	**S_HT**	**S_DEN**	**S1**	**S2**	**S3**	**H_HT**	**H_DEN**	**H1**	**H2**	**H3**
Pinus taeda-Quercus (nigra, falcata) Forest Alliance	3-6	1	02 02	00 04	00 00										
Pinus taeda Wetland Forest Alliance	3-6	1	02 02	00 01	00 00										
Pinus taeda Woodland Alliance	2-6	2-3	02	00	00										
Prunus serotina - Amelanchier canadensis - Quercus spp. Forest Alliance	3-5 3-5 3-5	1-4 1-4 1-4	02 03 03	03 02											
Myrica pensylvanica - (Prunus maritima) Shrubland Alliance		4-5 or 0 4-5 or 0 4-5 or 0				2 2 2	3-5 1-5 4-5	04 04 04	01		1	4-5	01		
Myrica cerifera (Wet) Shrubland Alliance		4-5 or 0 4-5 or 0				2-3 2-3	1-3 1-2	05 05	00 01	0 00					
Smilax spp. - *Toxicodendron radicans* Shrubland Alliance						2 2	3-5 3-5	07 07	02 02	00 00	1	4-5	00 02	00 00	00 00
Myrica (cerifera, pensylvanica) - Vaccinium corymbosum (wet) Shrubland Alliance		4-5 or 0 4-5 or 0				2 2	2-5 2-5	06 05	05 06						
Myrica cerifera - Baccharis halimifolia Shrubland Alliance		4-5 or 0 4-5 or 0 4-5 or 0 4-5 or 0				2 2 2 2	1-5 1-5 3-5 3-5	01 01 05 05	05 05 01 01	00 00 00 00	1 1 1 1	1-3 1-3 1-3 1-3	03 09 03 09	03 03	
Baccharis halimifolia - Iva frutescens Shrubland Alliance		4-5 or 0 4-5 or 0 4-5 or 0				2 2 2	1-4 1-4 3-4	03	03	03					

NATIONAL BIOLOGICAL SERVICE/NATIONAL PARK SERVICE
VEGETATION INVENTORY AND MAPPING PROGRAM
PHOTO PRIMITIVE to NATIONAL CLASSIFICATION CROSSWALK KEY - ASSATEAGUE ISLAND NATIONAL SEASHORE
*** PRELIMINARY ***

Myrica pensylvanica - Schizachyrium scoparium Sparse Shrubland Alliance		4-5 or 0 4-5 or 0 4-5 or 0 4-5 or 0 4-5 or 0 4-5 or 0				2 2 2 2 2 2	2-5 2-5 2-5 3-5 2-5 1-5	05 05 07 05 04 05	07 02 05 00 07 07	00	1 1 1 1 1 0	2-5 2-5 2-5 2-5 2-5	02 02 02 02 02	00 00 00 00 00	00 00 00 00 00
Hudsonia tomentosa Dwarf Shrubland Alliance		4-5 or 0				1	2-5	02							
Juncus roemerianus Herbaceous Alliance		4-5 or 0 4-5 or 0					4-5 or 0 4-5 or 0				2 1-2	1-2 1-2	04 03	04	
Typha angustifolia - Hibiscus moscheutos Herbaceous Alliance		4-5 or 0 4-5 or 0					4-5 or 0 4-5 or 0				2 1-2	1-2 1-2	12 03	12	
Phragmites australis Herbaceous Alliance		4-5 or 0 4-5 or 0					4-5 or 0 4-5 or 0				2 2	1-3 1-3	05 03	05	
Spartina alterniflora Herbaceous Alliance		5 or 0 5 or 0					5 or 0 5 or 0				1-2 1-2	1-5 1-5	06 06	03 09	03
Ammophila breviligulata Herbaceous Alliance	0										1 1	3-5 3-5	01 11	01	
Panicum virgatum (seasonally flooded) Herbaceous Alliance		4-5 or 0 4-5 or 0					4-5 or 0 4-5 or 0				2 1-2	1-4 1-4	13 03	13	
Scirpus pungens (seasonally flooded) Herbaceous Alliance		4-5 or 0 4-5 or 0 4-5 or 0					4-5 or 0 4-5 or 0 4-5 or 0				1 1 1	1-3 1-3 1-3	08 08 03	00 03 08	00
Spartina patens - Scirpus pungens Herbaceous Alliance	0 0						5 or 0 5 or 0				1 1	4-5 4-5	08 08	09 02	
Spartina patens (Estuarine) Herbaceous Alliance		5 or 0 5 or 0					5 or 0 5 or 0				1-2 1-2	1-5 1-5	09 09	03 06	03
Salicornia - Spartina alterniflora Herbaceous Alliance	0										1	2-5	06	07	03

Attachment C.

ASSATEAGUE NATIONAL SEASHORE
NBS/NPS VEGETATION MAPPING PROGRAM
PRELIMINARY DATA INFORMATION REPORT

COVERAGENAME ..... ASIS
RELATE FILE: ..... ASIS_LUT
RELATE NAME: ..... ALLIANCE

Relate name: ..... Alliance
Table: ..... Asis.lut
Database: ..... Info
Item: ..... Seqno
Column: ..... Seqno
Relate Typ: ..... Ordered
Relate Access: ..... RO

Column	Item Name	Wd.	Out	Type
1	Area	8	18	F
5	Perimeter	8	18	F
9	Asis_veg#	4	5	B
13	Asis_veg-id	4	5	B
17	Seqno	4	4	I

Table A-3. Attribute lookup table (Relate file): Asis.lut

Column	Item Name	Width	Output	Type	N. Dec.	Alternate Name	Indexed?
1	SEQNO	6	6	I	-		-
7	ALLIANCE	2	2	I	-		-
9	LANDUSE	4	4	C	-		-
13	PROFILE1	1	1	C	-		-
14	STATURE1	1	1	C	-		-
15	SPECIES1	2	2	C	-		-
17	HEIGHT1	1	1	C	-		-
18	DENSITY1	1	1	C	-		-
19	PROFILE2	1	1	C	-		-
20	STATURE2	1	1	C	-		-
21	SPECIES2	2	2	C	-		-
23	HEIGHT2	1	1	C	-		-
24	DENSITY2	1	1	C	-		-
25	PROFILE3	1	1	C	-		-
26	STATURE3	1	1	C	-		-
27	SPECIES3	2	2	C	-		-
29	HEIGHT3	1	1	C	-		-
30	DENISTY3	1	1	C	-		-
31	PROFILE4	1	1	C	-		-
32	STATURE4	1	1	C	-		-
33	SPECIES4	2	2	C	-		-
35	HEIGHT4	1	1	C	-		-
36	DENISTY4	1	1	C	-		-
37	PROFILE5	1	1	C	-		-
38	STATURE5	1	1	C	-		-
39	SPECIES5	2	2	C	-		-
41	HEIGHT5	1	1	C	-		-
42	DENSITY5	1	1	C	-		-
43	PROFILE6	1	1	C	-		-
44	STATURE6	1	1	C	-		-
45	SPECIES6	2	2	C	-		-
47	HEIGHT6	1	1	C	-		-
48	DENSITY6	1	1	C	-		-
49	PROFILE7	1	1	C	-		-
50	STATURE7	1	1	C	-		-
51	SPECIES7	2	2	C	-		-
53	HEIGHT7	1	1	C	-		-
54	DENISTY7	1	1	C	-		-
** REDEFINED ITEMS **							
13	REL2	42	42	C	-		-
13	CODE1	6	6	C	-		-
19	CODE2	6	6	C	-		-
25	CODE3	6	6	C	-		-
31	CODE4	6	6	C	-		-
37	CODE5	6	6	C	-		-
43	CODE6	6	6	C	-		-
49	CODE7	6	6	C	-		-

PERTINENT LOOKUP TABLE FILES:

Species.name (combines stature and species into one numeric)
Height.name
Density.name
Alliance.name (includes a plotting shade symbol)
Landuse.name

LAYER CHARACTERISTICS - DESCRIPTIONS-VALUES

Stature

1 = Tree
2 = Shrub
3 = Herbaceous
8 = Dead
9 = Not applicable

Height

1 = <0.5 meters
2 = 0.5 - 2 meters
3 = 2 - 5 meters
4 = 5 - 15 meters
5 = 15 - 35 meters
6 = 35 - 50 meters
7 = >50 meters
9 = Not Applicable

Absolute Crown Density

1 = Closed/Continuous: >60%
2 = Discontinuous: 40% - 60%
3 = Dispersed: 25% - 40%
4 = Sparse: 10% - 25%
5 = Rare: 2% - 10%
9 = Not Applicable

FLORISTIC COMPOSITION - Trees (up to three taxa)

01 = Ar - *Acer rubrum*
02 = Pt - *Pinus taeda*
03 = - - *Rosaceae*
04 = Qf - *Quercus species*
08 = Dead
98 = Water
99 = Unvegetated

FLORISTIC COMPOSITION - Shrubs/Vines/Dwarf Shrubs (Up to three taxa)

01 = Bh - *Baccharis halimifolia*
02 = Ht - *Hudsonia tomentosa*
03 = If - *Iva frutescens*
04 = Mp - *Myrica pensylvanica*
05 = My - *Myrica species*
06 = Vc - *Vaccinium corymbosum*
07 = Vsp - Vines species
08 = Dead
98 = Water
99 = Unvegetated

FLORISTIC COMPOSITION - Herbaceous (Up to three taxa)

01 = Ab - *Ammophila breviligulata*
02 = - - Graminoid (dry)
03 =- - Graminoid (wet)
04 = Jr - *Juncus roemerianus*
05 = Pa - *Phragmites australis*
06 = Sa - *Spartina alterniflora*
07 = Sal - *Salicornia* species
08 = Sc - *Scirpus pungens*
09 = Sp - *Spartina patens*
11 = Ss - *Solidago sempervirens*
12 = Ta - *Typha angustifolia*
13 = Pv - *Panicum virgatum*
14 = - - *Scirpus robustus*
77 = - - Algae
88 = Dead
98 = Water
99 = Unvegetated

LAND USE

100 = Urban or Built-Up
- 110 = Residential
- 120 = Commercial and Services
- 130 = Industrial
- 140 = Transportation, Communications, and Utilities
- 150 = Mixed Commercial and Industrial
- 160 = Mixed Urban
- 170 = Under Construction
- 180 = Open Space and Recreation

190 = Vacant within Urban Context
200 = Agriculture
300 = Mining

400 = National Park/Monument Facilities
401 = Jetty
402 = Road
403 = Parking Area
404 = Restrooms
405 = Building
406 = Campground
500 = Water
600 = Vacant

ALLIANCE LIST

1 *Pinus taeda - Quercus (nigra, falcata*) Alliance/*Pinus taeda* Wetland Forest Alliance
2 (not used)
3 *Pinus taeda* Woodland Alliance
4 *Prunus serotina - Amelanchier canadensis - Quercus spp*. Forest Alliance
5 *Myrica pensylvanica - (Prunus maritima)* Shrubland Alliance
6 *Myrica cerifera* (Wet) Shrubland Alliance
7 *Smilax spp. - Toxicodendron radicans* Shrubland Alliance
8 *Myrica (cerifera, pensylvanica) Vaccinium corymbosum* (Wet) Shrubland Alliance
9 *Myrica cerifera - Baccharis halimifolia* Shrubland Alliance
10 *Baccharis halimifolia - Iva frutescens* Shrubland Alliance
11 *Myrica pensylvanica - Schizachyrium scoparium* Sparse Shrubland Alliance
12 *Hudsonia tomentosa* Dwarf Shrubland Alliance
13 *Juncus roemerianus* Herbaceous Alliance
14 *Typha angustifolia - Hibiscus moscheutos* Herbaceous Alliance
15 *Phragmites australis* Herbaceous Alliance
16 *Spartina alterniflora* Herbaceous Alliance
17 *Ammophila breviligulata* Herbaceous Alliance
18 *Panicum virgatum* (seasonally flooded) Herbaceous Alliance
19 *Scirpus pungens* (seasonally flooded) Herbaceous Alliance
20 *Spartina patens - Scirpus pungens* Herbaceous Alliance
21 *Spartina patens* (Estuarine) Herbaceous Alliance
22 *Salicornia spp. - Spartina alterniflora* Herbaceous Alliance
23 (not used)
24 (not used)
25 (not used)
26 (not used)
27 Algae - (Mixed Fines Alliance)
28 (not used)
29 (not used)
30 Water
31 Naturally Occurring Unvegetated Areas
32 Built Up Areas

33 Dead Vegetation
34 Undifferentiated Dry Grasses

ASSOCIATION LIST

1 *Pinus taeda/Myrica cerifera/Osmunda regalis* Forest *Pinus taeda/Myrica cerifera/Vitis rotundifolia* Forest
2 (not used)
3 *Pinus taeda/Hudsonia tomentosa* Woodland
4 *Prunus serotina/Myrica cerifera/Smilax rotundifolia* Forest
5 *Myrica pensylvanica/Diodia teres* Shrubland
6 *Myrica cerifera/Hydrocotyle spp*. Shrubland
7 *Smilax glauca - Toxicodendron radicans* Shrubland
8 *Myrica (cerifera, pensylvanica) Vaccinium corymbosum* Shrubland
9 *Myrica cerifera - Baccharis halimifolia/Spartina patens* Shrubland
10 *Baccharis halimifolia - Iva frutescens/Spartina patens* Shrubland
11 *Myrica pensylvanica - Schizachyrium scoparium Ssp. littorale-Eupatorium hyssopifolium* Sparse Shrubland
12 *Hudsonia tomentosa/Panicum (amarum, amarulum)* Dwarf-shrubland
13 *Juncus roemerianus* Herbaceous vegetation
14 *Typha angustifolia - Hibiscus moscheutos* Herbaceous vegetation
15 *Phragmites australis* Herbaceous vegetation
16 *Spartina alterniflora/Ascophyllum nodosum* Herbaceous vegetation
17 *Ammophila breviligulata - Panicum (amarum, amarulum)* Herbaceous vegetation
18 *Panicum virgatum - Spartina patens* Herbaceous vegetation
19 *Scirpus pungens/Fimbristylis castanea* Herbaceous vegetation
20 *Spartina patens - Scirpus pungens - Solidago sempervirens* (Upland) Herbaceous vegetation
21 *Spartina patens - Distichlis spicata - Borrichia frutescens* Herbaceous vegetation
22 *Salicornia spp. - Sarcocornia perennis - Spartina alterniflora* Herbaceous vegetation
23 (not used)
24 (not used)
25 (not used)
26 (not used)
27 Algae - (Mixed Fines Alliance)
28 (not used)
29 (not used)
30 Water
31 Naturally Occurring Unvegetated Areas
32 Built Up Areas
33 Dead Vegetation
34 Undifferentiated Dry Grasses

Appendix B. Vegetation Plot Sampling Form

A. Identifiers / Locators

1. Provisional alliance name:_____
2. Provisional community name:_____
3. Polygon code:_____ 4. Plot code(s)_____
5. Quad name(s):_____
6. Lat: ___ ___ ___ ___ ___ ___ N 7. Long: _0___ ___ ___ ___ ___ ___ W 8. GPS Error: _____
9. Directions to plot: _____
_____
_____
_____
_____
10.Plot length _____ 11. Plot width: _____12 Survey Date:_____.____.____
13. Plot permanent (Y/N) _____ 14. Surveyors:_____

B. Environmental Description

15. Slope degrees _____	16. Slope aspect: _____	17. Elevation:
18. Topographic position: 19. Landform	20. Topographic sketch:	21. Surficial geology:
22. 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	23. Hydrologic regime: Tidal ___Irregularly exposed ___Regularly flooded ___Irregularly flooded Non-tidal ___Prmanently flooded ___Semipermanently flooded ___Seasonally / temporarily flooded ___Seasonally flooded / saturated ___Intermittently flooded ___ Saturated Salinity / halinity ___Saltwater ___Brackish ___ Freshwater	
	24. Soil drainage: ___Rapidly drained ___Well drained ___Moderately well drained ___ Poorly drained ___Somewhat poorly drained ___Very poorly drained	34. Soil texture: ___sand ___sandy loam ___loam ___other: ___clay loam ___clay ___ peat ____ muck _____
	25. Unvegetated surface: _____ % Bedrock _____ % Large rocks (cobble, boulders >10cm _____ % Small rocks (gravel, 0.2-10 cm) _____ % Bare soil _____ % Litter, duff _____ % Wood (> 1cm) _____ % Water _____ % Other: _____	
	26. Environmental Comments: Note homogeneity of vegetation, erosion / sedimentation, inundation, etc. 27. Plot representativeness:	

Figure B-1. An example of page 1 of the National Park Service Vegetation Mapping Program: Plot Survey Form (1995).

C. Vegetation 38. System: ____Terrestrial ____Palustrine ____Estuarine

28. Leaf type:
__Borad-leaf
__Semi-broad leaf
__Semi-needle leaf
__Needle-leaf
__Graminoid
__Broad-leaf herbaceous
__Pteridophyte

29. Leaf phenology:
__Decidous
__Semi-decidous
__Semi-Evergreen
__Evergreen
__Perennial
__Annual

30. Physiognomic type:
__Forest
__Sparse woodland
__Shrubland
__Dwarf shrublnad
__Sparse dwarf shrubland
__Non-vascular
__Woodland
__Scrub thicket
__Sparse shrubland
__Dwarf scrub thicket
__Herbaceous
__Sparsely vegetated

31. height % cover
TI Emergent tree
T2 Tree canopy
T3 Tree sub-canopy
S1 Tall shrub
S2 Short shrub
H Herbaceous
N Non-vascular
E Epiphyte
V Vine / liana

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

Figure B-2. An example of page 2 of the National Park Service Vegetation Mapping Program: Plot Survey Form (1995).

Appendix C. Accuracy Assessment Data Form

NATIONAL PARK VEGETATION MAPPING PROGRAM: ACCURACY ASSESSMENT
IDENTIFIERS/LOCATORS – Assateague Island National Seashore (ASIS), Maryland

Field Point Code _____ Database Point Code _____

Primary Map Unit _____ Assoc Code / Name _____

Secondary Map Unit_____Assoc Code / Name _____

Other Map Unit / Assoc within 50m _____

Key or Classification Comments:

GPS file name _____ UTM X ___ ___ ___ ___ ___ ___ m E UTM Y ___ ___ ___ ___ ___ ___ ___m N

GPS Error _____ m GPS unit: _____ UTM Zone: _____

Survey Date _____2009 Surveyors _____

Section of Island _____

Quad Name _____ Quad Code _____

Area surveyed: 25m radius circle ____
Other (describe)

VEGETATION DESCRIPTION

Leaf phenology (of dominant stratum)	Leaf Type (of dominant stratum)	Physiognomic class
Trees and Shrubs	__ Broad-leaved	
__ Evergreen	__Needle-leaved	__Forest
__Cold-deciduous	__Mixed broad/needle-leaved	__Woodland
__Mixed evergreen – cold-deciduous	__Graminoid	__Shrubland
__ % evergreen __ % deciduous	__Forb	__Dwarf-shrubland
Herbs	__Pteridophyte	__Herbaceous
__Annual		__Nonvascular
__Perennial		__Sparsely vegetated

Stratum	Height	Dominant / characteristic species (mark dominants "D" or characteristic "*"
Tree dominants		
Shrub dominants		
Herb dominants		
Other notable		

Figure C-1. An example of page 1 of the National Park Service Vegetation Mapping Program: Accuracy Assessment Identifiers/Locators – Assateague Island National Seashore (ASIS), Maryland.

Appendix D. Classification Confidence

Association Classification Confidence

Confidence refers to the certainty that the classification is correct, that the association is accurately described, and that the association is distinct from other similar associations. Confidence for the global USNVCS association descriptions was attributed by NatureServe. Confidence for the state association crosswalks was attributed by the Pennsylvania Natural Heritage Program and the New Jersey Natural Heritage Program.

1. **Strong** – Classification is based on quantitative analysis of verifiable, high-quality field data (species lists and associated environmental information) from plots that are published in full or are archived in a publicly accessible database. A sufficient number of high-quality plots covering the expected geographic distribution and habitat variability of the vegetation type, as well as plots from related types across the region, have been used in the analysis.

2. **Moderate** – Classification is based either on quantitative analysis of a limited data set of high-quality, published/accessible plots and/or plots from only part of the geographic range, or on a more qualitative assessment of published/accessible field data of sufficient quantity and quality.

3. **Weak** – Classification is based on limited, or unpublished/inaccessible plot data or insufficient analysis, anecdotal information, or community descriptions that are not accompanied by plot data. These types have often been identified by local experts. Although there is a high level of confidence that these types represent recognized vegetation entities, it is not known whether they would meet national standards for floristic types in concept or in classification approach if sufficient data were available.

Appendix E. Definitions of conservation ranks and classification confidence

Global Rank Codes and Definitions

Global ranks (i.e. range-wide conservation status ranks) are assigned at NatureServe's Headquarters or by a designated lead office in the Heritage/Conservation Data Center Network.

GX - Presumed Extinct - Believed to be extinct throughout its range. Not located despite intensive searches of historic sites and other appropriate habitat, and virtually no likelihood that it will be rediscovered.

GH - Possibly Extinct - Known from only historical occurrences. Still some hope of rediscovery.

G1 - Critically Imperiled - Critically imperiled globally because of extreme rarity or because of some factor(s) making it especially vulnerable to extinction. Typically 5 or fewer occurrences or very few remaining individuals (<1,000) or acres (<2,000) or stream miles (<10).

G2 - Imperiled - Imperiled globally because of rarity or because of some factor(s) making it very vulnerable to extinction. Typically 6 to 20 occurrences or few remaining individuals (1,000 to 3,000) or acres (2,000 to 10,000) or stream miles (10 to 50).

G3 - Vulnerable - Vulnerable globally either because very rare and local throughout its range, found only in a restricted range (even if abundant at some locations), or because of other factors making it vulnerable to extinction. Typically 21 to 100 occurrences or between 3,000 and 10,000 individuals.

G4 - Apparently Secure - Uncommon but not rare, and usually widespread. Possibly cause for long-term concern. Typically more than 100 occurrences and more than 10,000 individuals.

G5 - Secure - Common, typically widespread and abundant. Typically with considerably more than 100 occurrences and more than 10,000 individuals.

GNA - Rank not applicable – Common cultural, ruderal, planted, modified, managed, invasive, and/or non-natural type. Has little or no conservation value.

GNR – Not Ranked – A rank has not yet been determined for this element, therefore its rarity is currently unspecified. As the USNVCS is further revised with additional information, the SNR will be changed to a numeric rank based on available data.

G#G# - Rank Range – The actual rank of the element is within the range specified by the numbers, however the exact status of the rariety of the element is uncertain. For example, G2G3 indicates that the rank may be either G2 or G3.

Appendix F. Field Key to associations of Assateague Island National Seashore (2009)

Vascular plant species nomenclature within the local and global descriptions follows the nationally standardized list of Kartesz (1999), with very few exceptions. Where Kartesz 1999 differs from PLANTS 3.5, synonymy is indicated parenthetically. 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 PLANTS 3.5 common names that are used within the local description information and throughout the rest of the report.

1a. Vegetation present; may be very sparse 2
1b. Vegetation absent or comprised entirely, or nearly so, of alien species, or of native species in small patches surrounded by anthropogenic surfaces 28

2a. Vegetation woody, tall (height 2-3 meters or taller) 3
2b. Vegetation generally shorter than 2-3 meters 9

FOREST or WOODLAND VEGETATION

3a. Vegetation characterized by abundant *Pinus taeda* 4
3b. Vegetation predominantly broad-leaved 6

4a. Open or patchy canopy dominated by *Pinus taeda;* bare sand prevalent; *Hudsonia tomentosa* usually present in quantity; occurs in large patches (greater than 0.5 acre) only[7] .....
Pinus taeda / Hudsonia tomentosa Woodland (CEGL006052)
4b. Vegetation more or less densely shaded 5

5a. Soils characterized by duff overlying sands; not influenced by water table .....
Pinus taeda / Morella cerifera / Vitis rotundifolia Forest (CEGL006040)
5b. Soils characterized by moderately deep muck, surface water often present .....
Pinus taeda / Morella cerifera / Osmunda regalis Forest (CEGL006137)

6a. Broad-leaved tree species or tall deciduous shrubs dominant (*Prunus serotina*, *Sassafras albidum*, *Aronia* spp. 7
6b. Shrub species dominant 8

7a. Soils not influenced by water table; primarily deciduous scrub forest; *Pinus taeda* may be present but not in quantity .....
Prunus serotina / Morella cerifera / Smilax rotundifolia Forest (CEGL006319)
7b. Soils wet; generally occurs as small patches, if at all, on ASIS.....
Acer rubrum - Nyssa sylvatica - Magnolia virginiana / Viburnum nudum Forest (CEGL006238)

[7] Small areas (less than 0.5 acre) characterized by *Hudsonia tomentosa* supporting only a few trees should be classified as *Hudsonia tomentosa / Panicum (amarum, amarulum)* Dwarf-shrubland (CEGL003950)

TALL SHRUB VEGETATION

8a. Tall dense shrubland over deep muck with surface water common; *Morella cerifera* often monotypic; hydrophytes present .....
Morella cerifera / Hydrocotyle spp. Shrubland (CEGL003839)

8b. Mesic tall shrubland; *Baccharis halimifolia* often present, *Spartina patens* usually present in quantity.....
Morella cerifera / Spartina patens Shrubland (CEGL003840)[8]

9a. Vegetation characterized by shrubs of variable cover, < 2m tall, or vines 10
9b. Vegetation characterized by herbs 15

SHORT SHRUB VEGETATION

10a. *Morella pensylvanica* dominant shrub; may be very sparse 11
10b. Vegetation not as above 12

11a. Vegetation of foredunes or backdune flats; patchy, sparse, with open sand patches common; *Schizachyrium scoparium* absent; floristically depauperate .....
Morella pensylvanica / Diodia teres Shrubland (CEGL003881)

11b. Vegetation of more stable substrate, usually backdunes; bunch grasses (*Schizachyrium scoparium, Andropogon virginicus*) and herbs *Eupatorium hyssopifolium, E. rotundifolium* present in quantity; widely variable and common type on ASIS; often occurs in complex with *Hudsonia tomentosa / Panicum (amarum, amarulum)* Dwarf-shrubland (CEGL003950).....
(*Morella pensylvanica) / Schizachyrium scoparium* ssp. *littorale – .....Eupatorium hyssopifolium* Sparse Shrubland (CEGL004129)

12a. *Morella cerifera* dominant shrub; *Vaccinium corymbosum* present, may be of low cover .....
Morella cerifera - Vaccinium corymbosum Shrubland (CEGL003906)

12b. *Morella cerifera* absent or of low cover 13

13a.Vines dominant; vegetation restricted to exposed dunes .....
Smilax glauca - Toxicodendron radicans Shrubland (CEGL003886)

13b. Short or dwarf shrubs dominant..... 14

14a. *Hudsonia tomentosa* dominant; vegetation of dry dune slacks; often in complex with (*Morella pensylvanica) / Schizachyrium scoparium* ssp. *littorale –Eupatorium hyssopifolium* Sparse Shrubland (CEGL004129); a few stunted *Pinus taeda* trees may occur where this vegetation occurs in small patches.....
Hudsonia tomentosa / Panicum (amarum, amarulum) Dwarf-shrubland (CEGL003950)

14b. *Iva frutescens* characteristic; shrubland of upper salt marshes .....
Iva frutescens / Spartina patens Shrubland (CEGL006848)[9]

[8] Formerly called Myrica cerifera – Baccharis halimifolia / Spartina patens Shrubland

[9] Type on ASIS has been changed; *Baccharis halimifolia - Iva frutescens / Spartina patens* Shrubland (CEGL003921) not present at ASIS

HERBACEOUS VEGETATION

15a. Herbaceous vegetation restricted to salt or brackish marshes (influenced by tidal flooding or occasional overwash) 16
15b. Herbaceous vegetation not occurring in salt or brackish marshes 21

16a. *Spartina alterniflora* present 17
16b. *Spartina alterniflora* absent or nearly so 18

17a. *Spartina alterniflora* dominant, or codominant with *Distichlis spicata* .....
Spartina alterniflora / Distichlis spicata Herbaceous Vegetation (CEGL006586)
17b. *Spartina alterniflora* present, may be sparse and/or stunted; *Salicornia* spp. usually present in quantity; algal mats usually evident; small marsh pools often numerous.....
Salicornia (virginica, bigelovii, maritima)- Spartina alterniflora Herbaceous Vegetation (CEGL004308)

18a. *Juncus roemerianus* strongly dominant .....
Juncus roemerianus Herbaceous Vegetation (CEGL004186)
18b. *Spartina patens* prevalent; *Juncus roemerianus* absent or of low cover 19

19a. High tidal marsh; *Spartina patens* strongly dominant; may be associated with *Distichlis spicata, Juncus roemerianus, Schoenoplectus robustus*.....
Spartina patens - Distichlis spicata – (Juncus roemerianus) Herbaceous Vegetation (CEGL004197)
19b Not tidally flooded, not situated on high salt marsh 20

20a. No peat development; sandy substrate, not wet; *Spartina patens* (usually var. *monogyna)* present at variable cover, may be sparse; evident on aerial photography as overwash fan;.....
Spartina patens – Schoenoplectus pungens – Solidago sempervirens Herbaceous Vegetation (CEGL004097)
20b. Peaty substrate, wet; *Spartina patens* strongly dominant, in association with *Fimbristylis castanea, Schoenoplectus pungens,* and / or *Hibiscus moscheutos*.....
Spartina patens – Eleocharis parvula Herbaceous Vegetation (CEGL006342)

21a. Cattails prevalent; occurs sparingly on ASIS.....
Typha angustifolia - Hibiscus moscheutos Herbaceous Vegetation (CEGL004201)
21b. Vegetation not as above 22

22a. Vegetation of dry sandy beaches and flats 23
22b. Vegetation of sheltered areas influenced by seasonal water table 25

23a. Vegetation of overwash areas, *Spartina patens* (rarely *Schoenoplectus pungens*) of variable cover.....
Spartina patens – Schoenoplectus pungens – Solidago sempervirens Herbaceous Vegetation (CEGL004097)
23b. Vegetation of foredunes or upper beaches 24

24a. *Ammophila breviligulata* present at variable cover; vegetation of foredunes.....
Ammophila breviligulata - Panicum var. *amarum* Herbaceous Vegetation (CEGL004043)

24b. *Cakile edentula* present; may be sparse; vegetation of upper ocean beaches .....
Cakile edentula ssp, *edentula – Chamaesyce polygonifolia* Herbaceous Vegetation (CEGL004400)

25a. Tall graminoid, depauperate, strongly dominated by *Phragmites australis* .....
Phragmites australis Eastern North America Temperate Semi-Natural Herbaceous Vegetation (CEGL004141)
25b. Vegetation of greater diversity..... 26

26a. Interdunal swale (may be large) characterized by abundant *Panicum virgatum*; shrub cover variable.....
(*Morella cerifera) / Panicum virgatum - Spartina patens* Herbaceous Vegetation (CEGL004129)
26b. *Panicum virgatum* minor to absent..... 27

27a. *Drosera intermedia* very common; *Scirpus pungens* minor to absent.....
Juncus (dichotomus, scirpoides) - Drosera intermedia Herbaceous Vegetation (CEGL004111)
27b. *Drosera intermedia* absent; *Scirpus pungens* and *Fimbristylis castanea* common; interdunal swale.....
Schoenoplectus pungens -Fimbristylis (castanea, caroliniana) Herbaceous Vegetation (CEGL004117)

UNVEGETATED OR ANTHROPOGENIC AREAS

28a. Vegetation present..... 29
28b. Vegetation absent, or hydromorphic..... 31

29a. Vegetation of small patches, comprised of native species, but surrounded by anthropogenic surfaces.....
Converted
29b. Vegetation comprised of alien species..... 30

30a. Upland vegetation; lawns, weedy patches, areas dominated by invasives..... Converted
30b. Wetland vegetation; *Phragmites* dominant.....
Phragmites australis Eastern North America Temperate Semi-Natural Herbaceous Vegetation (CEGL004141)

31a. Unvegetated anthropogenic surfaces, including pavement, buildings, unvegetated fill, obviously anthropogenic sand trails or roads..... Converted
31b Not as above; natural surfaces. 32

32a. Water surfaces (bays, tidal creeks, ponds, marsh pools)..... Water
32b. Surface not water 33

33a. Sandy or muddy surfaces not influenced by tidal flooding.....
Naturally occurring Unvegetated Area
33b. Sandy or muddy surfaces influenced by tidal flooding..... 34

34a. Mudflats, usually with algal cover prominent, occurring in low salt marsh.....

Salicornia (virginica, bigelovii, maritima)- Spartina alterniflora Herbaceous Vegetation (CEGL004308) (unvegetated variant)

33b. Wet sand flats or mud flats ..... Unvegetated Intertidal

OTHER TYPES THAT MAY BE ENCOUNTERED BUT WERE NOT MAPPED

Panicum virgatum – Spartina patens var. *monogyna – Carex silicea* Herbaceous Vegetation (CEGL006150): Brackish meadow of upper edge of high marsh; *Panicum virgatum* present in quantity; floristically more diverse, with *Agalinis maritima, Sebatia stellaris, Teucrium canadense,* and others.

Eleocharis rostellata – Spartina patens Herbaceous Vegetation (CEGL006611): occurs as small patches in high salt marshes. Note long arching stems of *Eleocharis rostellata.*

Spartina cynosuroides Herbaceous Vegetation (CEGL004195): Brackish marsh, very unlikely but you may come across it.

Morella cerifera - Baccharis halimifolia / Eleocharis fallax Shrubland (CEGL006846): Brackish Tidal Creek Shrubland

Appendix G. Original 1994 Vegetation Classification Report, Assateague Island National Seashore

NBS/NPS Vegetation Mapping Program

Vegetation Classification of
Assateague Island National Seashore

14 November 1995

The Nature Conservancy
Eastern Regional Office
201 Devonshire Street, 5th Floor
Boston, MA 02110

The Nature Conservancy
International Headquarters
1815 North Lynn Street
Arlington, VA 22209

Contributors

The following individuals contributed to this report (*authors):

Lesley Sneddon*
Mark Anderson
The Nature Conservancy
Eastern Regional Office
120 Devonshire Street, Floor 5
Boston, MA 01280

Cynthia Swinehart*
Dennis Grossman
Kathy Goodin
The Nature Conservancy
International Headquarters
1815 North Lynn Street
Arlington, VA 22209

M. Ashton Berdine*
Maryland Natural Heritage Program
Maryland Department of Natural Resources
E1 Towes State Office Building
Annapolis, MD 21401

C. Elaine Furbish
Mark Duffy
Rose Railey
National Park Service
Assateague Island National Seashore
Rt. 611, 7206 National Seashore Lane
Berlin, MD 21811

VEGETATION SAMPLING & CLASSIFICATION

Introduction

This report presents the results of the vegetation classification portion of the NBS/NPS Vegetation Mapping Program at Assateague Island National Seashore. The methods for sampling the vegetation are briefly discussed, particularly in relation to the standard described in NBS/NPS Vegetation Mapping Program: Field Methods for Vegetation Mapping. Also included in this document are the vegetation classification for Assateague Island, the field key to the vegetation types, and descriptions of each vegetation type. Supplements to this report include the field data sheets for the classification plots and corresponding electronic data files (in dBase 5.0).

Methods

During a two day reconnaissance visit, an initial list of community types was developed by visually inspecting the National Seashore and visiting examples of all obvious vegetation polygon types.

The methods used for developing the vegetation classification for Assateague Island National Seashore followed the standards described in Field Methods for Vegetation Mapping. Due to the size of Assateague Island, the sampling approach was based on sampling across key environmental gradients and photographic signatures. The sample area consisted of the entire area of Assateague Island with no sites being inaccessible to sampling. Polygons were selected for sampling based on environmental factors (primarily beach, foredunes, interdunes, back dunes and salt marsh). Due to the low relief across the island, aspect, slope and soil type were not used for stratifying the samples. In addition, samples were selected to be geographically dispersed to capture the representative variability of each of the vegetation types. Accessibility was a minor factor in the selection of polygons for sampling (most polygons were not difficult to access).

Sample plots were subjectively located within polygons so as to include representative expressions of the community. The heterogeneity of the vegetation and the number of samples per type precluded randomly selecting plot location. The number of sample plots per vegetation type varied with the total coverage, number of polygons, and variability of each type. A total of 114 plots were taken across Assateague Island National Seashore, which averages to approximately 5 plots per vegetation type.

The size of sample plots varied with vegetation type. For forest, woodland and shrubland communities, 15 x 15 m and 20 x 20 m plots were used. The herbaceous vegetation was sampled with a 5 x 5 m sampling frame. In addition to the species information collected within the classification plots, additional species that were encountered in the vegetation polygon were noted on the field form.

Accuracy assessment will be completed following the completion of the final vegetation map. It is anticipated that additional field data will be collected to test and assess the accuracy of the map.

Results

Twenty-five vegetation types were delineated for Assateague Island National Seashore, including: 4 forest types, 1 woodland type, 8 shrubland types, 11 herbaceous types and 1 sparsely vegetated type.

Wild ponies that live on Assateague Island have created and maintain many disturbance vegetation types. Staff at the Monument have created several exclusion areas that demonstrate what the structure and composition of vegetation would be in the absence of grazing.

Following is the vegetation classification for Assateague Island National Seashore (set within the hierarchy of the National Vegetation Classification System). A vegetation key to facilitate identification of the types in the field and a description of each vegetation type at the National Seashore are provided in later sections of this report.

Classification

I. Forest

I.A. Evergreen forest

I.A.9. Temperate and subpolar needle-leaved evergreen forest

I.A.9.e. Needle-leaved evergreen seasonally flooded / saturated forest with rounded crowns

I.A.9.e.i. *Pinus taeda* (wetland) Forest Alliance

***Pinus taeda / Myrica cerifera / Osmunda regalis* Forest**

I.B. Deciduous forest

I.B.2. Cold-deciduous forest

I.B.2.a.ix. *Prunus serotina - Amelanchier canadensis - Quercus* spp. Forest Alliance

***Prunus serotina / Myrica cerifera / Smilax rotundifolia* Forest**

I.B.2.f.iii. *Acer rubrum - Nyssa sylvatica* Wetland Forest Alliance

***Acer rubrum - Nyssa sylvatica - Magnolia virginiana* Forest**

I.C. Mixed evergreen - deciduous forest

I.C.3. Mixed needle-leaved evergreen - cold-deciduous forest

I.C.3.a. Mixed needle-leaved evergreen - cold-deciduous (upland) forest

I.C.3.a.iv. *Pinus taeda - Quercus (nigra, falcata)* Forest Alliance

***Pinus taeda / Myrica cerifera / Vitis rotundifolia* Forest**

II. Woodland

II.A. Evergreen woodland

II.A.2. Needle-leaved evergreen woodland

II.A.2.a. Needle-leaved evergreen woodland with rounded crowns

II.A.2.a.iv. *Pinus taeda* Woodland Alliance

***Pinus taeda / Hudsonia tomentosa* Woodland**

IV. Shrubland

IV.B. Deciduous shrubland

IV.B.2. Cold-deciduous shrubland

IV.B.2.a. Temperate deciduous shrubland

IV.B.2.a.i. *Myrica pensylvanica - (Prunus maritima)* Shrubland Alliance

***Myrica pensylvanica / Diodia teres* Shrubland**

IV.B.2.a.ii. *Myrica cerifera* (Wet) Shrubland Alliance

***Myrica cerifera / Hydrocotyle* spp. Shrubland**

Smilax spp. - *Toxicodendron radicans* Shrubland Alliance

***Smilax glauca - Toxicodendron radicans* Shrubland**

IV.B.2.c. Deciduous seasonally / temporarily flooded shrubland

IV.B.2.c.i. *Myrica (cerifera, pensylvanica) - Vaccinium corymbosum* (wet) Shrubland Alliance

***Myrica (cerifera, pensylvanica) - Vaccinium corymbosum* Shrubland**

IV.B.2.c.ii. *Myrica cerifera - Baccharis halimifolia* Shrubland Alliance

***Myrica cerifera - Baccharis halimifolia / Spartina patens* Shrubland**

IV.B.2.g. Saltwater-tidal irregularly flooded shrubland

IV.B.2.g.i. *Baccharis halimifolia - Iva frutescens* Shrubland Alliance

***Baccharis halimifolia - Iva frutescens / Spartina patens* Shrubland**

V. Sparse Shrubland

V.B. Deciduous sparse shrubland

V.B.2. Cold-deciduous sparse shrubland with a dominant herbaceous stratum

V.B.2.b. Deciduous sparse shrubland with medium-tall grasses

V.B.2.b.i. *Myrica pensylvanica - Schizachyrium scoparium* Sparse Shrubland

***Myrica pensylvanica / Schizachyrium scoparium* ssp. *littorale - Eupatorium hyssopifolium* Sparse Shrubland**

VI. Dwarf shrubland

VI.A. Evergreen dwarf shrubland

VI.A.1. Needle-leaved and microphyllous evergreen dwarf shrubland

VI.A.1.b. Needle-leaved and microphyllous evergreen creeping or matted dwarf shrubland

VI.A.1.b.i. *Hudsonia tomentosa* Dwarf Shrubland Alliance

***Hudsonia tomentosa / Panicum (amarum, amarulum)* Dwarf-shrubland**

VIII. Herbaceous vegetation

VIII.A. Tall grassland

VIII.A.2. Temperate tall grassland

VIII.A.2.a.ii. *Juncus roemerianus* Herbaceous Alliance

***Juncus roemerianus* Herbaceous Vegetation**

VIII.A.2.g. Brackish tidal regularly/irregularly flooded tall grassland

VIII.A.2.g.i. *Typha angustifolia* - *Hibiscus* spp. Herbaceous Alliance

***Typha angustifolia - Hibiscus moscheutos* Herbaceous Vegetation**

VIII.A.2.g.iii. *Phragmites australis* Herbaceous Alliance

***Phragmites australis* Herbaceous Vegetation**

VIII.A.2.i. Saltwater tidal regularly/irregularly flooded tall grassland

VIII.A.2.i.i. *Spartina alterniflora* Herbaceous Alliance

***Spartina alterniflora / Ascophyllum nodosum* Herbaceous Vegetation**

VIII.B. Medium tall grassland

VIII.B.2. Temperate and subpolar medium tall grassland

VIII.B.2.b. Open medium tall grassland

VIII.B.2.b.i. *Ammophila breviligulata* Herbaceous Alliance

***Ammophila breviligulata - Panicum (amarum, amarulum)* Herbaceous Vegetation**

VIII.B.2.d. Seasonally / temporarily flooded medium tall grassland

VIII.B.2.d.v. *Juncus dichotomus* Herbaceous Alliance

***Juncus dichotomus - Drosera intermedia* Herbaceous Vegetation**

VIII.B.2.d.vi. *Panicum virgatum* (seasonally flooded) Herbaceous Alliance

***Panicum virgatum - Spartina patens* Herbaceous Vegetation**

VIII.B.2.d.vii. *Scirpus pungens* (seasonally flooded) Herbaceous Alliance

***Scirpus pungens - Fimbristylis castanea* Herbaceous Vegetation**

VIII.C. Short grassland

VIII.C.2. Temperate and subpolar short grassland

VIII.C.2.b. Open short grassland

VIII.C.2.b.i. *Spartina patens* - *Scirpus pungens* Herbaceous Alliance

***Spartina patens* - *Scirpus pungens* - *Solidago sempervirens* (Upland) Herbaceous Vegetation**

VIII.C.2.e. Saltwater tidal regularly/irregularly flooded short grassland

VIII.C.2.e.i. *Spartina patens* (Estuarine) Herbaceous Alliance

***Spartina patens* - *Distichlis spicata* - *Borrichia frutescens* Herbaceous Vegetation**

VIII.E. Low forb vegetation

VIII.E.1. Perennial low forb vegetation

VIII.E.1.b. Saltwater tidal semipermanently flooded low perennial forb vegetation

VIII.E.1.b.i. *Salicornia* - *Spartina alterniflora* Herbaceous Alliance

***Salicornia* spp. - *Sarcocornia perennis* - *Spartina alternifolia* Herbaceous Vegetation**

IX. Sparsely vegetated

IX.D. Sparsely vegetated sand accumulations

IX.D.1. Sparsely vegetated sand dunes

IX.D.1.e. Storm tide irregularly flooded upper beaches

IX.D.1.e.i. *Cakile edentula* Sparsely Vegetated Alliance

***Cakile edentula* ssp. *edentula* - *Salsola caroliniana* Sparse Vegetation**

VEGETATION DESCRIPTIONS

Pinus taeda / Myrica cerifera / Osmunda regalis Forest

COMMON NAME: Loblolly pine / waxmyrtle / royal fern Forest

SYNONYM: Estuarine fringe loblolly pine forest

TNC SYSTEM: Terrestrial

PHYSIOGNOMIC CLASS: Forest

PHYSIOGNOMIC SUBCLASS: Evergreen forest

PHYSIOGNOMIC GROUP: Temperate and subpolar needle-leaved evergreen forest

FORMATION: Needle-leaved evergreen seasonally flooded / saturated forest with rounded crowns

ALLIANCE: *Pinus taeda* (wetland) Forest Alliance

CLASSIFICATION CONFIDENCE LEVEL: 2

RANGE: This community ranges from the coast of Delaware to North Carolina.

ENVIRONMENTAL DESCRIPTION: This community is a maritime / coastal loblolly pine wetland forest occurring in backdune depressions intersecting the water table. Soils are characterized by moderately shallow muck (15 cm) overlying organic matter-stained sands. This vegetation occurs adjacent to salt marshes, sometimes even forming small "islands" within high salt marsh. This forest occurs on Assateague Island NS almost exclusively in association with the upland *Pinus taeda / Vitis rotundifolia* Forest Community as a result of the relatively high water table and natural undulations on the dune surface. Where sand has accumulated to a depth of 0.5m or more above the water table, leaf litter accumulates as undecomposed duff, but where the substrate intersects the water table, organic material accumulates as muck.

USFWS WETLAND SYSTEM: Palustrine System

MOST ABUNDANT SPECIES:

Globally:

Strata	Species
Tree canopy	*Pinus taeda*
Tall shrub	*Myrica cerifera*

Herbaceous	*Polygonum pensylvanicum*
Vine/liana	*Similax rotundifolia, Toxicodendron radicans*

ASIS:

Strata	Species
Tree canopy	*Pinus taeda*
Tall shrub	*Myrica cerifera*
Herbaceous	*Polygonum pensylvanicum*
Vine/liana	*Smilax rotundifolia, Toxicodendron radicans*

DIAGNOSTIC SPECIES: *Pinus taeda, Myrica cerifera, Smilax rotundifolia*

VEGETATION DESCRIPTION: This coastal wetland forest community is characterized by closed to partially open canopy dominated by *Pinus taeda*. Other canopy associates may be absent, or may include *Acer rubrum*, *Persea palustris*, or *Liquidambar styraciflua*. The understory is made up of vines, strongly dominated by *Smilax rotundifolia*, with lesser amounts of *Toxicodendron radicans* and *Parthenocissus quinquefolia*. In addition to comprising the majority of the ground layer of these forests, these vines are relatively large-stemmed lianas that contribute significant cover to the canopy by covering the lower branches of trees. *Myrica cerifera* is a typical shrub of this community. The herbaceous layer is usually relatively sparse, characterized most frequently by ferns such as *Woodwardia areolata, Osmunda regalis,* or *Osmunda cinnamomea. Polygonum pensylvanicum* may also occur.

On Assateague Island NS, *Pinus taeda* dominates the canopy, with occasional *Acer rubrum. Smilax rotundifolia* is the strongly dominant vine of the understory, with lesser amounts of *Toxicodendron radicans* and *Parthenocissus quinquefolia*. *Myrica cerifera* is also a minor component of this vegetation. Despite the shallow water table and presence of muck, there is little reflection of the influence of hydrology on the vegetation. Trees tend to occur on slightly elevated hummocks, with standing water evident in hollows. *Phragmites australis, Rubus argutus, Panicum virgatum,* and *Polygonum pensylvanicum* also occur within this community on Assateague Island NS. Tree diameters range from 12-36 cm at breast height. This community occurs primarily on the bay side of the island adjacent to salt marsh.

OTHER NOTEWORTHY SPECIES: *Acer rubrum* and *Persea palustris* are often canopy associates; *Arundinarea gigantea* is a component of this community in North Carolina.
CONSERVATION RANK: G2G3

RANK JUSTIFICATION: This type is restricted to the mid-Atlantic coast and vulnerable to development pressure.

COMMENTS: The pine woodland of Higgins et al. (1971), the woodland community of Hill (1986), the mature loblolly pine stands of wet sites described from Cape Hatteras by Bratton and Davison (1987), and the loblolly pine association of Brush et al. (1980) are partially contained within this community. The estuarine fringe loblolly pine forest of Schafale and Weakley (1990) and the coniferous swamp described from eastern Maryland by Shreve et al. (1910) are synonymous with this type.

REFERENCES:

Bratton, S.P. and K. Davison 1987. Disturbance and succession in Buxton Woods, Cape Hatteras, North Carolina. Castanea 52: 166-179.

Brush, G.S., C. Lenk, and J. Smith. 1980. The natural forests of Maryland: an explanation of the vegetation map of Maryland. Ecol. Monogr. 50: 77-92.

Higgins, E.A.T., R.D. Rappleye, and R.G. Brown. 1971. The flora and ecology of Assateague Island. University of Maryland Agriculture Experiment Station Bull. A-172. 70 pp.

Hill, S. 1986. An annotated checklist of the vascular flora of Assateague Island (Maryland and Virginia). Castanea 5: 265-305.

Schafale, M.P. and A.S. Weakley. 1990. Classification of the natural communities of North Carolina. Third Approximation. North Carolina Natural Heritage Program, Division of Parks and Recreation, N.C. Dept. of Environment, Health, and Natural Resources. Raleigh, NC. 325 p.

Shreve, F., M.A. Chrysler, F.H. Blodgett, F.W. Besley. 1910. The Plant Life of Maryland. Maryland Weather Service. Special Publication, Vol. III. Johns Hopkins Press, Baltimore, MD.

PLOTS:

42AB05

Prunus serotina / Myrica cerifera / Smilax rotundifolia Forest

COMMON NAME:	Black Cherry / Waxmyrtle / Greenbrier Forest
SYNONYM:	Maritime forest; Deciduous Maritime Scrub Forest
TNC SYSTEM:	Terrestrial
PHYSIOGNOMIC CLASS:	Forest
PHYSIOGNOMIC SUBCLASS:	Deciduous forest
PHYSIOGNOMIC GROUP:	Cold-deciduous forest
FORMATION:	Lowland and submontane broad-leaved cold-deciduous forest
ALLIANCE:	*Prunus serotina , Amelanchier canadensis , Quercus* spp. Forest Alliance

CLASSIFICATION CONFIDENCE LEVEL: 2

RANGE: This community occurs on the coast from Delaware to Virginia; the range may also include southern New Jersey.

ENVIRONMENTAL DESCRIPTION:
This community occurs on the coast, and is subject to salt spray and winds. Occurrences of this community on barrier islands and on dunes of the mainland exhibit wind-pruning. The substrate of this community varies from pure sand directly adjacent to the ocean, to loamy sands in more sheltered areas of the coast.

This community generally occurs behind the interdunes on Assateague Island NS and often, but not always, exhibits the same "sunken forest" quality noted further north in New York (Stalter 1979) and southern New Hampshire (Dunlop and Crow 1985). This sunken forest refers to the topography created by large depressions, lower in elevation (by 1 to 3 meters) than the interdunes themselves. Interdunes often shield this community from strong prevailing winds and salt spray, permitting lush growth of broadleaf shrub and vine species.

USFWS WETLAND SYSTEM: Not applicable

MOST ABUNDANT SPECIES:

Globally:

Strata	Species
Tree canopy	*Prunus serotina, Amelanchier canadensis, Sassafras albidum*
Tall shrub	*Myrica cerifera*
Herbaceous	(absent)
Vine/liana	*Smilax rotundifolia, Parthenocissus quinquefolia, Toxicodendron radicans*

ASIS

Strata	Species
Tree canopy	*Prunus serotina, Aronia arbutifolia*
Tall shrub	*Myrica cerifera, Vaccinium corymbosum*
Herbaceous	*Festuca rubra*
Vine/liana	*Smilax rotundifolia, Smilax glauca*

DIAGNOSTIC SPECIES: *Prunus serotina, Myrica cerifera, Pinus taeda*

VEGETATION DESCRIPTION: This community is a temperate deciduous maritime forest, generally occurring on the lee side of sand dunes. Although placed within the forest class, the physiognomy of this vegetation is very variable and ranges from open woodland to stunted forest to dense nearly impenetrable thicket. Individual trees tend to be wind-pruned and multiple-stemmed. This community is characterized by *Prunus serotina, Amelanchier canadensis, Pinus taeda, Aronia arbutifolia,* and *Sassafras albidum* in varying proportions. *Myrica cerifera* may form a subcanopy, but if the forest is particularly stunted, this species may contribute substantially to the canopy as well. As other communities in this alliance, the *Prunus serotina / Myrica cerifera , Smilax rotundifolia* community supports a number of vines in great abundance, such as *Smilax rotundifolia, Smilax glauca, Parthenocissus quinquefolia,* and *Toxicodendron radicans.* Herbs are generally scarce to lacking entirely, and when present are generally made up of tree and vine seedlings.

Assateague Island NS supports variable expressions of this community, but in general they are characterized by a tree canopy that is patchy, open and of variable species composition; *Prunus serotina, Acer rubrum, Amelanchier canadensis, Diospyros virginiana,* and *Pyrus angustifolia* contribute variable cover. In some areas, *Prunus serotina* contributes only minor cover in comparison to *Acer rubrum* and *Aronia arbutifolia*. Stunted trees are evenly mixed with tall *Myrica cerifera* and *Vaccinium corymbosum* to form dense vegetation. To a much lesser extent, *Pinus taeda* and *Ilex opaca* may occur locally. The dense tall shrub layer is dominated by *Myrica cerifera* with *Vaccinium corymbosum* as a common associate. Less common, yet scattered throughout are shrubs of *Aronia arbutifolia.* Tangled over most of the sub-canopy and shrub layers of this community is a dense cover of vines, predominantly *Smilax rotundifolia, Smilax glauca, Parthenocissus quinquefolia,* and *Toxicodendron radicans* making this vegetation almost impenetrable. Herb cover is sparse to non-

existent due to heavy shading from the dense canopy above. Most obvious are *Festuca rubra, Rumex acetosella* and vine seedlings sparsely scattered on the dry leaf litter.

OTHER NOTEWORTHY SPECIES: None

CONSERVATION RANK : G2G3

RANK JUSTIFICATION: This type is restricted to the mid-Atlantic coast and vulnerable to development pressure.

COMMENTS: This community is similar to the *Prunus serotina, Sassafras albidum , Amelanchier canadensis / Smilax rotundifolia* community of the same alliance (Anderson, Sneddon, and Metzler 1994) ranging from southern New Hampshire to New Jersey, but is differentiated from this community by the presence of *Pinus taeda* and *Myrica cerifera*. The woodland community (Hill 1986) and the mixed woodland (Higgins et al. 1971) described from Assateague Island are partially contained within this community. The woodland described from Virginia by Boule (1979) is synonymous with this community. The range of this community is approximately the same as that of the floristic transition region of the maritime forests of the Atlantic coast proposed by Bellis (1992).

REFERENCES:

Anderson, M.G., Sneddon, L.A., and K.J. Metzler. 1994. In Grossman, D., K.L. Goodin, and C.L. Reuss. Rare Plant Communities of the Conterminous United States. The Nature Conservancy, Arlington, VA. 620 pp.

Bellis, V.J. 1992. Floristic continuity among the maritime forests of the Atlantic coast of the United States. In Cole, C.A. and K. Turner (eds). Barrier Island Ecology of the Mid-Atlantic Coast: A Symposium. Tech. Rep. NPS/SERCAHA/NRTR-93/04. National Park Service Southeast Regional Office, Science and Natural Resources Division, Atlanta, GA. 208 pp.

Boule, M.E. 1979. The vegetation of Fisherman Island, Virginia. Castanea 44: 98-108.

Breden, T.F. 1989. A preliminary natural community classification for New Jersey. in E.F. Karlin (ed). New Jersey's Rare and Endangered Plants and Animals. Institute for Environmental Studies, Ramapo College, Mahwah, NJ. 280 p.

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.

Hill, S. 1986. An annotated checklist of the vascular flora of Assateague Island (Maryland and Virginia). Castanea 5: 265-305.

Higgins, E.A.T., R.D. Rappleye, and R.G. Brown. 1971. The flora and ecology of Assateague Island. University of Maryland Agriculture Experiment Station Bull. A-172. 70 pp.

Klotz, L.H. 1986. The vascular flora of Wallops Island and Wallops Mainland, Virginia. Castanea 5: 306-326.

Stalter, R. 1979. The major plant communities of the Fire Island National Seashore. Proc. of the 1st conference on Scientific Research in the National Parks. Vol. 1: 177-181.

PLOTS:

72AB01
42AB03
42AB01

Acer rubrum, Nyssa sylvatica, Magnolia virginiana Forest

COMMON NAME: Red maple , Black gum , Bay Forest

SYNONYM: Inland red aple swamp

TNC SYSTEM: Terrestrial

PHYSIOGNOMIC CLASS: Forest

PHYSIOGNOMIC SUBCLASS: Deciduous forest

PHYSIOGNOMIC GROUP: Cold-deciduous forest

FORMATION: Lowland and submontane broad-leaved cold-deciduous forest

ALLIANCE: *Acer rubrum , Nyssa sylvatica* (wetland) Forest Alliance

CLASSIFICATION CONFIDENCE LEVEL: 3

RANGE:This community occurs on the coastal plain in New Jersey, Pennsylvania, Delaware, Maryland, and northern Virginia.

ENVIRONMENTAL DESCRIPTION: This community is a nutrient-poor wetland forest occurring in poorly drained depressions. Soils are typically moderately deep to deep muck over mineral soil, with pools of standing water at the surface. Water pH is acidic. At Assateague Island NS, standing water is not generally visible on the surface, but the water table is close to the surface.

USFWS WETLAND SYSTEM: Palustrine System

MOST ABUNDANT SPECIES:

Globally:

Strata	Species
Tree canopy	*Acer rubrum, Nyssa sylvatica, Liquidambar styraciflua*
Tall shrub	*Vaccinium corymbosum, Clethra alnifolia*
Herbaceous	*Osmunda cinnamomea, Osmunda regalis, Woodwardia areolata*
Non-vascular	*Sphagnum* spp.

ASIS:

Strata	Species
Tree canopy	*Acer rubrum*

Tall shrub	*Vaccinium corymbosum, Myrica cerifera*
Herbaceous	*Smilax rotundifolia*
Non-vascular	*Sphagnum* spp.

DIAGNOSTIC SPECIES: *Acer rubrum, Nyssa sylvatica, Magnolia virginiana, Osmunda cinnamomea*

VEGETATION DESCRIPTION: This community is characterized by *Acer rubrum* and *Nyssa sylvatica* in the canopy, which may be quite open in some examples. Canopy associates include *Magnolia virginiana*, *Liquidambar styraciflua,* and *Persea palustris*. The shrub layer is characterized by *Vaccinium corymbosum,* as well as *Clethra alnifolia, Ilex verticillata, Rhododendron viscosum*. The herbaceous layer is generally poorly developed, and may include *Symplocarpus foetidus, Triadenum virginicum, Lythrum lineare, Osmunda regalis, Woodwardia areolata,* and *Osmunda cinnamomea. Sphagnum* and other mosses are common.

At Assateague Island National Seashore, this community occurs in small isolated patches and is characterized by scattered individuals of *Acer rubrum* and more dense understory of *Vaccinium corymbosum, Myrica cerifera*, and *Smilax rotundifolia*. This community is better represented on the Virginia portion of Assateague Island, where it supports *Quercus nigra, Ilex opaca, Aronia arbutifolia,* and *Salix nigra* in the tree and shrub layers, and *Triadenum virginicum, Viola lanceolata, Lobelia siphilitica,* and *Galium obtusum* in the herb layer (Harvill 1967).

OTHER NOTEWORTHY SPECIES: None

CONSERVATION RANK: G3?

RANK JUSTIFICATION: Confidence in global rank is low; mature examples of this community are relatively rare.

COMMENTS: This community occurs only sparingly within Assateague Island NS, and always below minimum mapping unit in size. It always occurs as a complex, most commonly in close association with the *Pinus taeda / Myrica cerifera / Osmunda regalis* (Wetland) Forest with the *Prunus serotina / Myrica cerifera / Smilax rotundifolia* Forest as small inclusions or on the periphery of these forests.

The inland red maple swamp and the Cape May lowland swamp described by Breden (1989), the broadleaf swamp forest described from Cumberland County, New Jersey (Heckscher 1994), the *Acer rubrum, Quercus nigra , Nyssa sylvatica* swamp of Harvill (1967) described from the Virginia portion of Assateague Island and the woodland fresh marsh community of Hill (1986) are either contained within this community or synonymous with it.

REFERENCES:

Breden, T.F. 1989. A preliminary natural community classification for New Jersey. in E.F. Karlin (ed). New Jersey's Rare and Endangered Plants and Animals. Institute for Environmental Studies, Ramapo College, Mahwah, NJ. 280 p.

Harvill, A.M., Jr. 1967. The vegetation of Assateague Island, Virginia. Castanea 32: 105-108.

Heckscher, S. 1994. The vegetation of the Glades Region, Cumberland County, New Jersey. Bartonia 58: 101-113.

Hill, S. 1986. An annotated checklist of the vascular flora of Assateague Island (Maryland and Virginia). Castanea 5: 265-305.

PLOTS: (none)

Pinus taeda / Myrica cerifera / Vitis rotundifolia Forest

COMMON NAME:	Loblolly Pine / Waxmyrtle / Muscadine Forest
SYNONYM:	Coastal loblolly pine forest
TNC SYSTEM:	Terrestrial
PHYSIOGNOMIC CLASS:	Forest
PHYSIOGNOMIC SUBCLASS:	Mixed evergreen, deciduous forest
PHYSIOGNOMIC GROUP:	Mixed needle-leaved evergreen, cold-deciduous forest
FORMATION:	Mixed needle-leaved evergreen, cold-deciduous (upland) forest
ALLIANCE:	*Pinus taeda, Quercus (nigra, falcata)* Forest Alliance

CLASSIFICATION CONFIDENCE LEVEL: 2

RANGE: This community occurs discontinuously along the coast from Delaware south to North Carolina.

ENVIRONMENTAL DESCRIPTION: This community occurs on the outer coastal plain and on barrier islands in sheltered backdunes protected from salt spray and overwash. The substrate is rapidly drained sands or sandy loams which are nutrient poor.

On Assateague Island NS, this community occurs more frequently towards the western or bay side, often adjacent to the high salt marsh (*Spartina patens, Distichlis spicata , Borrichia frutescens* Herbaceous Vegetation). *Pinus taeda / Andropogon virginicus* Woodland often occurs as large distinct inclusions within the forest. The *Pinus taeda / Myrica cerifera / Osmunda regalis* (Wetland) Forest often occurs in close association with the *Pinus taeda / Myrica cerifera / Vitis rotundifolia* Forest, particularly in areas where the water table is close to the surface.

USFWS WETLAND SYSTEM: Not applicable

MOST ABUNDANT SPECIES:

Globally:

Strata	Species
Tree canopy	*Pinus taeda, Quercus falcata*

Tall shrub	*Myrica cerifera, Vaccinium corymbosum*
Vine / liana	*Vitis rotundifolia, Toxicodendron radicans, Smilax rotundifolia*
Herbaceous	*Chasmanthium laxum*

ASIS:

Strata	Species
Tree canopy	*Pinus taeda*
Tall shrub	*Myrica cerifera, Vaccinium corymbosum*
Vine / liana	*Toxicodendron radicans, Smilax rotundifolia, Vitis rotundifolia*
Herbaceous	*Chasmanthium laxum*

DIAGNOSTIC SPECIES: *Pinus taeda, Vitis rotundifolia, Chasmanthium laxum*

VEGETATION DESCRIPTION: This community is a mid-Atlantic coastal upland loblolly pine forest dominated by *Pinus taeda*. Although this community is predominantly needle-leaved, it is placed within a mixed forest alliance because of its strong floristic and ecologic affinity with other maritime forests of the *Pinus taeda, Quercus (nigra, falcata)* Forest Alliance. Canopy associates often include *Quercus falcata, Acer rubrum, Prunus serotina,* and *Sassafras albidum*. The tall shrub layer is comprised of *Myrica cerifera* and *Vaccinium corymbosum*. Vines and lianas are always present in abundance; *Vitis rotundifolia* is most commonly present, but *Toxicodendron radicans, Smilax rotundifolia, S. glauca,* and *Parthenocissus quinquefolia* are usually present in abundance as well. The herbaceous layer may be sparse, particularly if shrubs and vines are dense, but *Chasmanthium laxum* may be fairly abundant in this community. Other herbs include *Chasmanthium laxum, Panicum amarulum, Eupatorium hyssopifolium,* and *Elephantopus nudatus*. In southern Virginia and North Carolina, *Quercus virginiana* and *Gelsemium sempervirens* may also be present, but *Quercus virginiana* is never abundant and when present is usually restricted to the understory.

Assateague Island NS occurrences of this community are characterized by mature forests of *Pinus taeda* (DBHs ranging from 20-55 cm) with canopy closures up to 85 percent with very few, or no other associated canopy species. Scattered deciduous trees make up a sparse subcanopy tree layer, comprising less than 15 percent cover and more often even less than 5 percent. Subcanopy trees include such species as *Sassifras albidum, Acer rubrum, Juniperus virginiana, Diospyros virginiana, Amelanchier canadensis,* and *Magnolia virginiana*. Typically, no *Pinus taeda* is found in the subcanopy of the mature forests at Assateague. Shrub cover is variable but generally not prevalent. *Myrica cerifera* is common in clumps and scattered individuals of *Vaccinium corymbosum, Diospyros virginiana, Amelanchier canadensis,* and *Sassafras albidum* are local in the shrub layer. These forests have various densities of vine cover ranging from very dense (80 percent) to sparse (15 percent). *Smilax rotundifolia* and *Vitis rotundifolia* are characteristic, often climbing into the lower tree canopy. Also, *Toxicodendron radicans, Smilax glauca,* and *Parthenocissus quinquifolia* are other common vines in this community. The herb layer is generally sparse, falling below 30% cover. Tree seedlings (*Sassafras albidum, Pinus taeda, Acer rubrum*) are common, and the grass

Chasmanthium laxum is almost always present. *Panicum virgatum, Mitchella repens, Andropogon glomeratus, Carex albolutescens,* and *Elephantopus nudatus* are present, but much less frequent.

OTHER NOTEWORTHY SPECIES: None

CONSERVATION RANK: G2G3

RANK JUSTIFICATION: These forests are restricted to a narrow geographic range in regions particularly vulnerable to development pressure.

COMMENTS: Logging of predominantly live oak maritime forests in North Carolina is suspected to have caused expansion of forests dominated by *Pinus taeda* (Bratton and Davison 1987; Schafale and Weakley 1990), and logging likely impacted the maritime forests of Assateague Island as well (Higgins et al. 1971). However, disturbance brought on by high winds and coastal storms has always been a part of coastal systems and natural coastal and maritime forests dominated by *Pinus taeda* are likely to have always occurred.

The following descriptions are synonymous with the *Pinus taeda / Myrica cerifera / Vitis rotundifolia* Forest: *Pinus taeda / Myrica* coastal forest association in Delaware (Clancy 1993); mature loblolly pine forest of dry sites at Cape Hatteras (Bratton and Davison 1987); the *Pinus taeda* community described from Assateague Island, Virginia (Harvill 1967); the pine woodland and the pine-deciduous hardwood woodland of the Virginia portion of Assateague Island (Stalter 1990); the upland forest of Virginia described by Klotz (1986); and the mature loblolly pine stand at Angola Neck, Delaware (Fleming 1978). Portions of the maritime deciduous forest in North Carolina (Schafale and Weakley (1990), the woodland community of Assateague Island (Hill 1986), and of the mesic forest and maritime forest at Virginia Beach (Clampitt 1992) are included within this community.

This community has floristic affinity with communities of the *Quercus virginiana* Forest Alliance, but is differentiated by a strong dominance by *Pinus taeda* and lack of species of southern maritime forests such as *Sabal minor* and *Osmanthus americanus*. This community also shares a number of species in common with the *Prunus serotina / Myrica cerifera / Smilax rotundifolia* Forest, but is differentiated by a strong dominance by *Pinus taeda*, a structure characterized by generally taller and straighter trees, a better developed herbaceous layer, and in general, a more protected position in back dunes.

REFERENCES:

Bratton, S.P. and K. Davison 1987. Disturbance and succession in Buxton Woods, Cape Hatteras, North Carolina. Castanea 52: 166-179.

Clampitt. C.A. 1992. The upland plant communities of Seashore State Park, Virginia Beach, Virginia. Virginia Journal of Science. 42: 419-435.

Clancy, K. 1993. A preliminary classification of the natural communities of Delaware (draft). Delaware Natural Heritage Inventory, Div. of Parks and Recreation, Dover, DE. 30 p.

Fleming, L.M. 1978. Delaware's Outstanding Natural Areas and their Preservation. Delaware Nature Education Society, Hockessin, DE. 422 pp.

Harvill, A.M., Jr. 1967. The vegetation of Assateague Island, Virginia. Castanea 32: 105-108.

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Stalter, R. 1990. The vascular flora of Assateague Island, Virginia. Bull. Torr. Bot. Club 117: 48-56.

PLOTS:

67AB01
67AB06
67AB04
62AB01
52AB07

Pinus taeda / Hudsonia tomentosa Woodland

COMMON NAME: Loblolly pine / Beach Heather Woodland

SYNONYM: Loblolly pine woodland; Loblolly pine dune woodland

TNC SYSTEM: Terrestrial

PHYSIOGNOMIC CLASS: Woodland

PHYSIOGNOMIC SUBCLASS: Evergreen woodland

PHYSIOGNOMIC GROUP: Needle-leaved evergreen woodland

FORMATION: Needle-leaved evergreen woodland with rounded crowns

ALLIANCE: *Pinus taeda* Woodland Alliance

CLASSIFICATION CONFIDENCE LEVEL: 3

RANGE: This community probably ranges from Delaware south along the coast to northern Virginia, but further research will be required to determine the range with greater confidence.

ENVIRONMENTAL DESCRIPTION: This community is a maritime woodland of sand dunes. Soils in this community are sandy and rapidly drained. Unlike the *Pinus taeda / Myrica cerifera / Vitis rotundifolia* Forest, this community often occurs directly adjacent to actively shifting foredune and is exposed to salt spray, winds, and storms. The community also occurs on unstable sands of protected backdunes. In the denser woodlands, more pine duff accumulates and herb diversity and cover is generally higher. Where woodlands are more open and trees sparse, growing conditions are harsh, less duff accumulates, and vast areas of exposed white sand are characteristic.

Large areas of this woodland occur on Assateague Island NS, both on foredunes and on protected backdunes.

USFWS WETLAND SYSTEM: Not applicable

MOST ABUNDANT SPECIES:

Globally:

Strata	Species
Tree canopy	*Pinus taeda*

Herbaceous	*Andropogon virginicus, Hudsonia tomentosa, Dichanthelium acuminatum*

ASIS:

Strata	Species
Tree canopy	*Pinus taeda*
Herbaceous	*Andropogon virginicus, Hudsonia tomentosa, Dichanthelium acuminatum*

DIAGNOSTIC SPECIES: *Pinus taeda, Hudsonia tomentosa*

VEGETATION DESCRIPTION: This maritime woodland community may be restricted to barrier islands of the mid-Atlantic. Trees are generally characterized by low spreading branches and multiple trunks. A shrub layer is lacking, herbaceous cover is usually low, and the vines so evident in all other forests of Assateague Island NS are scarce. Large patches of exposed sand are not uncommon. This community is poorly known regionally. Few published accounts of maritime forests make reference to open-canopy woodlands in the mid-Atlantic. This description is based on data collected from Assateague Island NS.

This community is characterized by a very open canopy created by sparsely distributed *Pinus taeda.* The tree canopy ranges from 10 to 50 percent closure and tree diameter and height is generally less, ranging from 10 to 30 cm and 6 to 10 m respectively. *Pinus taeda* dominates the canopy, but hardwoods such as *Quercus falcata, Q. phellos,* and *Ilex opaca* are frequent. The oaks often take on picturesque, low spreading multiple trunks. Younger, smaller pines make up a sparse subcanopy. Tall shrubs are also sparse, although an occasional *Myrica cerifera, Pinus taeda* sapling, or *Vaccinium corymbosum* can be found. Sparse low shrubs of *Hudsonia tomentosa* are more common (contributing less than 5 percent cover). *Smilax glauca* and *Toxicodendron radicans* are typical vine species but also make up less than 5 percent cover. Herbs are sparse, yet much varied. *Andropogon virginicus* and *Smilax rotundifolia* are commonly present. The typical pattern of herb distribution is on dry open sand, in direct sunlight. Here, small patches of *Dichanthelium acuminatum, D. scoparium, Andropogon virginicus, Eupatorium rotundifolium, Erigeron sp., Euthamia tenuifolia, Solidago sempervirens,* and *Gnaphalium obtusifolium* are typically mixed with scattered *Hudsonia tomentosa* and *Smilax rotundifolia*. In total, herb cover ranges from 5 to 40 percent, generally near the lower end of the scale.

Small depressions under shading trees may hold *Juncus dichotomus, J. canadensis, Scirpus pungens, Chasmanthium laxum, Panicum virgatum,* or *Andropogon virginicus* and *A. glomeratus*. These comprise very low cover but reflect a tendency for low moist sandy depressions to occur within the woodland.

OTHER NOTEWORTHY SPECIES: None

CONSERVATION RANK: G2

RANK JUSTIFICATION: This community is probably restricted to barrier islands or foredunes of the mid-Atlantic coastal mainland. Further research will be required to justify the rank.

COMMENTS: This woodland community often occurs in complex with the *Hudsonia tomentosa / Panicum (amarum, amarulum)* Dwarf-shrubland, and may actually represent a natural succession of dwarf-shrubland to woodland.

The pine woodland of Higgins et al. (1971) and the woodland community of Hill (1986) described from Assateague Island are partially contained within this community. The upland forest described from northern Virginia by Klotz (1986) is suspected to contain this community, but will require further research. Portions of the maritime forest and the dune woodland described by Clampitt (1992) from Virginia Beach are floristically and ecologically related to this community and may be classified as such when additional regional data become available.

REFERENCES:

Clampitt. C.A. 1991. The upland plant communities of Seashore State Park, Virginia Beach, Virginia. Virginia Journal of Science. 42: 419-435.

Higgins, E.A.T., R.D. Rappleye, and R.G. Brown. 1971. The flora and ecology of Assateague Island. University of Maryland Agriculture Experiment Station Bull. A-172. 70 pp.

Hill, S. 1986. An annotated checklist of the vascular flora of Assateague Island (Maryland and Virginia). Castanea 5: 265-305.

Klotz, L.H. 1986. The vascular flora of Wallops Island and Wallops Mainland, Virginia. Castanea 5: 306-326.

PLOTS:

32RR03
47AB01
52AB03
42AB04
62AB02

Myrica pensylvanica / Diodia teres Shrubland

COMMON NAME: Bayberry / PoorjoeShrubland

SYNONYM: Maritime shrubland; Bayberry dune shrubland

TNC SYSTEM: Terrestrial

PHYSIOGNOMIC CLASS: Shrubland

PHYSIOGNOMIC SUBCLASS: Deciduous shrubland

PHYSIOGNOMIC GROUP: Cold-deciduous shrubland

FORMATION: Temperate deciduous shrubland

ALLIANCE: *Myrica pensylvanica, (Prunus maritima)* Shrubland Alliance

CLASSIFICATION CONFIDENCE LEVEL: 2

RANGE: This community occurs from Delaware south to northern North Carolina.

ENVIRONMENTAL DESCRIPTION: This maritime shrubland community usually occupies the area intermediate between the very unstable oceanward portions of the dunes and the more protected backdunes, where it forms partially open to dense shrub thickets. The substrate is sand with no soil profile development, and with variable amounts of accumulated leaf litter. Where this community occupies the lee side of foredunes, greater exposure to winds and storms contributes to a shorter stature and more open aspect of the vegetation. Here, there are large patches of open unvegetated or sparsely vegetated sand.

On Assateague Island NS, this community is exposed to winds and salt spray, occurring on the unstable sands of foredunes, but well beyond tidal influence. Storm surges and overwash frequently kill back the shrubs, however, imposing a perpetual long-term disturbance regime. Large expanses of unvegetated sand are characteristic, although the vegetation may be quite patchy and dense in some areas that have remained relatively undisturbed for longer time periods. The substrate is generally deep (greater than 1 meter) unconsolidated sands, with the water table usually exceeding this depth.

USFWS WETLAND SYSTEM: Not applicable

MOST ABUNDANT SPECIES:

Globally:

Strata	Species
Short shrub	*Myrica pensylvanica, Myrica cerifera*
Herbaceous	*Solidago sempervirens, Ammophila breviligulata, Diodia teres*

ASIS:

Strata	Species
Short shrub	*Myrica pensylvanica, Myrica cerifera*
Herbaceous	*Solidago sempervirens, Ammophila breviligulata, Triplasis purpurea, Oenothera humifusa*

DIAGNOSTIC SPECIES: *Myrica pensylvanica, Diodia teres*

VEGETATION DESCRIPTION: This community is a maritime shrubland dominated by *Myrica pensylvanica*. It supports the following species characteristic of the *Myrica pensylvanica, (Prunus maritima)* Shrubland Alliance, including *Solidago sempervirens, Oenothera humifusa, Cyperus grayii, Ammophila breviligulata, Chamaesyce polygonifolia, Rhus copallinum,* and from Maryland and north, *Prunus maritima*. This community is further characterized by species that differentiate it from other communities in the alliance, most notably *Myrica cerifera, Panicum amarulum, Spartina patens, Baccharis halimifolia,* and stunted individuals of *Pinus taeda*.

On Assateague Island NS, this community is characterized by sparse (generally less than 50%) cover of low or stunted *Myrica pensylvanica*. The low growth form (less than 1.5 meters) of *M. pensylvanica* is partially the result of sand burial, sometimes almost covering individual shrubs. *Myrica pensylvanica, Solidago sempervirens,* and *Ammophila breviligulata* are the most characteristic species of this community at Assateague Island NS. Much less frequent are shrubs of *Baccharis halimifolia, Diospyros virginiana,* and *Myrica cerifera*. *Prunus maritima* occurs sparingly, as Assateague is the southern range limit of this species, but it can be found in very local patches or as individuals within this foredune community as a shrub or small tree in growth form. The constant movement of sand in this community also limits the herbaceous cover. Species suited to these shifting sands include sparse *Hudsonia tomentosa* with *Solidago sempervirens* and *Ammophila breviligulata*. Other herbaceous species characteristic but sparsely distributed in this community include *Diodia teres, Panicum amarulum, Triplasis purpurea, Toxicodendron radicans, Chamaesyce polygonifolia, Cenchrus tribuloides, Parthenocissus quinquefolia, Lechea maritima, Dichanthelium acuminatum,* and *Rumex acetosella.* This community is common on Assateague Island NS, occurring most frequently on the southern portion of the island beyond the limits of the artificially created and maintained foredune planted with *Ammophila breviligulata*. This community also occurs on the northern tip of the island on artificial habitat created by dredge spoil deposition; here the vegetation is less typical and supports a number of exotic species in addition to those previously mentioned, including *Bromus tectorum, Vulpia myuros, Lepidium* spp., and *Trifolium arvense*. Total shrub cover is also greater here than in most other occurrences of the more natural manifestation of this community.

OTHER NOTEWORTHY SPECIES: None

CONSERVATION RANK: G2G3

RANK JUSTIFICATION: This community is restricted to coastal dunes of the mid-Atlantic, and is vulnerable to development pressure.

COMMENTS: The *Prunus maritima, Myrica pensylvanica* coastal dune scrub association described from Delaware (Clancy 1993) and the dunegrass-shrub transition zone of Assateague Island described by Higgins et al. (1971) are synonymous with this community. The shrub succession community (Hill 1986) and the dunegrass-shrub transition zone (Higgins et al. 1971) described from Assateague Island, and the upland (dune) thicket described from Virginia (Klotz 1986) are partially contained within this community.

REFERENCES:

Clancy, K. 1993. A preliminary classification of the natural communities of Delaware (draft). Delaware Natural Heritage Inventory, Div. of Parks and Recreation, Dover, DE. 30 p.

Higgins, E.A.T., R.D. Rappleye, and R.G. Brown. 1971. The flora and ecology of Assateague Island. University of Maryland Agriculture Experiment Station Bull. A-172. 70 pp.

Hill, S. 1986. An annotated checklist of the vascular flora of Assateague Island (Maryland and Virginia). Castanea 5: 265-305.

Klotz, L.H. 1986. The vascular flora of Wallops Island and Wallops Mainland, Virginia. Castanea 5: 306-326.

PLOTS:

57AB08
47AB06
12RR04
52AB06
32CEF
12RR02
77AB05
22RR01
12RR03

Myrica cerifera / Hydrocotyle spp. Shrubland

COMMON NAME: Waxmyrtle / Water Pennywort Shrubland

SYNONYM: Maritime shrub; Wet maritime shrubland

TNC SYSTEM: Terrestrial

PHYSIOGNOMIC CLASS: Shrubland

PHYSIOGNOMIC SUBCLASS: Evergreen shrubland

PHYSIOGNOMIC GROUP: Broad-leaved evergreen shrubland

FORMATION: Broad-leaved evergreen saturated shrubland

ALLIANCE: *Myrica cerifera* (wetland) Shrubland Alliance

CLASSIFICATION CONFIDENCE LEVEL: 3

RANGE: The range of this community has not been fully evaluated, but likely includes Delaware to North Carolina.

ENVIRONMENTAL DESCRIPTION: This community is a maritime tall wetland shrubland of backdunes. It is influenced by a shallow water table, as evidenced by the presence of obligate and facultative wetland species in the herbaceous layer. Surface water may be evident in pools, and a shallow to moderately deep layer of muck usually characterizes the soil profile, although the hydrologic regime of this alliance is somewhat variable. On Assateague Island NS, moderately deep, wet, mucky soils are characteristic.

USFWS WETLAND SYSTEM: Palustrine system

MOST ABUNDANT SPECIES:

Globally:

Strata	Species
Tall shrub	*Myrica cerifera, Baccharis halimifolia*
Herbaceous	*Toxicodendron radicans, Parthenocissus quinquefolia*

ASIS:

Strata	Species
Tall shrub	*Myrica cerifera, Baccharis halimifolia*

Herbaceous	*Toxicodendron radicans, Chasmanthium laxum, Polygonum pensylvanicum*

DIAGNOSTIC SPECIES: *Myrica cerifera, Hydrocotyle verticillata*

VEGETATION DESCRIPTION: This community has not been fully evaluated regionally, and is largely based on data collected from Assateague Island NS. It is a tall maritime shrubland of sheltered backdunes. It is characterized by tall, tree-like dense shrub growth dominated by *Myrica cerifera,* with associates including *Baccharis halimifolia, Acer rubrum, Vaccinium corymbosum, Rosa palustris, Ilex opaca*; common herbs include *Hydrocotyle* spp., *Juncus dichotomus, Juncus scirpoides, Woodwardia areolata, Osmunda regalis, Carex albolutescens, C. hormathodes, Leersia virginica, Polygonum pensylvanicum, Boehmeria cylindrica,* and *Rubus flagellaris*.

At Assateague Island NS, this shrubland community typically forms a dense (greater than 80%) cover dominated by *Myrica cerifera*. Large individuals of *Baccharis halimifolia* are also scattered throughout. Shrubs are tall, reaching heights of 6m and appear tree-like in their growth form. This community is prevalent at Assateague Island NS, forming vast thickets, particularly in more protected areas behind the artificial dune, most typically located between the bayside high marsh herbaceous vegetation and the inner-island forests. Commonly associated species include *Rosa palustris, Baccharis halimifolia,* and *Myrica pensylvanica* in the shrub layer. Herbaceous vegetation is also quite lush and diverse. Common herbs include *Calystegia sepium, Galium obtusum, Chasmanthium laxum, Panicum* spp., and *Festuca rubra*. *Toxicodendron radicans* is very common and constitutes a large portion of the "understory" cover. The well shaded, yet lush nature, promotes many additional facultative and obligate wetland species such as *Ludwigia palustris, Juncus canadensis, Eleocharis* sp., *Eleocharis rostellata, Ranunculus sceleratus, Ptilimnium capillaceum, Lycopus americanus, Bidens* spp., *Carex hormathodes, Samolus parviflorus, Hydrocotyle verticillata,* and *Polygonum pensylvanicum.*

OTHER NOTEWORTHY SPECIES: None

CONSERVATION RANK: Information not available.

RANK JUSTIFICATION: Further comparison with similar vegetation in Delaware, Virginia and North Carolina will be required to determine the conservation rank with confidence.

COMMENTS: This vegetation is prone to invasion by *Pragmites australis,* so this species can be found in various densities throughout, but generally never very prevalent over large areas. The mesic shrub zone of Higgins et al. (1986) and the shrub succession community of Hill (1971) described from Assateague Island, as well as the thicket community of Boule (1979) and the swamp thicket of Klotz (1986) described from Virginia are partially contained within this community. Maritime shrub vegetation occurring on sites having a high water table, described for North Carolina by Schafale and Weakley (1990) is also likely contained in part within this community.

REFERENCES:

Boule, M.E. 1979. The vegetation of Fisherman Island, Virginia. Castanea 44: 98-108.

Higgins, E.A.T., R.D. Rappleye, and R.G. Brown. 1971. The flora and ecology of Assateague Island. University of Maryland Agriculture Experiment Station Bull. A-172. 70 pp.

Hill, S. 1986. An annotated checklist of the vascular flora of Assateague Island (Maryland and Virginia). Castanea 5: 265-305.

Klotz, L.H. 1986. The vascular flora of Wallops Island and Wallops Mainland, Virginia. Castanea 5: 306-326.

Schafale, M.P. and A.S. Weakley. 1990. Classification of the natural communities of North Carolina. Third Approximation. North Carolina Natural Heritage Program, Division of Parks and Recreation, N.C. Dept. of Environment, Health, and Natural Resources. Raleigh, NC. 325 p.

PLOTS:

67AB05
37AB06

Myrica (cerifera, pensylvanica), Vaccinium corymbosum Shrubland

COMMON NAME: (Waxmyrtle, Bayberry), Highbush Blueberry Shrubland

SYNONYM: Shrub bog

TNC SYSTEM: Terrestrial

PHYSIOGNOMIC CLASS: Shrubland

PHYSIOGNOMIC SUBCLASS: Deciduous shrubland

PHYSIOGNOMIC GROUP: Cold-deciduous shrubland

FORMATION: Deciduous seasonally / temporarily flooded shrubland

ALLIANCE: *Myrica (cerifera, pensylvanica) , Vaccinium corymbosum* (wet) Shrubland Alliance

CLASSIFICATION CONFIDENCE LEVEL: 3

RANGE: This community occurs in Delaware and Maryland, and may extend to Virginia.

ENVIRONMENTAL DESCRIPTION: This community occurs in seasonally flooded interdunal depressions. On Assateague Island NS, these depressions remain saturated and hold standing water (to a depth of less than .15 meters) early in the growing season. Standing water disappears later in the summer, but soils remain somewhat moist throughout the season. A shallow organic layer (1-5 cm) overlies sand.

USFWS WETLAND SYSTEM: Palustrine System

MOST ABUNDANT SPECIES:

Globally:

Strata	Species
Short shrub	*Myrica cerifera, Vaccinium corymbosum*
Herbaceous	*Drosera intermedia, Panicum virgatum, Scirpus pungens*

ASIS:

Strata	Species
Short shrub	*Myrica cerifera, Vaccinium corymbosum*
Herbaceous	*Drosera intermedia, Panicum virgatum, Scirpus pungens*

DIAGNOSTIC SPECIES: *Myrica cerifera, Vaccinium corymbosum, Osmunda regalis, Drosera intermedia, Xyris torta*

VEGETATION DESCRIPTION: This community is a relatively open, short-statured shrub wetland. The two most characteristic shrubs are *Myrica cerifera* and *Vaccinium corymbosum*. *Rosa palustris* and *Myrica pensylvanica* are two other common shrub associates. Unlike the *Myrica cerifera / Hydrocotyle* spp. Shrubland, this community is of generally shorter stature. *Panicum virgatum, Andropogon virginicus* and other grasses are common. Other herbs include *Juncus canadensis, J. scirpoides, J. dichotomus, Pluchea foetida, Triadenum virginicum, Drosera intermedia, Lycopodiella appressa, Xyris torta,* and *Osmunda regalis.*

This community is not widespread on Assateague Island NS, being largely confined to southern portion. Occurrences range in size from an eighth to a quarter hectare and are generally located in the interdunal areas of the inner-island. This community is distinct in that *Myrica cerifera* grows in standing water forming a 20 to 50 percent cover with *Vaccinium corymbosum* characteristically scattered around the perimeter of the wet depressions. It is characterized by patchy, open *Myrica cerifera* 1-2m tall, with lesser amounts of *Vaccinium corymbosum*. *Pinus taeda* seedlings and saplings may also be found scattered throughout. Characteristic of this community are high cover of particular grasses and rushes such as *Panicum virgatum, Scirpus pungens, Juncus dichotomus, Juncus canadensis*, and to a lesser degree *Andropogon glomeratus and A. virginicus*. Other herbaceous species associated with this community include *Pluchea foetida, Rhexia mariana, Euthamia tenuifolia, Triadenum virginicum*, and occasionally *Osmunda regalis*. The presence of *Lycopodiella appressa, Drosera intermedia*, and *Xyris torta* suggest the presence of acidic, nutrient poor conditions, hence the local name "shrub bog."

OTHER NOTEWORTHY SPECIES: None

CONSERVATION RANK: Information not available.

RANK JUSTIFICATION: Insufficient information available to assign a rank.

COMMENTS: This alliance and community are poorly known; the description of the community is synonymous with the alliance and based largely on data collected from Assateague Island NS.

The mesic shrub zone (Higgins et al. 1971) is partially contained within this community, and the shrub bog (Hill 1986) is synonymous with the community. The scrub-shrub/mixed herbaceous interdunal wetland association of McAvoy and Clancy (1994) and the mesic shrub thicket described

from New Jersey by Martin (1959) are closely related floristically and ecologically, and may also be synonymous with this community.

REFERENCES:

Clancy, K. 1993. A preliminary classification of the natural communities of Delaware (draft). Delaware Natural Heritage Inventory, Div. of Parks and Recreation, Dover, DE. 30 p.

Higgins, E.A.T., R.D. Rappleye, and R.G. Brown. 1971. The flora and ecology of Assateague Island. University of Maryland Agriculture Experiment Station Bull. A-172. 70 pp.

Hill, S. 1986. An annotated checklist of the vascular flora of Assateague Island (Maryland and Virginia). Castanea 5: 265-305.

McAvoy, W. and K. Clancy. 1994. Community Classification and Mapping Criteria for Category I Interdunal Swales and Coastal Plain Pond Wetlands in Delaware. Final Report submitted to Division of Water Resources, Wetlands and Aquatic Protection Branch, Department of Natural Resources and Environmental Control. 47 pp. + figures.

Martin, W.E. 1959. The vegetation of Island Beach State Park, New Jersey. Ecol. Monogr. 29: 1-46.

PLOTS:

57AB04
57AB01
52AB01
42CEF02

Myrica cerifera, Baccharis halimifolia / Spartina patens Shrubland

COMMON NAME: Waxmyrtle , Groundsel Tree / Salt Hay Shrubland

SYNONYM: Maritime shrubland

TNC SYSTEM: Terrestrial

PHYSIOGNOMIC CLASS: Shrubland

PHYSIOGNOMIC SUBCLASS: Deciduous shrubland

PHYSIOGNOMIC GROUP: Cold-deciduous shrubland

FORMATION: Deciduous seasonally / temporarily flooded shrubland

ALLIANCE: *Myrica cerifera , Baccharis halimifolia* Shrubland Alliance

CLASSIFICATION CONFIDENCE LEVEL: 3

RANGE: The range of this community likely includes New Jersey to South Carolina.

ENVIRONMENTAL DESCRIPTION: This mesic shrub community occurs on maritime dunes, usually on more protected backdunes not directly influenced by storm tides. It is not tidally flooded, although is impacted by salt spray. The substrate is sand with little or no organic layer. Soils have a shallow loamy component, from the accumulation of organic matter under graminoid vegetation, but in less vegetated examples, exposed sands persist. The water table is often less than half a meter below the surface, so mottled sands lie directly below the loam and loamy-sands.

USFWS WETLAND SYSTEM: Palustrine System

MOST ABUNDANT SPECIES:

Globally:

Strata	Species
Short shrub	*Myrica cerifera, Baccharis halimifolia*
Herbaceous	*Spartina patens, Toxicodendron radicans, Solidago sempervirens, Panicum virgatum*

ASIS:

Strata	Species
Short shrub	*Myrica cerifera, Baccharis halimifolia*

Herbaceous	*Spartina patens, Toxicodendron radicans, Solidago sempervirens, Panicum virgatum*

DIAGNOSTIC SPECIES: *Myrica cerifera, Baccharis halimifolia, Spartina patens, Panicum virgatum*

VEGETATION DESCRIPTION: This community is characterized by a moderately open canopy of *Myrica cerifera, Baccharis halimifolia, Myrica pensylvanica, Rhus copallinum. Spartina patens* and *Toxicodendron radicans* are characteristic herbs; other associates include *Panicum virgatum, Andropogon virginicus, Juncus dichotomus, Solidago sempervirens, Smilax* spp., *Parthenocissus quinquefolia, Vitis* spp., and *Scirpus pungens*. This community may be differentiated from the *Myrica cerifera / Hydrocotyle* spp. Shrubland by the absence of wetland species and muck soils, and from the *Baccharis halimifolia, Iva frutescens / Spartina patens* Shrubland community by the influence of the freshwater table rather than tidal flooding and by the absence of halophytes such as *Iva frutescens.* This community is differentiated from the *Myrica (cerifera, pensylvanica)* Shrubland by the absence of *Drosera intermedia, Xyris torta,* and *Lycopodiella appressa*.

Examples of community on Assateague Island NS are characterized by more or less evenly distributed shrubs, with *Myrica cerifera* and *Baccharis halimifolia* cover ranging from 10 to 60 percent. More often, *Baccharis* is much more prevalent than *Myrica* in this layer. *Toxicodendron radicans* characteristically covers up to 10 percent of this community. The herbaceous cover is predominantly dry, tufted *Spartina patens* (from 50 to 100 percent) and *Scirpus pungens*; *Panicum virgatum* may also be evenly mixed as a secondary component of the herbaceous cover (generally less than 30 percent). Other herbs are frequent but provide little overall cover. Characteristic species include *Eupatorium hyssopifolium, Solidago sempervirens, Juncus dichotomus, Fimbristylis castanea,* and *Panicum amarulum*.

OTHER NOTEWORTHY SPECIES: None

CONSERVATION RANK: Information not available.

RANK JUSTIFICATION: Further research is necessary to determine the conservation rank.

COMMENTS: This community is not well known; the description is based largely on data collected from Assateague Island NS. Portions of the mesic shrub community (Higgins et al. 1971) and the shrub succession community (Hill 1986) described from Assateague Island are contained within this community. The thicket community (Boule 1979) and the upland thicket (Klotz 1986) described from Virginia are suspected to by synonymous with this community. Portions of the maritime shrub community described from North Carolina by Schafale and Weakley (1990), particularly occurrences lacking *Ilex vomitoria* and *Quercus virginiana* may be included within this community. The salt grass, sea myrtle, red cedar savanna and the salt grass , sea myrtle savanna described from New Jersey (Martin 1959) may also be synonymous with this community.

REFERENCES:

Boule, M.E. 1979. The vegetation of Fisherman Island, Virginia. Castanea 44: 98-108.

Higgins, E.A.T., R.D. Rappleye, and R.G. Brown. 1971. The flora and ecology of Assateague Island. University of Maryland Agriculture Experiment Station Bull. A-172. 70 pp.

Hill, S. 1986. An annotated checklist of the vascular flora of Assateague Island (Maryland and Virginia). Castanea 5: 265-305.

Klotz, L.H. 1986. The vascular flora of Wallops Island and Wallops Mainland, Virginia. Castanea 5: 306-326.

Martin, W.E. 1959. The vegetation of Island Beach State Park, New Jersey. Ecol. Monogr. 29: 1-46.

Schafale, M.P. and A.S. Weakley. 1990. Classification of the natural communities of North Carolina. Third Approximation. North Carolina Natural Heritage Program, Division of Parks and Recreation, N.C. Dept. of Environment, Health, and Natural Resources. Raleigh, NC. 325 p.

PLOTS:

57AB03
77AB06
TNC1
TNC3
TNC7
TNC2
TNC9
37AB05

Baccharis halimifolia, Iva frutescens / Spartina patens Shrubland

COMMON NAME: Groundsel Tree, Marsh Elder / Saltmeadow Grass Shrubland

SYNONYM: Salt shrub; Tidal salt scrub

TNC SYSTEM: Terrestrial

PHYSIOGNOMIC CLASS: Shrubland

PHYSIOGNOMIC SUBCLASS: Deciduous shrubland

PHYSIOGNOMIC GROUP: Cold-deciduous shrubland

FORMATION: Saltwater-tidal irregularly flooded shrubland

ALLIANCE: *Baccharis halimifolia, Iva frutescens* Shrubland Alliance

CLASSIFICATION CONFIDENCE LEVEL: 2

RANGE: New Jersey to South Carolina and perhaps farther south.

ENVIRONMENTAL DESCRIPTION: This community always occurs in association with salt marshes. In its natural condition, this community forms the border of the salt marsh between the high salt marsh (communities of the *Spartina patens* Herbaceous Alliance) and the 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 community often forms an abrupt transition from salt marsh to upland reflecting the relatively higher elevation and less frequent tidal flooding. Shrub cover in this situation tends to be fairly dense, and herbs are sparsely distributed. Where the topographic relief is more gradual, the community is characterized by an open and relatively evenly spaced shrub stratum 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.

At Assateague Island NS, this community is characterized by a shallow (10-20 cm) organic layer comprised of peat or peaty muck overlying sand or sandy loam.

USFWS WETLAND SYSTEM: Estuarine System

MOST ABUNDANT SPECIES:

Globally:

Strata	Species
Short shrub	*Iva frutescens, Baccharis halimifolia*
Herbaceous	*Spartina patens*

ASIS:

Strata	Species
Short shrub	*Iva frutescens, Baccharis halimifolia*
Herbaceous	*Spartina patens*

DIAGNOSTIC SPECIES: *Iva frutescens*

VEGETATION DESCRIPTION: Characteristic shrub species include *Baccharis halimifolia* and *Iva frutescens*. Associated shrubs include *Myrica cerifera* and *M. pensylvanica*; *Borrichia frutescens* and *Juniperus virginiana* var. *silicicola* are also found in this community in the southern part of the range. *Spartina patens* is a characteristic and usually abundant grass; other common herbaceous associates include *Distichlis spicata, Hibiscus moscheutos, Toxicodendron radicans, Teucrium canadense, Festuca rubra, Limonium carolinianum,* and *Setaria parviflora.* This community is differentiated from the *Baccharis halimifolia , Iva frutescens / Panicum virgatum* community to the north by the relative unimportance of *Panicum virgatum* and by the abundance of *Spartina patens* and presence of more southern-ranging species such as *Setaria parviflora.*

On Assateague Island NS, *Iva frutescens* is the dominant shrub of this community, with cover values ranging from 30 to 85 percent. *Baccharis halimifolia* is often present at very low cover. Ground cover is complete and most commonly *Spartina patens* but can be mixed with *Eleocharis palustris, E. rostellata, Scirpus pungens, and Distichlis spicata*. Seedlings of *Baccharis* and *Iva* are frequent and individuals of *Lythrum lineare, Kostyletzyka virginicus, Limonium carolinium,* and *Solidago sempervirens* are scattered throughout.

OTHER NOTEWORTHY SPECIES: None

CONSERVATION RANK: G5

RANK JUSTIFICATION: This community is a common component of salt marshes of the mid-Atlantic coast.

COMMENTS: Portions of the shrub succession community (Higgins et al. 1971) and the salt marsh community (Hill 1986) described from Assateague Island, and the swamp thicket (Klotz 1986) described from Virginia are contained within this community. Vegetation that may be considered synonymous with this community has been described to varying extent by several authors, and includes the following names: salt marsh and upper border (Barry 1980; South Carolina); salt grass , marsh elder savanna (Martin 1959; New Jersey); saltbush zone (Boule, 1979, Virginia); Estuarine

scrub-shrub wetland (Tiner 1985a and 1985b; Delaware and New Jersey); Salt bush , salt meadow marsh (Daiber et al. 1976, Delaware); *Iva frutescens* , *Baccharis halimifolia* (Good 1965, New Jersey); and *Iva frutescens* and *Baccharis halimifolia* (Klemas et al. 1973, Delaware); Salt shrub (Reschke 1990, New York); Salt marsh complex, marsh-upland border (Breden 1989, New Jersey). Portions of the salt shrub (Schafale and Weakley 1990, North Carolina) are included in this community. This community is differentiated from the *Myrica cerifera , Baccharis halimifolia / Spartina patens* community by the presence of *Iva frutescens* and by the influence of tidal flooding.

REFERENCES:

Barry, J.M. 1980. Natural Vegetation of South Carolina. University of South Carolina Press, Columbia, S.C. 214 pp.

Boule, M.E. 1979. The vegetation of Fisherman Island, Virginia. Castanea 44: 98-108.

Breden, T.F. 1989. A preliminary natural community classification for New Jersey. in E.F. Karlin (ed). New Jersey's Rare and Endangered Plants and Animals. Institute for Environmental Studies, Ramapo College, Mahwah, NJ. 280 p.

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, DE. 528 p.

Good, R.E. 1965. Salt marsh vegetation, Cape May, New Jersey. Bull. NJ Acad. Sci. 10: 1-11.

Higgins, E.A.T., R.D. Rappleye, and R.G. Brown. 1971. The flora and ecology of Assateague Island. University of Maryland Agriculture Experiment Station Bull. A-172. 70 pp.

Hill, S. 1986. An annotated checklist of the vascular flora of Assateague Island (Maryland and Virginia). Castanea 5: 265-305.

Klemas, V., F.C. Daiber, D.S. Bartlett, O.W. Crichton, and A.O. Fornes. 1973. Coastal vegetation of Delaware. College of Marine Studies, University of Delaware. 27 p.

Martin, W.E. 1959. The vegetation of Island Beach State Park, New Jersey. Ecol. Monogr. 29: 1-46.

Reschke, C. 1990. Ecological communities of New York State. New York Natural Heritage Program. New York State Dept. of Environmental Conservation. Latham, NY. 96 p.

Schafale, M.P. and A.S. Weakley. 1990. Classification of the natural communities of North Carolina. Third Approximation. North Carolina Natural Heritage Program, Division of Parks and Recreation, N.C. Dept. of Environment, Health, and Natural Resources. Raleigh, NC. 325 p.

Tiner, R.W. 1985a. Wetlands of Delaware. U.S. Fish and Wildlife Service, National Wetlands Inventory, Newton Corner, MA and Delaware Department of Natural Resources and Environmental Control, Wetlands Section, Dover, DE. Cooperative Publication. 77 p

Tiner, R.W. 1985b. Wetlands of New Jersey. U.S. Fish and Wildlife Service, National Wetlands Inventory. Newton Corner, MA 117 p.

PLOTS:

32RR06
47AB03
32RR11
37AB02
67AB08
32RR10

Myrica pensylvanica / Schizachyrium scoparium ssp. littorale, Eupatorium hyssopifolium Sparse Shrubland

COMMON NAME:	Bayberry / Little Bluestem, Hyssop-leaved Eupatorium Sparse Shrubland
SYNONYM:	Maritime Grassland; Backdune grassland
TNC SYSTEM:	Terrestrial
PHYSIOGNOMIC CLASS:	Sparse Shrubland
PHYSIOGNOMIC SUBCLASS:	Deciduous sparse shrubland
PHYSIOGNOMIC GROUP:	Cold-deciduous sparse shrubland with a dominant herbaceous stratum
FORMATION:	Deciduous sparse shrubland with medium-tall grasses
ALLIANCE: Sparse Shrubland	*Myrica pensylvanica , Schizachyrium scoparium* ssp. *littorale*

CLASSIFICATION CONFIDENCE LEVEL: 3

RANGE: The range of this community is not well known; North Carolina is likely the southern extent. This community is related to maritime grasslands of New England and New York. Further analysis is required to determine the classification, and thus the range, with confidence.

ENVIRONMENTAL DESCRIPTION: This community occurs on deep well-drained sands of old leveled interdunes of Assateague Island NS. It usually occurs within the influence of offshore winds and salt spray.

USFWS WETLAND SYSTEM: Not applicable

MOST ABUNDANT SPECIES:

Globally:

Strata	Species
Short shrub	*Myrica pensylvanica*
Herbaceous	*Eupatorium hyssopifolium, E. rotundifolium, Schizachyrium scoparium* ssp. *littorale, Toxicodendron radicans, Solidago sempervirens*

ASIS:

Strata	Species
Short shrub	*Myrica pensylvanica*
Herbaceous	*Eupatorium hyssopifolium, E. rotundifolium, Schizachyrium scoparium* ssp. *littorale, Toxicodendron radicans, Solidago sempervirens*

DIAGNOSTIC SPECIES: *Myrica pensylvanica, Schizachyrium scoparium* ssp. *littorale, Eupatorium hyssopifolium, E. rotundifolium*

VEGETATION DESCRIPTION: Although highly variable in species composition, the typical expression of this community is characterized by a predominance (25 - 50 percent cover) of bunch grasses including *Schizachyrium scoparium* ssp. *littorale, Andropogon virginicus, Panicum amarulum, Ammophila breviligulata, Dichanthelium scoparium* and *D. acuminatum*. Generally one or two of these species will dominate while the others occur as more infrequent, scattered clumps. Occasionally *Spartina patens*, growing in a dry "wispy" condition, will form the dominant graminoid cover. Shrubs of *Myrica pensylvanica* are sparse and stunted *Baccharis halimifolia* and *Diospyros virginiana* are even less frequent. Dense tangles of *Toxicodendron radicans* are very characteristic of this alliance as they sprawl over the bare ground and sparse vegetation. *Rubus argutus* is also scattered throughout. Much of the remaining dry sands are exposed with sparsely distributed herbs. Characteristic herb species include *Cirsium horridulum, Solidago sempervirens, Gnaphalium obtusifolium, Linaria canadensis, Euthamia tenuifolia, Oenothera humifusa,* and *Diodia teres*.

OTHER NOTEWORTHY SPECIES: None

CONSERVATION RANK: Information not available

RANK JUSTIFICATION: Further research is necessary to determine the conservation rank.

COMMENTS: This community is not well known; the description provided here is based on data collected from Assateague Island NS. The shrub succession community of (Hill 1986) and the xeric shrub community (particularly at lower elevations) (Higgins et al. 1971) described from Assateague Island are partially contained within this community. The sandplain grassland (Dunwiddie et al. 1993), the maritime grassland in New York (Reschke 1990), and the Andropogonetum scoparii described from Long Island, New York (Blizzard 1931) are related to this community, but classification will require further work.

REFERENCES:

Blizzard, A.W. 1931. Plant sociology and vegetational change on High Hill, Long Island, New York. Ecology 12: 208-231.

Dunwiddie P.W., Harper, K.A. and B. Zaremba. 1993. Classification and ranking of coastal heathlands and sandplain grasslands in Massachusetts. Final report to the Massachusetts Natural Heritage and Endangered Species Program, Boston, MA.

Higgins, E.A.T., R.D. Rappleye, and R.G. Brown. 1971. The flora and ecology of Assateague Island. University of Maryland Agriculture Experiment Station Bull. A-172. 70 pp.

Hill, S. 1986. An annotated checklist of the vascular flora of Assateague Island (Maryland and Virginia). Castanea 5: 265-305.

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PLOTS:

77AB01
77AB03
32RR01
37RR05
TNC4

Hudsonia tomentosa / Panicum (amarum, amarulum) Dwarf-shrubland

COMMON NAME: Beach Heather / Beachgrass Dwarf-shrubland

SYNONYM: Hudsonia dune; Beach heather dune

TNC SYSTEM: Terrestrial

PHYSIOGNOMIC CLASS: Dwarf-shrubland

PHYSIOGNOMIC SUBCLASS: Evergreen dwarf-shrubland

PHYSIOGNOMIC GROUP: Needle-leaved and microphyllous evergreen dwarf-shrubland

FORMATION: Needle-leaved and microphyllous evergreen creeping or matted dwarf-shrubland

ALLIANCE: *Hudsonia tomentosa* Dwarf-shrubland Alliance

CLASSIFICATION CONFIDENCE LEVEL: 2

RANGE: This community is locally abundant on coastal dunes from New Jersey to northern Virginia.

ENVIRONMENTAL DESCRIPTION: This community is largely confined to maritime interdunes. Influenced by wind-deposited sand, the substrate is unstable and supports no soil development and large patches of sparsely vegetated or unvegetated sand are common. This community occurs on well drained sands of back dunes and interdunes of Assateague Island.

USFWS WETLAND SYSTEM: Not applicable

MOST ABUNDANT SPECIES:

Globally:

Strata	Species
Short shrub	*Hudsonia tomentosa*
Herbaceous	*Lechea maritima, Schizachyrium scoparium* ssp. *littorale, Toxicodendron radicans, Solidago sempervirens, Artistida tuberculosa*

ASIS:

Strata	Species

Short shrub	*Hudsonia tomentosa*
Herbaceous	*Lechea maritima, Myrica pensylvanica, Solidago sempervirens, Spartina patens*

DIAGNOSTIC SPECIES: *Hudsonia tomentosa, Lechea maritima, Panicum amarulum*

VEGETATION DESCRIPTION: This community is a maritime dwarf-shrubland characterized by *Hudsonia tomentosa*, a species adapted to sand burial. *Hudsonia tomentosa* is dominant, occurring as discrete patches that may coalesce into a dense mat on older more stabilized dunes. A number of other shrubs such as *Myrica pensylvanica, Myrica cerifera, Pinus taeda* saplings, and *Prunus maritima* may occur, but in low abundance and cover. *Schizachyrium scoparium* ssp. *littorale, Ammophila breviligulata, Aristida tuberculosa, Spartina patens,* and *Panicum amarulum* are common grasses of this community, and *Toxicodendron radicans* is a common vine. Other herbaceous associates include *Lechea maritima, Cyperus grayi, Artemisia stelleriana, Chamaesyce polygonifolia, Solidago sempervirens,* and *Diodia teres.*

On Assateague Island NS, *Hudsonia tomentosa* generally constitutes 30 to 70 percent of the total ground cover with exposed sand remaining. *Myrica pensylvanica* shrubs and *Pinus taeda* saplings are almost non-existent but can occur as scattered individuals. Herbaceous vegetation is also quite sparse (less than 5 percent cover) but may include scattered individuals of *Panicum amarulum, Panicum amarum, Solidago sempervirens, Linaria canadensis, Lechea maritima, Ammophila breviligulata, Gnaphalium obtusifolium, Schizachyrium scoparium* ssp. *littorale, Dichanthelium acuminatum,* and *Oenothera humifusa*. Scattered vines of *Smilax rotundifolia* and canes of *Rubus argutus* are occasional.

OTHER NOTEWORTHY SPECIES: None

CONSERVATION RANK: G3

RANK JUSTIFICATION: There are many occurrences of this community, but it is restricted to large coastal dune systems vulnerable to development pressure and to ORV use.

COMMENTS: At Assateague Island NS, community size can range from very small openings within a shrubland or woodland to large extensive dunes dominated by *Hudsonia tomentosa.*

The *Hudsonia* dunes (Higgins et al. 1971) and the *Hudsonia* dune community (Hill 1986) described from Assateague Island are synonymous with this community. Numerous other researchers have described this vegetation to varying degrees. The following names have been ascribed to vegetation that may be placed within this community: Dunegrass , beach heather , low thicket mixture (Martin 1959, New Jersey); beach heather community (Collins and Anderson 1994, New Jersey); dune crest community (Clampitt 1992, Virginia); *Hudsonia tomentosa , Ammophila breviligulata* dune scrub association (Clancy 1993, Delaware); Coastal dune shrubland (Breden 1989, in part, New Jersey).

REFERENCES:

Breden, T.F. 1989. A preliminary natural community classification for New Jersey. in E.F. Karlin (ed). New Jersey's Rare and Endangered Plants and Animals. Institute for Environmental Studies, Ramapo College, Mahwah, NJ. 280 p.

Clampitt. C.A. 1991. The upland plant communities of Seashore State Park, Virginia Beach, Virginia. Virginia Journal of Science. 42: 419-435.

Clancy, K. 1993. A preliminary classification of the natural communities of Delaware (draft). Delaware Natural Heritage Inventory, Div. of Parks and Recreation, Dover, DE. 30 p.

Collins, B.R. and K.H. Anderson. 1994. Plant communities of New Jersey. 1994. Rutgers University Press, New Brunswick, NJ. 287 pp.

Higgins, E.A.T., R.D. Rappleye, and R.G. Brown. 1971. The flora and ecology of Assateague Island. University of Maryland Agriculture Experiment Station Bull. A-172. 70 pp.

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Martin, W.E. 1959. The vegetation of Island Beach State Park, New Jersey. Ecol. Monogr. 29: 1-46.

PLOTS:

52AB02
42AB02
12RR01
TNC10
57AB02

Typha angustifolia, Hibiscus moscheutos Herbaceous Vegetation

COMMON NAME: Narrow-leaved Cattail, Rose Mallow Herbaceous Vegetation

SYNONYM: Brackish tidal marsh

TNC SYSTEM: Terrestrial

PHYSIOGNOMIC CLASS: Herbaceous

PHYSIOGNOMIC SUBCLASS: Tall grassland

PHYSIOGNOMIC GROUP: Temperate tall grassland

FORMATION: Brackish tidal regularly / irregularly flooded tall grassland

ALLIANCE: *Typha angustifolia, Hibiscus* spp. Herbaceous Alliance

CLASSIFICATION CONFIDENCE LEVEL: 3

RANGE: The range of this community is not known; the alliance occurs in coastal areas from Maine through South Carolina. Further research is necessary to determine the classification, and thus the range, with confidence.

ENVIRONMENTAL DESCRIPTION: This community is a brackish tidal marsh occurring where water salinity ranges from 0.5-18.0 ppt. Brackish marshes are most extensive on large tidal rivers, but smaller marshes of this alliance also occur at the upper limits of larger tidal creeks. At Assateague Island NS, the soils of this community are comprised of a shallow organic layer (5-20 cm peaty muck) overlying sand.

USFWS WETLAND SYSTEM: Estuarine system

MOST ABUNDANT SPECIES:

Globally:

Strata	Species
Herbaceous	*Typha angustifolia, Pontederia cordata, Hibiscus moschuetos, Scirpus pungens*

ASIS:

Strata	Species
Herbaceous	*Typha angustifolia, Scirpus pungens*

DIAGNOSTIC SPECIESL: *Typha angustifolia, Hibiscus moscheutos*

VEGETATION DESCRIPTION: The species composition of this community is a mixture of salt marsh and freshwater tidal marsh species. The vegetation is dense and characterized by tall graminoids such as *Typha angustifolia,* with associates including *Spartina cynosuroides, Phragmites australis* or *Scirpus americanus, Pontederia cordata, Lilaeopsis chinensis, Hibiscus palustris, H. moscheutos,* and *Pluchea odorata*.

At Assateague Island NS, this herbaceous vegetation typically occurs on the edge of non-tidal intermittently flooded wetlands and irregularly flooded tidal wetlands, or where the two meet. Therefore, a brackish influence is often present in the water feeding these poorly drained wetlands. *Typha angustifolia* characteristically dominates the vegetation cover (30 to 90 percent cover). Otherwise, the soil substrate is either bare muck or peat, standing water, or an accumulation of dead *Typha* litter. Other herbaceous species are present but sparsely distributed and with low cover values; characteristic species include: *Hibiscus moscheutos, Spartina patens, Distichlis spicata, Scirpus pungens, Lycopus americanus, Eleocharis palustris, Hydrocotyle umbellata, Eupatorium capillifolium, Ptilimnium capillaceum, Bidens* spp., and *Spartina alterniflora*. This vegetation is not widespread on Assateague, and is largely confined to the head of tidal creeks on the bay side.

OTHER NOTEWORTHY SPECIES: None

CONSERVATION RANK: Information not available.

RANK JUSTIFICATION: Further research is necessary to determine the rank.

COMMENTS: Classification of this community and associated brackish tidal marshes is complex and awaits the collection and analysis of further data. The transitional fresh marsh (Hill 1986) described from Assateague Island is partially contained in this community. Higgins et al. (1971) did not describe this vegetation. The following vegetation descriptions are contained partially or entirely within the *Typha angustifolia , Hibiscus* spp. Alliance: *Typha angustifolia , Hibiscus palustris* community (Metzler and Barrett 1992, Connecticut); Brackish tidal marsh (Reschke 1990, New York); Brackish tidal marsh complex (Breden 1989, New Jersey); Brackish tidal marsh community (Maine Natural Heritage Program 1991, Maine); Brackish marsh (Sperduto 1994, New Hampshire); *Hibiscus* marsh (Cahoon and Stevenson 1986, Maryland); narrowleaf cattail type (McCormick and Ashbaugh 1972, New Jersey); *Typha angustifolia* community (Good and Good 1975, New Jersey); *Typha angustifolia* type (Ferren et al 1981, New Jersey); fresh-brackish marsh (Klotz 1986, Virginia). The *Typha* association described from Maryland by Shreve et al. (1910) is likely synonymous with this community.

REFERENCES:

Breden, T.F. 1989. A preliminary natural community classification for New Jersey. in E.F. Karlin (ed). New Jersey's Rare and Endangered Plants and Animals. Institute for Environmental Studies, Ramapo College, Mahwah, NJ. 280 p.

Cahoon, D.R. and J.C. Stevenson. 1986. Production, predation, and decomposition in a low-salinity *Hibiscus* marsh. Ecology 67: 1341-1350.

Ferren, W.R., Jr., R.E. Good, R. Walker, and J. Arsenault. 1981. Vegetation and flora of Hog Island, a brackish wetland in the Mullica River, New Jersey. Bartonia 48: 1-10.

Good, R.E. and N.F. Good. 1975. Vegetation and production of the Woodbury Creek and Hessian Run Freshwater tidal marshes. Bartonia 43: 38-45.

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Higgins, E.A.T., R.D. Rappleye, and R.G. Brown. 1971. The flora and ecology of Assateague Island. University of Maryland Agriculture Experiment Station Bull. A-172. 70 pp.

Klotz, L.H. 1986. The vascular flora of Wallops Island and Wallops Mainland, Virginia. Castanea 5: 306-326.

McCormick, J. and R. Ashbaugh. 1972. Vegetation of a section of Oldmans Creek Tidal Marsh and related areas in Salem and Gloucester Counties, New Jesey. N.J. Acad. Sci. 17: 31-37.

Maine Natural Heritage Program. 1991. Natural landscapes of Maine: a classification of ecosystems and natural communities. Provisional edition. Maine Natural Heritage Program, Office of Comprehensive Planning, DECD, Augusta, ME.

Metzler, K.J. and J. Barrett. 1992. Connecticut Community Classification (draft). Connecticut Natural Diversity Database. Natural Resources Center. Department of Environmental Protection. Hartford, CT.

Reschke, C. 1990. Ecological communities of New York State. New York Natural Heritage Program. New York State Dept. of Environmental Conservation. Latham, NY. 96 p.

Shreve, F., M.A. Chrysler, F.H. Blodgett, F.W. Besley. 1910. The Plant Life of Maryland. Maryland Weather Service. Special Publication, Vol. III. Johns Hopkins Press, Baltimore, MD.

Sperduto, D. 1994. A Classification of the Natural communities of New Hampshire. April 1994 Approximation. New Hampshire Natural Heritage Inventory, Dept. of Resources and Economic Development. Concord, NH. 45p. + appendices.

PLOTS:

37AB04
37RR02
42RR03

***Phragmites australis* Herbaceous Vegetation**

COMMON NAME: Reed-grass Herbaceous Vegetation

SYNONYM: Reed-grass marsh; Phragmites wetland

TNC SYSTEM: Terrestrial

PHYSIOGNOMIC CLASS: Herbaceous

PHYSIOGNOMIC SUBCLASS: Tall grassland

PHYSIOGNOMIC GROUP: Temperate tall grassland

FORMATION: Brackish tidal regularly / irregularly flooded tall grassland

ALLIANCE: *Phragmites australis* Herbaceous Alliance

CLASSIFICATION CONFIDENCE LEVEL: 1

RANGE: This community has a broad geographic range, including eastern and midwestern states, as well as Canada.

ENVIRONMENTAL DESCRIPTION: This community is a dense tall grassland indicative of disturbance. It occurs in a range of wetland habitats from fresh to brackish in salinity. At Assateague Island NS, the soil profile is characterized by a shallow organic layer overlying sand.

USFWS WETLAND SYSTEM: Estuarine System, Palustrine System

MOST ABUNDANT SPECIES:

Globally:

Strata	Species
Herbaceous	*Phragmites australis*

ASIS:

Strata	Species
Herbaceous	*Phragmites australis*

DIAGNOSTIC SPECIES: *Phragmites australis*

VEGETATION DESCRIPTION: This community is a broadly-defined reed-grass marsh. It is characterized by dense stands of *Phragmites australis*, 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.

On Assateague Island NS, *Phragmites australis* most frequently invaded stands of the following communities: *Myrica cerifera / Hydrocotyle* spp. (Wet) Shrubland, *Myrica cerifera , Baccharis halimifolia / Spartina patens* Shrubland, or *Myrica (cerifera, pensylvanica) , Vaccinium corymbosum* shrubland. Spreading in large colonies, *Phragmites* eventually dominates disturbed areas at coverage up to 100 percent. More typically, though, scattered individuals of other species may occur, such as sparse *Myrica cerifera* shrubs, *Kosteletzyka virginica, Calystegia sepium, Boehmeria cylindrica, Typha angustifolia, Apocynum cannabinum, Rosa palustris, Polygonum* sp., and *Mikania scandens*. Vines of *Toxicodendron radicans* are also frequent, but typically occur at low cover.

OTHER NOTEWORTHY SPECIES: None

CONSERVATION RANK: *

RANK JUSTIFICATION: *This community is not only globally secure, but its growing distribution is highly undesirable from a conservation perspective.

COMMENTS: Although *Phragmites australis* 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, 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. The presence of the *Phragmites australis* 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. In cases where *Phragmites australis* 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 community. In cases where *Phragmites australis* cover is so high that native species have been excluded and the original community is no longer recognizable, the occurrence then falls within the *Phragmites australis* Herbaceous Vegetation.

The following state Natural Heritage program communities are contained within this community: *Phragmites australis* community (Metzler and Barrett 1992, Connecticut); *Phragmites australis* tidal marsh association (Clancy 1993, Delaware).

REFERENCES:

Clancy, K. 1993. A preliminary classification of the natural communities of Delaware (draft). Delaware Natural Heritage Inventory, Div. of Parks and Recreation, Dover, DE. 30 p.

Metzler, K.J. and J. Barrett. 1992. Connecticut Community Classification (draft). Connecticut Natural Diversity Database. Natural Resources Center. Department of Environmental Protection. Hartford, CT.

Niering W.A. and R.S. Warren. 1977. Our dynamic tidal marshes: vegetation changes as revealed by peat analysis. The Connecticut Arboretum. Bulletin 22.

PLOTS:

37AB03
37RR01
32RR04

Spartina alterniflora / Ascophyllum nodosum Herbaceous Vegetation

COMMON NAME: Saltwater Cordgrass Herbaceous Vegetation

SYNONYM: Low salt marsh

TNC SYSTEM: Terrestrial

PHYSIOGNOMIC CLASS: Herbaceous

PHYSIOGNOMIC SUBCLASS: Tall grassland

PHYSIOGNOMIC GROUP: Temperate tall grassland

FORMATION: Saltwater tidal regularly/irregularly flooded tall grassland

ALLIANCE: *Spartina alterniflora* Herbaceous Alliance

CLASSIFICATION CONFIDENCE LEVEL: 2

RANGE: This community occurs in estuaries from southern Maine to Cape Hatteras, North Carolina. The northern limit is determined by 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).

ENVIRONMENTAL DESCRIPTION: The community is generally limited to the zone between mean sea level and the mean high water level. The habitat occurs in protected inlets behind barrier beaches, or in drowned river valleys. Peat depth ranges from a few feet if the community formed over a mud flat, to 80 feet in drowned river valleys. *Spartina alterniflora* is limited to the low marsh zone by moderate salinity; it can withstand longer submergence than other salt marsh grasses, but still requires periodic exposure of the substrate. It also requires moderately high levels of iron (7-15 ppm).

On Assateague Island NS, this community is irregularly to regularly flooded by the brackish waters from the bay and has standing water at or near the soil surface.

USFWS WETLAND SYSTEM: Estuarine system

MOST ABUNDANT SPECIES:

Globally:

Strata	Species
Herbaceous	*Spartina alterniflora*

ASIS:

Strata	Species
Herbaceous	*Spartina alterniflora*

DIAGNOSTIC SPECIES: *Spartina alterniflora*

VEGETATION DESCRIPTION: This community is commonly known as the "low salt marsh," occurring as a tall grassland strongly dominated by *Spartina alterniflora*. There is little variation in vascular plant species composition across the range. It occurs in nearly pure stands, with occasional low-growing species such as *Spergularia marina, Salicornia* spp., *Suaeda maritima* and seaweeds such as *Ulva lactuca* and other algae such as *Fucus vesiculosus* and *Ascophyllum nodosum*, which grow at the bases of the *Spartina* plants (Moul 1973).

At Assateague Island NS, this community typically exhibits two different expressions. Both form the low marshes of the island's bay side or fringes along gut channels into the island's interior. *Spartina alterniflora* growing in monotypic stands is the characteristic community closest to the tidal influence (along the water's edge). These pure stands of *Spartina alterniflora* generally cover 50 to 80 percent of the ground, leaving the remainder as exposed peat, mucky sand or algal mats. Herbs of *Salicornia virginica* and *S. bigelovii* can be quite common mixed in with the *Spartina*, often becoming more apparent later in the growing season. *Limonium carolinianum* is another characteristic herb, but only as scattered individuals. *Ascophyllum nodosum* was not observed during 1995 sampling, but may occur sparingly.

OTHER NOTEWORTHY SPECIES: None

CONSERVATION RANK: G5

RANK JUSTIFICATION: This community occurs throughout the northeast and mid-Atlantic coast. However, high quality examples lacking disturbance as a result of ditching, dredging, filling and other activities are uncommon.

COMMENTS: *Ascophyllum nodosum* may be sparse or absent from southern occurrences of this community, but these occurrences are placed within this type because of the associated characteristic faunal assemblage, including *Uca pugnax, Littorina saxatilis, Littorina obtusata*, and *Brachidontes demissus*.

Assateague Island NS supports a variant of the *Spartina alterniflora / Ascophyllum nodosum* community in which *Distichlis spicata* is abundant, in some cases more so than *Spartina alterniflora*. The vegetation is ecologically equivalent to low marsh, receiving regular tidal inundation. The same herb species as the typical community are associated here as well, but the *Salicornia* spp. become more scattered. Water table levels are slightly lower (5 - 30 cm) in the *Spartina , Distichlis* community, but soils are basically the same in both communities, 0 - 20 cm of peat over blue-gray and brown mottled sand. The prevalence of *Distichlis spicata* in this low marsh setting is unusual from a regional perspective. The alteration of tidal regime and the subsequent inundation of former high marsh is suspected to have contributed to the species composition of this tidal marsh vegetation at Assateague (Furbish, pers. comm.) In addition, *Spartina alterniflora* is heavily grazed by feral horses on the island. Grazing may be impacting species composition and density within these communities and promoting the growth of *Distichlis spicata* (a non-browsed species). Additional research is needed to determine the significance of this vegetation.

The salt marsh (Higgins et al. 1971) and the salt marsh community (Hill 1986) described from Assateague Island are partially contained within this community. The following state Natural Heritage program communities are contained partially or fully within this alliance: *Spartina alterniflora* community (Metzler and Barrett 1992, Connecticut); Salt marsh complex, low marsh (Breden 1989, New Jersey); *Spartina alterniflora* salt marsh (Clancy 1993, Delaware); Low salt marsh (Reschke 1990, New York); Cordgrass saltmarsh community (Maine Natural Heritage Program 1991); Low salt marsh (Enser 1993, Rhode Island); Low salt marsh community (Sperduto 1994, New Hampshire). This vegetation has been described or documented by a wealth of authors. Teal (1986) provides an extensive bibliography.

REFERENCES:

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Metzler, K.J. and J. Barrett. 1992. Connecticut Community Classification (draft). Connecticut Natural Diversity Database. Natural Resources Center. Department of Environmental Protection. Hartford, CT.

Moul, E.T. 1973. Marine flora and fauna of the northeastern United States. Higher plants of the marine fringe. NOAA Technical Report NMFS CIRC-384. US Dept. of Commerce. Seattle, WA.61 pp.

Reschke, C. 1990. Ecological communities of New York State. New York Natural Heritage Program. New York State Dept. of Environmental Conservation. Latham, NY. 96 p.

Sperduto, D. 1994. A Classification of the Natural communities of New Hampshire. April 1994 Approximation. New Hampshire Natural Heritage Inventory, Dept. of Resources and Economic Development. Concord, NH. 45p. + appendices.

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PLOTS:

32RR12
47RR02
22RR02
32RR15
72AB02
17RR01
67AB07

Juncus roemerianus Herbaceous Vegetation

COMMON NAME: Needlerush Herbaceous Vegetation

SYNONYM: Needlerush marsh

TNC SYSTEM: Terrestrial

PHYSIOGNOMIC CLASS: Herbaceous

PHYSIOGNOMIC SUBCLASS: Tall grassland

PHYSIOGNOMIC GROUP: Temperate tall grassland

FORMATION: Brackish-tidal regularly/irregularly flooded tall grassland

ALLIANCE: *Juncus roemerianus* Herbaceous Alliance

CLASSIFICATION CONFIDENCE LEVEL: 2

RANGE: This community occurs in coastal marshes from Maryland south to Louisiana.

ENVIRONMENTAL DESCRIPTION: Degree of tidal inundation and relative elevation control the distribution of salt marsh vegetation in general; *Juncus roemerianus* was found to be lower in elevation than the associated *Spartina patens* type and mixed type (Cooper and Waits 1973). In general, *Juncus roemerianus* occurs on sandy substrates (Penfound 1952).

USFWS WETLAND SYSTEM: Estuarine System

MOST ABUNDANT SPECIES:

Globally:

Strata	Species
Herbaceous	*Juncus roemerianus*

ASIS:

Strata	Species
Herbaceous	*Juncus roemerianus*

DIAGNOSTIC SPECIES: *Juncus roemerianus*

VEGETATION DESCRIPTION: This southern salt marsh community occurs in association with low salt marshes or in brackish marshes, and is characterized by discrete, dense patches usually strongly dominated by *Juncus roemerianus* with few other associates. Associates that do occur at low cover may include *Borrichia frutescens, Baccharis halimifolia, Spartina alterniflora, Distichlis spicata, Scirpus robustus, Aster tenuifolius,* and *Aster subulatus.* This community may occur as isolated patches within low salt marsh, or may dominate vast areas at the heads of tidal creeks that drain the marsh.

At Assateague Island NS, this community occurs within the low and high salt marshes of the bay side, therefore, usually surrounded by the *Spartina alterniflora / Ascophyllum nodosum* Herbaceous Vegetation or the *Spartina patens , Distichlis spicata , Borrichia frutescens* Herbaceous Vegetation. *Juncus roemerianus* forms large clones or clone-like patches effectively excluding other species. Vegetation generally covers 98 to 100 percent of the ground with a small percentage of other herbs associated, which may include scattered individuals of *Spartina alterniflora, S. patens, Limonium carolinianum,* or *Iva frutescens.* Soils of this alliance are generally poorly to very poorly drained, often with standing water atop of peat accumulations (averaging 15 cm in depth) which in turn overlie gleyed sands.

OTHER NOTEWORTHY SPECIES: None

CONSERVATION RANK: G5

RANK JUSTIFICATION: This community is common on the southeastern seaboard, but large undisturbed areas are of high conservation concern.

COMMENTS: Although this community exhibits little floristic variation across its range, the associated animal species may vary to a greater extent. Further analysis may suggest a further subdivision of this community.

The salt marsh community (Hill 1986) and the salt marsh (Higgins et al. 1971) described from Assateague Island are partially contained within this community. The brackish marsh (Schafale and Weakley 1990, North Carolina), and the *Spartina , Distichlis , Juncus* associates described by Penfound (1952) are partially contained within this community. The *Juncus roemerianus* association of the low marsh (Adams 1963) and the *Juncus* type (Cooper and Waits 1973) described from North Carolina, the irregularly flooded salt marsh (Jenkins 1974) described from the Chesapeake Bay, the lower high marsh of South Carolina (Stalter 1973), and the needlerush , saltmeadow type described from Maryland by Nicholson and van Deusen (1954) are related to and may be synonymous with this community.

REFERENCES

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Nicholson, W.R. and R.D.Van Deusen. 1954. Marshes of Maryland. Resource Report no. 6. Maryland Game and Inland Fish Commission. Baltimore, MD.

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Schafale, M.P. and A.S. Weakley. 1990. Classification of the natural communities of North Carolina. Third Approximation. North Carolina Natural Heritage Program, Division of Parks and Recreation, N.C. Dept. of Environment, Health, and Natural Resources. Raleigh, NC. 325 p.

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PLOTS:

27RR02
32RR09
32RR14
37AB01
42RR01

Ammophila breviligulata, Panicum (amarum, amarulum) Herbaceous Vegetation

COMMON NAME: American Beachgrass, Beachgrass Herbaceous Vegetation

SYNONYM: Dunegrass community; Beachgrass dune

TNC SYSTEM: Terrestrial

PHYSIOGNOMIC CLASS: Herbaceous

PHYSIOGNOMIC SUBCLASS: Medium tall grassland

PHYSIOGNOMIC GROUP: Temperate and subpolar medium tall grassland

FORMATION: Open medium tall grassland

ALLIANCE: *Ammophila breviligulata* Herbaceous Alliance

CLASSIFICATION CONFIDENCE LEVEL: 2

RANGE: This community occurs on maritime dunes from southern New Jersey south to the Chesapeake Bay, Virginia.

ENVIRONMENTAL DESCRIPTION: This dune grassland community occurs almost exclusively on sandy, unstable, droughty substrates with no soil profile development. Aeolian 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. At Assateague Island NS, much of the soil surface in the community (40 to 60 percent of total area) as exposed, unstable sand. Sands are generally unconsolidated and the water table at least one meter deep (or beyond, on the foredune proper).

USFWS WETLAND SYSTEM: Not applicable

MOST ABUNDANT SPECIES:

Globally:

Strata	Species
Herbaceous	*Ammophila breviligulata, Panicum amarulum, Panicum amarum*

ASIS:

Strata	Species
Herbaceous	*Ammophila breviligulata, Solidago sempervirens*

DIAGNOSTIC SPECIES: *Ammophila breviligulata, Solidago sempervirens, Panicum amarulum, Oenothera humifusa*

VEGETATION DESCRIPTION: This community is a maritime dune grassland dominated by *Ammophila breviligulata, Panicum amarum,* and *Panicum amarulum*. Plant cover is variable, ranging from 10% to 75%, but is usually low. Other associated species characteristic of this community include *Solidago sempervirens, Strophostyles helvula, Triplasis purpurea, Cenchrus tribuloides, Chamaesyce polygonifolia*. *Panicum amarulum, Oenothera humifusa,* and *Spartina patens* are common associates of this community, and differentiate it from communities of this alliance from New Jersey and north. This community contains several species characteristic to the *Cakile edentula* ssp. edentula sparsely vegetated community, but the *Ammophila breviligulata , Panicum (amarum, amarulum*) Herbaceous Vegetation 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*.

At Assateague Island NS, this community is best developed on the island foredunes, next to the beach, and extends to the western base of the dunes adjacent to the *Myrica pensylvanica , Diodia teres* Shrubland occurring behind the protection of the foredune. These two communities often occur in complex as well. This community is nearly restricted to the ocean side of the island, but was observed at a single site on the bay side of Assateague on the very northern tip of the island. The largest examples of the *Ammophila breviligulata , Panicum (amarum, amarulum)* Herbaceous Vegetation occur on both slopes and the summit of the artificial dune on the central portion of the island where *Ammophila* was extensively planted. In a more natural condition, *Ammophila breviligulata* can be the dominant cover (up to 60 percent) but this generally occurs only in protected enclosures, established to prevent browse by feral horses on the island. Unprotected, high quality, examples of dense *Ammophila breviligulata* do occur at the northern-most end of the island. The more typical expression of this community is a mix of *Ammophila breviligulata* with other herbaceous species, including a broad mix of *Solidago sempervirens, Triplasis purpurea, Scirpus pungens* (where overwashed by sand), *Chamaesyce polygonifolia, Diodia teres, Cakile edentula* ssp. *edentula, Linaria canadensis, Spartina patens, Salsola caroliniana, Panicum amarulum, Lechea maritima,* and *Oenothera humifusa*. Sparse individuals of stunted *Myrica pensylvanica* shrubs and seedlings occur in this alliance but make up less than 2 percent of the total vegetation cover.

OTHER NOTEWORTHY SPECIES: None

CONSERVATION RANK: G3G4

RANK JUSTIFICATION: This community is restricted to the mid-Atlantic coast and is vulnerable to development pressure.

COMMENTS: The dunegrass community described from Assateague Island by Hill (1986) and Higgins et al. (1971) is synonymous with this community, as are the following: mid-Atlantic *Ammophila breviligulata , Panicum amarulum* dune grassland variant (Clancy 1993, Delaware); *Ammophila , Panicum amarum* dunes (Harvill 1965, Virginia); *Panicum , Ammophila* community (Egler 1962, Virginia); foredune (Klotz 1986, Virginia); foredune (Boule 1979, Virginia); sand dune (Fender 1937, southern New Jersey); dune community (Baumann 1978, Virginia). Portions of the following are also included within this community: dune grass (Schafale and Weakley 1990, North Carolina); dune community (Baumann 1978, Virginia); coastal dune grass community (Breden 1989, New Jersey); primary dune (Stalter 1990, Assateague Island, Virginia); dunegrass community (Clampitt 1992, Virginia).

REFERENCES:

Baumann, C. 1978. The effects of overwash on the vegetation of a Virginia barrier island. MA thesis. College of William and Mary, Williamsburg, VA. 104 pp.

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Egler, F.E. 1962. Ferns and Flowering Plants of Seashore State Park, Cape Henry, Virginia. New York State College of Forestry, Syracuse, New York. 60 pp.

Fender, F.S. 1937. The flora of Seven Mile Beach, New Jersey. Bartonia 19: 23-41.

Harvill, A.M., Jr. 1965. The vegetation of Parramore Island, Virginia. Castanea 30: 226-228.

Higgins, E.A.T., R.D. Rappleye, and R.G. Brown. 1971. The flora and ecology of Assateague Island. University of Maryland Agriculture Experiment Station Bull. A-172. 70 pp.

Hill, S. 1986. An annotated checklist of the vascular flora of Assateague Island (Maryland and Virginia). Castanea 5: 265-305.

Klotz, L.H. 1986. The vascular flora of Wallops Island and Wallops Mainland, Virginia. Castanea 5: 306-326.

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Stalter, R. 1990. The vascular flora of Assateague Island, Virginia. Bull. Torr. Bot. Club 117: 48-56.

PLOTS:

12RR05
37RR03
52AB05
TNC16
TNC14
TNC8
62AB04
32RR02

Juncus dichotomus, Drosera intermedia Herbaceous Vegetation

COMMON NAME: Rush, Spatulate-leaved Sundew Herbaceous Vegetation

SYNONYM: Bog; Sand Bog; Forked rush dune swale

TNC SYSTEM: Terrestrial

PHYSIOGNOMIC CLASS: Herbaceous

PHYSIOGNOMIC SUBCLASS: Medium tall grassland

PHYSIOGNOMIC GROUP: Temperate and subpolar medium tall grassland

FORMATION: Seasonally / temporarily flooded medium tall grassland

ALLIANCE: *Juncus dichotomus* Herbaceous Alliance

CLASSIFICATION CONFIDENCE LEVEL: 3

RANGE: Further data analysis will be required to establish the classification and range of this community with greater confidence. The range is suspected to include Delaware south to Virginia.

ENVIRONMENTAL DESCRIPTION: This interdunal wetland community occurs in small, very shallow seasonally flooded basins. Soils are characterized by a shallow organic layer overlying sands. At Assateague Island NS, this community typically occurs in very small (4 square meters to one-eighth hectare) interdunal freshwater depressions that remain saturated throughout the growing season. Soils are characterized by a very shallow organic layer (2 cm thick) over a grey-brown sand. The water table is generally high (from 10 to 50 cm from the surface).

USFWS WETLAND SYSTEM: Palustrine System

MOST ABUNDANT SPECIES:

Globally:

Strata	Species
Herbaceous	*Juncus dichotomus, Drosera intermedia, Andropogon virginicus*

ASIS:

Strata	Species
Herbaceous	*Juncus dichotomus, Drosera intermedia, Andropogon virginicus*

DIAGNOSTIC SPECIES: *Juncus dichotomus, Drosera intermedia, Xyris torta, Lycopodiella appressa*

VEGETATION DESCRIPTION: This community is typically small rush-dominated vegetation of seasonally flooded basins. Related to "dune swales" of the *Vaccinium macrocarpon* dwarf-shrub alliance (Sneddon *et al*. 1994), this community shares some species with communities of this alliance, such as *Lycopodiella appressa, Utricularia subulata,* and *Drosera intermedia*. However, sedges and rushes rather than *Vaccinium macrocarpon* are more characteristic of this community. Associates include *Andropogon virginicus, Juncus dichtomus, Juncus canadensis, Juncus biflorus, J. scirpoides, Drosera intermedia, Fimbristylis autumnalis, Linum medium, Scirpus pungens* and *Solidago sempervirens*. This community occurs in close association, often as a finely textured mosaic, with the *Myrica (cerifera, pensylvanica) , Vaccinium corymbosum* Shrubland and the *Myrica cerifera / Hydrocotyle* spp. Shrubland.

At Assateague Island NS, characteristic species include high coverage (up to 40 percent) of *Juncus dichotomus* and to a much less extent *Utricularia subulata, Drosera intermedia,* and *Lycopodiella appressa*. Common associates include *Andropogon virginicus, Juncus canadensis, J. biflorus, J. scirpoides, Fimbristylis autumnalis, Linum medium,* and *Solidago sempervirens*. This community has a limited extent on Assateague, primarily occurring in interdunal depressions in the central portion of the island, south to the Fox Hills area.

OTHER NOTEWORTHY SPECIES: None

CONSERVATION RANK: Information not available.

RANK JUSTIFICATION: Classification of this type will require further clarification before a conservation rank can be assigned.

COMMENTS: This community is poorly known regionally; it is synonymous with the bog community described by Hill (1986) from Assateague Island. Higgins et al. (1971) did not describe this community. The *Andropogon* community described from Virginia by Tyndall and Levy (1978) may be synonymous with this community. Jones (1992) describes interdunal wetlands of Virginia, which appear to be floristically related. Portions of the maritime wet grassland described from North Carolina (Schafale and Weakley 1990) may be included in this community.

REFERENCES:

Hill, S. 1986. An annotated checklist of the vascular flora of Assateague Island (Maryland and Virginia). Castanea 5: 265-305.

Jones, H.A. 1992. A vegetational analysis of interdunal swale communities of False Cape State Park, Currituck Spit, Virginia. MS thesis. College of William and Mary, Williamsburg, VA.

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Sneddon, L., M. Anderson, and K. Metzler. 1994. A Classification and Description of Terrestrial Community Alliances in The Nature Conservancy's Eastern Region: First Approximation. The Nature Conservancy, Eastern Regional Office, Boston, MA. 116 pp.

Tyndall, R.W. and G.F. Levy. 1978. Plant distribution and succession within interdunal depressions on a Virginia barrier dune system. J. Elisha Mitchell Sci. Soc. 94: 1-15.

PLOTS:

42CEF03

Panicum virgatum, Spartina patens Herbaceous Vegetation

COMMON NAME: Switchgrass, Salt Hay Herbaceous Vegetation

SYNONYM: Switchgrass swale

TNC SYSTEM: Terrestrial

PHYSIOGNOMIC CLASS: Herbaceous

PHYSIOGNOMIC SUBCLASS: Medium tall grassland

PHYSIOGNOMIC GROUP: Temperate and subpolar medium tall grassland

FORMATION: Seasonally / temporarily flooded medium tall grassland

ALLIANCE: *Panicum virgatum* (seasonally flooded) Herbaceous Alliance

CLASSIFICATION CONFIDENCE LEVEL: 3

RANGE: The range of this vegetation is poorly known due to the low confidence of the classification. The community apparently occurs in New Jersey, Delaware, Maryland, and may occur extend to North Carolina, but the full range will require further study.

ENVIRONMENTAL DESCRIPTION: This community is characterized by seasonally flooded basins landward of maritime backdunes. Soils are characterized by a shallow organic layer (usually a few centimeters in depth) overlying loamy sand or sand. The water table is at or close to the surface in the spring. Freshwater maintains these depressions as saturated or seasonally flooded and somewhat poorly drained.

USFWS WETLAND SYSTEM: Palustrine System

MOST ABUNDANT SPECIES:

Globally:

Strata	Species
Herbaceous	*Panicum virgatum, Spartina patens*

ASIS:

Strata	Species
Herbaceous	*Panicum virgatum, Scirpus pungens, Spartina patens*

DIAGNOSTIC SPECIES: *Panicum virgatum, Spartina patens*

VEGETATION DESCRIPTION: This medium-tall grassland community is strongly dominated by *Panicum virgatum*. The vegetation is similar in total floristic composition to the *Myrica (cerifera, pensylvanica), Vaccinium corymbosum* Shrubland, but shrubs are generally lacking or at very low cover and grasses are much more abundant. Associated species include *Spartina patens, Juncus canadensis, Solidago sempervirens, Festuca rubra, Eleocharis palustris, Toxicodendron radicans, Linum medium, Carex albolutescens,* and *Euthamia tenuifolia*. This community is variable in its expression but is typically dominated by 40 to 85 percent cover of *Panicum virgatum* and occurs in larger interdunal depressions (up to one-half hectare). Variability occurs in the cover of *Panicum virgatum* and the richness of associated species. In some cases, *Myrica cerifera* or *Baccharis halimifolia* will constitute less than 10 percent shrub cover. In most cases, shrub coverage is much less or none and other herbs co-dominate. When *Panicum virgatum* is not as dense, it is most often associated with an even mixture of *Scirpus pungens* or *Spartina patens*.

OTHER NOTEWORTHY SPECIES: None

CONSERVATION RANK: Information not available.

RANK JUSTIFICATION: Further analysis is necessary to determine the classification, and thus the conservation rank, with confidence.

COMMENTS: The fresh marsh (Hill 1986) partially contains this community. This vegetation is not described by Higgins et al. (1971) *per se*, although a portion of the mesic shrub community appears to fall within this community. The freshwater marsh described in New Jersey (Fender 1937) is partially contained within this community, as is the *Panicum virgatum* Wetland Association described from Delaware (Heckscher et al. 1995).

REFERENCES:

Fender, F.S. 1937. The flora of Seven Mile Beach, New Jersey. Bartonia 19: 23-41.

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Hill, S. 1986. An annotated checklist of the vascular flora of Assateague Island (Maryland and Virginia). Castanea 5: 265-305.

PLOTS:

47AB08
47AB05
52AB04
77AB04

Scirpus pungens, Fimbristylis castanea Herbaceous Vegetation

COMMON NAME: Three-Square, Coastal Fimbry Herbaceous Vegetation

SYNONYM: Interdunal swale; Fresh marsh

TNC SYSTEM: Terrestrial

PHYSIOGNOMIC CLASS: Herbaceous

PHYSIOGNOMIC SUBCLASS: Medium tall grassland

PHYSIOGNOMIC GROUP: Temperate and subpolar medium tall grassland

FORMATION: Seasonally / temporarily flooded medium tall grassland

ALLIANCE: *Scirpus pungens* (seasonally flooded) Herbaceous Alliance

CLASSIFICATION CONFIDENCE LEVEL: 3

RANGE: The range of this community will require further research to determine with greater confidence, but is suspected to include Delaware to North Carolina.

ENVIRONMENTAL DESCRIPTION: This community is characterized by seasonally wet maritime interdunal depressions, commonly known as interdunal swales. There is usually standing water present in these swales in the spring.

At Assateague Island NS, vegetation is emergent in 0 to 15 cm of fresh water during the early and mid-growing season. The unvegetated surface is generally water or bare soil in some cases. During the dryer summer season, standing water disappears but soils may remain somewhat saturated. Soils consist of shallow peat averaging 5 cm in depth over dark mottled grey sand.

USFWS WETLAND SYSTEM: Palustrine System

MOST ABUNDANT SPECIES:

Globally:

Strata	Species
Herbaceous	*Scirpus pungens, Spartina patens, Andropogon virginicus, Fimbristylis castanea*

ASIS:

Strata	Species
Herbaceous	*Scirpus pungens, Eleocharis palustris, Fimbristylis castanea, F. autumnalis*

DIAGNOSTIC SPECIES: *Scirpus pungens, Fimbristylis castanea, Eleocharis* spp., *Juncus* spp.

VEGETATION DESCRIPTION: The general aspect and species composition of the *Scirpus pungens , Fimbristylis castanea* Herbaceous Vegetation is variable, not only among occurrences, but also over the course of the growing season. At Assateague Island NS, this community is typically characterized by dense *Scirpus pungens* (up to 80 percent cover). When *Scirpus pungens* is not as dense, it is most often associated with an even mixture of *Spartina patens* or *Fimbristylis castanea*. In spring, *Scirpus pungens* is generally dominant with few other associates except *Eleocharis* spp., imparting a distinct aerial photo signature. By late summer a number of other species such as *Fimbristylis castanea* and *Sabatia stellaris* contribute more substantial cover. Other herbs are sparse and provide very little to the overall vegetation cover. These associated species include *E. rostellata, Phragmites australis, Pluchea foetida, Juncus scirpoides, Hydrocotyle umbellata, Eleocharis parvula, Panicum amarulum, Fimbristylis autumnalis, Sabatia stellaris, Ptilimnium capillaceum* and *Juncus canadensis*. In some drier swales adjacent to the maintained dune on the central portion of Assateague Island NS, *Ammophila breviligulata* is present in quantity.

OTHER NOTEWORTHY SPECIES: None

CONSERVATION RANK: Information not available.

RANK JUSTIFICATION: The classification, and thus the conservation rank, will require further research.

COMMENTS: This community is poorly known regionally; the description provided here is based largely on data collected at Assateague Island NS.

The fresh marsh community described by Hill (1986) and Higgins et al. (1971) from Assateague Island are partially contained within this community. The *Scirpus, Hydrocotyle* community and the *Spartina, Scirpus* community described by Tyndall and Levy (1978) in Virginia, and the *Juncus scirpoides , Scirpus pungens* interdunal wetland association described by McAvoy and Clancy (1994) in Delaware are related to, and may be synonymous with this community. The wet community of barrier flats of North Carolina described by Travis and Godfrey (1976) may also be included in this community. Portions of the maritime wet grassland described from North Carolina by Schafale and Weakley (1990) may be included in this community.

REFERENCES:

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PLOTS:

47AB04
37RR04
TNC12
TNC13
TNC18

Spartina patens, Scirpus pungens , Solidago sempervirens (Upland) Herbaceous Vegetation

COMMON NAME:	Salt hay , Three-square , Seaside Goldenrod Herbaceous Vegetation
SYNONYM:	Maritime dry grassland; overwash community; Overwash dune grassland
TNC SYSTEM:	Terrestrial
PHYSIOGNOMIC CLASS:	Herbaceous vegetation
PHYSIOGNOMIC SUBCLASS:	Short grassland
PHYSIOGNOMIC GROUP:	Temperate and subpolar short grassland
FORMATION:	Open short grassland
ALLIANCE:	*Spartina patens , (Scirpus pungens)* (upland) Herbaceous Alliance

CLASSIFICATION CONFIDENCE LEVEL: 2

RANGE: This community ranges from Maryland to North Carolina.

ENVIRONMENTAL DESCRIPTION: This community is an upland dune grassland of mid-Atlantic barrier islands. 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* or *Uniola paniculata*, which are primarily impacted by wind-deposited sand. Storm overwash is a prevalent natural disturbance to this community. This community is common at the north end of Assateague Island NS where extensive sand overwash has occurred. This community is also frequent in the interdunes behind foredune "blowouts" created after large storm events. This community appears to be a successional step between interdunal herbaceous wetlands and interdunal herbaceous/shrub uplands. It is interesting to note that approximately 10 to 20 cm below the sandy surface of this vegetation often lies the dark organic soils of a buried wetland.

USFWS WETLAND SYSTEM: Not applicable

MOST ABUNDANT SPECIES:

Globally:

Strata	Species
Herbaceous	*Spartina patens, Solidago sempervirens, Strophostyles helvula*

ASIS:

Strata	Species
Herbaceous	*Scirpus pungens, Spartina patens*

DIAGNOSTIC SPECIES: *Spartina patens, Solidago sempervirens*

VEGETATION DESCRIPTION: This community is characterized by upland maritime dune grassland vegetation. *Spartina patens,* and sometimes *Scirpus pungens,* 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, Solidago sempervirens, Cenchrus tribuloides, Setaria parviflora, Distichlis spicata, Sabatia stellaris, Ammophila breviligulata, Suaeda linearis, Bassia hirsuta, Atriplex patula, Fimbristylis castanea,* and *Cakile edentula* ssp. *edentula*.

At Assateague Island NS, this community is characterized by *Spartina patens* and *Scirpus pungens,* which takes on a stunted growth form and *Spartina patens* takes on a dry wispy growth form. The two species can grow separately or together; separately they tend to be more sparse in their total cover than in areas where they occur together. Very few other species are associated with this community and constitute little additional ground cover. These may include scattered individuals of *Toxicodendron radicans, Solidago sempervirens, Lythrum lineare, Kosteletzkya virginica,* and seedlings of *Baccharis halimifolia*. Hill (1986) notes the following additional species of pans and washes: *Suaeda linearis, Bassia hirsuta, Atriplex patula, Polygonum glaucum, Spergularia marina, Salicornia bigelovii,* and *S. virginica*.

OTHER NOTEWORTHY SPECIES: None

CONSERVATION RANK: G2G3

RANK JUSTIFICATION: This community is restricted to mid-Atlantic barrier beaches, and is threatened by development pressure.

COMMENTS: The "wash" briefly described by Hill (1986) and Higgins et al. (1971) on Assateague Island are synonymous with this community, as are the grassland community described from Virginia by Baumann (1978) and the low dune community of Boule (1979). Portions of the dunegrass community of Higgins et al. (1971), the maritime dry grassland of North Carolina described by Schafale and Weakley (1990), the dry community of barrier flats described from North

Carolina by Travis and Godfrey (1976), and the secondary dunes described from Virginia by Klotz (1986) are also included in this community.

REFERENCES:

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PLOTS:

27RR01
TNC15
TNC17
22RR03

Spartina patens, Distichlis spicata , Borrichia frutescens Herbaceous Vegetation

COMMON NAME: Salt hay, Saltgrass , Sea Oxeye Daisy Herbaceous Vegetation

SYNONYM: High marsh; High salt marsh

TNC SYSTEM: Terrestrial

PHYSIOGNOMIC CLASS: Herbaceous

PHYSIOGNOMIC SUBCLASS: Short grassland

PHYSIOGNOMIC GROUP: Temperate and subpolar short grassland

FORMATION: Saltwater tidal regularly / irregularly flooded short grassland

ALLIANCE: *Spartina patens* (Estuarine) Herbaceous Alliance

CLASSIFICATION CONFIDENCE LEVEL: 2

RANGE: This community ranges from Delaware south to Florida.

ENVIRONMENTAL DESCRIPTION: This community is restricted to salt marshes, occurring at a slightly higher elevation than the adjacent *Spartina alterniflora, Ascophyllum nodosum* Herbaceous Vegetation. As such, it receives irregular tidal flooding. The substrate is peat of variable depths overlying sand. At Assateague Island NS, the community is irregularly to regularly flooded by the brackish waters from the bay or nearby water channels and its water table is at or near the surface. Soils are generally 10 to 30 cm of very poorly drained peaty organics overtop grey or mottled sand. The *Scirpus robustus* variant is characterized by shallow peaty soils (up to 20 cm) that are very poorly drained and appear to be influenced by freshwater, amidst infrequent brackish overwash.

USFWS WETLAND SYSTEM: Estuarine System

MOST ABUNDANT SPECIES:

Globally:

Strata	Species
Herbaceous	*Spartina patens, Distichlis spicata*

ASIS:

Strata	Species
Herbaceous	*Spartina patens, Distichlis spicata*

DIAGNOSTIC SPECIES: *Spartina patens, Distichlis spicata, Borrichia frutescens, Kostyletzyka virginica, Pluchea purpurascens*

VEGETATION DESCRIPTION: This high salt marsh coastal community is dominated by *Spartina patens,* forming meadows at slightly higher elevations in relation to the adjacent *Spartina alterniflora, Ascophyllum nodosum* Herbaceous Vegetation. *Distichilis spicata, Limonium carolinianum, Agalinis maritima, Salicornia virginica, Sabatia stellaris, Borrichia frutescens, Lythrum lineare, Scirpus pungens, Eleocharis rostellata, Solidago sempervirens, Fimbristylis castanea, Pluchea purpurascens, Hibiscus palustris,* and *Atriplex patula* var. *hastata* are characteristic associates. Shrub seedlings such as *Baccharis halimifolia* and *Myrica cerifera* may also be found in this community. This community is differentiated from the *Spartina patens, Distichlis spicata, Plantago maritima* Herbaceous Vegetation of New England, New York, and New Jersey by the absence or relative infrequent occurrence of *Juncus gerardii, Puccinellia fasciculata, Plantago maritima,* and *Triglochin maritima* and by the importance of species of southern distribution such as *Borrichia frutescens, Kostyletzyka virginica, Fimbristylis castanea, Lythrum lineare*. *Juncus roemerianus*, occurring as discrete patches reaching substantial size, is a community associated with the *Spartina patens, Borrichia frutescens* Herbaceous Vegetation.

At Assateague Island NS, this community covers extensive areas of bayside marsh. The community is almost solely vegetated by *Spartina patens* (from 75 to 100 percent cover) with few associated species except for small amounts of *Distichlis spicata* (up to 10 percent cover). Associates include *Eleocharis rostellata, Lythrum lineare, Fimbristylis castanea,* and *Sabatia stellaris*. Hill (1986) also notes the "infrequent but widespread" presence of *Juncus gerardi* in salt marshes of Assateague, and denotes *Borrichia frutescens* as "rare" and confined to the Virginia portion of the island.

A variant of this community has *Scirpus robustus* as a substantial component. It is comprised of *Scirpus robustus* forming large discrete patches up to a half hectare in size, with *Spartina patens* and *Distichlis spicata* forming a continuous and dense "understory". This variant is limited to the bayside highmarsh on Assateague Island NS. Combined, these three species completely cover the ground except for a small percentage of leaf and stem litter that persists from past growing seasons. *Baccharis halimifolia*, occurring primarily as seedlings, is also an associate.

OTHER NOTEWORTHY SPECIES: None

CONSERVATION RANK: G4G5

RANK JUSTIFICATION: Although widespread on the eastern seaboard, examples of this community that have not been impacted by ditching, dredging and filling, mosquito spraying, and other activities are relatively uncommon.

COMMENTS: Despite the rarity of *Borrichia frutescens* at Assateague Island NS, the high marsh community of Assateague is classified with the high marshes of southern affinity because of the

relative lack of northern species and the presence of others with southern distribution. The salt marsh community described from Assateague Island by Hill (1986) and Higgins et al. (1971) are partially contained within this community. The *Spartina patens , Distichlis spicata* high marsh described from Delaware (Clancy 1993) is synonymous, as are the *Spartina , Distichlis , Juncus* associates described of southern salt marshes by Penfound (1952), the *Spartina patens* type described from North Carolina by Cooper and Waits (1973), the *Aster tenuifolius , Distichlis spicata, Fimbristylis castanea , Borrichia frutescens , Spartina patens* association of the high marsh described from North Carolina by Adams (1963), and the high marsh of south Atlantic and Gulf coast marshes (Cooper 1974).

Vegetation similar to the *Scirpus robustus* variant has been described by several authors: *Spartina patens* type (Cooper and Waits 1973, North Carolina); *Scirpus robustus* association (Bourn and Cottam 1950, Delaware); salt estuarine bay-marsh, saltmarsh bulrush and seashore saltgrass (Hindman and Stotts 1989, Chesapeake Bay and North Carolina Sounds).

REFERENCES:

Adams, D.A. 1963. Factors influencing vascular plant zonation in North Carolina salt marshes. Ecology 44: 445-455.

Bourn, W.S. and C. Cottam. 1950. Some Biological Effects of Ditching Tidewater Marshes. Research Report 19, Fish and Wildlife Service, USDI. 30 pp.

Clancy, K. 1993. A preliminary classification of the natural communities of Delaware (draft). Delaware Natural Heritage Inventory, Div. of Parks and Recreation, Dover, DE. 30 p.

Cooper, A.S. 1974. Salt marshes. In Odum, H.T. and B.J. Copeland (eds). Coastal Ecological Systems of the United States. II. The Conservation Foundation, Washington D.C.

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Hindman, L.J. and V.D. Stotts. 1989. Chesapeake Bay and North Carolina Sounds. In Smith, Pederson and Kaminski (eds). Habitat Management for Migrating and Wintering Waterfowl in North America. Texas Tech. Univ. Press. Lubbick, TX. 560 pp.

Penfound, W.T. 1952. Southern swamps and marshes. Bot. Rev. 18: 413-446.

PLOTS:

47AB02
32RR05
77AB02
TNC11
47RR01
32RR07
77AB07
67AB02

Smilax glauca, Toxicodendron radicans Shrubland

COMMON NAME: Sawbrier, Poison Ivy Shrubland

SYNONYM: Vine dune

TNC SYSTEM: Terrestrial

PHYSIOGNOMIC CLASS: Shrubland

PHYSIOGNOMIC SUBCLASS: Deciduous shrubland

PHYSIOGNOMIC GROUP: Cold-deciduous shrubland

FORMATION: Temperate cold-deciduous shrubland

ALLIANCE: *Smilax* spp., *Toxicodendron radicans* Shrubland Alliance

CLASSIFICATION CONFIDENCE LEVEL: 3

RANGE: This vegetation is not widely described in the literature, but is suspected to occur in New England south to Maryland and perhaps Virginia.

ENVIRONMENTAL DESCRIPTION: Generally confined to barrier beach systems, this vegetation is comprised of dense vines that cover the crests of dunes that are exposed to salt spray and winds. Very little soil development occurs and the water table is well below 1 meter in depth.

USFWS WETLAND SYSTEM: Not applicable

MOST ABUNDANT SPECIES:

Globally:

Strata	Species
Herbaceous	*Smilax rotundifolia, S. glauca, Toxicodendron radicans*

ASIS:

Strata	Species
Herbaceous	*Smilax glauca, Vitis rotundifolia, Smilax rotundifolia, Parthenocissus quinquefolia*

DIAGNOSTIC SPECIES: *Smilax glauca, Smilax rotundifolia, Toxicodendron radicans, Parthenocissus quinquefolia*

VEGETATION DESCRIPTION: This community is best described as vine-covered maritime sand dunes. The dominant species of any single dune may be one of any of a number of vine species such as *Smilax glauca, S. rotundifolia, Vitis rotundifolia, Parthenocissus quinquefolia,* or *Toxicodendron radicans.* In some cases, the vines are low-growing and occur directly on the sand surface, but in others, the vegetation has a height of 1m or more, with vines growing over older stems of the same species, or over other shrubs such as *Myrica pensylvanica*.

At Assateague Island NS, this community is most common in the central portion of the island, near the area known as Fox Hills. Vegetation characteristic of this community is dominated by dense vines (up to 70 percent cover), primarily *Smilax glauca*. Usually present, but providing much less cover are other vines including *Vitis rotundifolia, Toxicodendron radicans, Smilax rotundifolia,* and *Parthenocissus quinquefolia*. Associated herbs are sparse and may include scattered individuals of *Linaria canadensis, Lechea maritima, Rumex acetosella, Schizachyrium scoparium* ssp. *littorale*, and *Solidago sempervirens.* Shrub species constitute very little cover and are much less common, but occasional *Rubus argutus, R. flagellaris, Hudsonia tomentosa, Myrica pensylvanica* and *Myrica cerifera* can be found. Overall, vegetation is low to the ground (less than half a meter tall) and generally covers 70 to 80 percent of the community, with exposed sand remaining.

OTHER NOTEWORTHY SPECIES: None

CONSERVATION RANK: Information not available.

RANK JUSTIFICATION: More study is necessary to determine the range of this community, but it is not likely to be common.

COMMENTS: The greenbrier thicket described from Island Beach State Park, New Jersey by Martin (1959) likely belongs to this community. Neither Hill (1986) nor Higgins et al. (1971) describe this community *per se* on Assateague Island.

REFERENCES:

Higgins, E.A.T., R.D. Rappleye, and R.G. Brown. 1971. The flora and ecology of Assateague Island. University of Maryland Agriculture Experiment Station Bull. A-172. 70 pp.

Hill, S. 1986. An annotated checklist of the vascular flora of Assateague Island (Maryland and Virginia). Castanea 5: 265-305.

Martin, W.E. 1959. The vegetation of Island Beach State Park, New Jersey. Ecol. Monogr. 29: 1-46.

PLOTS:

57AB07
57AB06
57AB05
42RR02

Salicornia spp , Sarcocornia perennis , Spartina alternifolia Herbaceous Vegetation

COMMON NAME: Saltwort, Saltwater Cordgrass Herbaceous Vegetation

SYNONYM: Salt panne

TNC SYSTEM: Terrestrial

PHYSIOGNOMIC CLASS: Herbaceous

PHYSIOGNOMIC SUBCLASS: Low forb vegetation

PHYSIOGNOMIC GROUP: Perennial low forb vegetation

FORMATION: Saltwater tidal semi-permanently flooded low perennial forb vegetation

ALLIANCE: *Salicornia, Spartina alterniflora* Herbaceous Alliance

CLASSIFICATION CONFIDENCE LEVEL: 2

RANGE: This community occurs in coastal salt marshes from Nova Scotia to the Carolinas, north of the range of *Batis maritima*.

ENVIRONMENTAL DESCRIPTION: This community tends to develop in shallow depressions within high salt marshes where drainage is poor. The depressions are 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, or by mosquito ditch levees which create small impoundments. At Assateague Island NS, this community is typically identified as large sparsely vegetated "circular" flats or depressions within the low marsh community. Throughout the seasons, large areas of slight depression in the low marsh hold brackish to hypersaline water up to 10 cm in depth.

USFWS WETLAND SYSTEM: Estuarine System

MOST ABUNDANT SPECIES:

Globally:

Strata	Species
Herbaceous	*Salicornia bigelovii, S. virginica, Sarcocornia berennis, Spartina alterniflora*

ASIS:

Strata	Species
Herbaceous	*Salicornia bigelovii, S. virginica, Sarcocornia perennis, Spartina alterniflora*

DIAGNOSTIC SPECIES: *Salicornia bigelovii, S. virginica, Sarcocornia perennis*

VEGETATION DESCRIPTION: This community is salt panne vegetation dominated by *Salicornia bigelovii, S. virginica, Sarcocornia perennis,* and/or a short form of *Spartina alterniflora*. Total vegetation cover is quite variable in pannes, from near total absence of vascular plants to a dense cover of *Salicornia bigelovii, S. virginicus, Sarcocornia perennis*, or *Spartina alterniflora*. *Limonium carolinianum* is another common associate. Algal mats are characteristically present, visible even in densely vegetated pannes. The following algae were noted to occur in association with *Spartina alterniflora* in the littoral zone of a Massachusetts salt marsh: *Oscillatoria subuliforms, O. amphibia, Lyngbya* spp., *Microcoleus chthonoplastes, Nodularia harveyana, Hydrocoleum lyngbyaceum, Symploca* spp. (Webber 1967).

At Assateague Island NS, this community most frequently occurs within large areas of the *Spartina alterniflora / Ascophyllum nodosum* Herbaceous Vegetation. Vegetation is sparse in these mud flats except for a dense algal mat that develops later in the summer. Occasional *Spartina alterniflora* persist in the flats, but the pans mostly remain unvegetated until late summer and fall. By late season, most of the standing water has dried and *Salicornia virginica* and *S. bigelovii* can become quite dense. No other vegetation is associated with this community. This community is regularly to irregularly flooded by nearby brackish water. Bare peat, and mucky soils are prevalent (up to 85 percent bare soils) and, at high tide, standing water covers this community. Hill (1986) includes the following additional species as components of pans on Assateague Island: *Bassia hirsuta, Spergularia marina, Atriplex patula* var. *hastata, Suaeda linearis, Suaeda maritima,* and *Agalinis maritima.*

OTHER NOTEWORTHY SPECIES; Blue-green algae are an important component of this community, in some cases contributing significantly more biomass than do vascular species.

CONSERVATION RANK: G5

RANK JUSTIFICATION: This community is common in salt marshes of the northeast.

COMMENTS: The pans described from Assateague Island by Hill (1986) and Higgins et al. (1971) are synonymous with this community. This vegetation has been described by numerous researchers. The following names are considered synonyms: *Salicornia europaea , Spartina alterniflora* community (Metzler and Barrett 1992, Connecticut); salt marsh complex, pannes (Breden 1989, New Jersey); salt panne (Reschke 1990, New York); *Spartina alterniflora / Salicornia europaea* community and salt panne (Clancy 1993, Delaware); pan (Nichols 1920, Connecticut); panne (Good

1965, New Jersey); *Salicornia* tidal flat (Clovis 1968, Virginia); salt pan (Klotz 1986, Virginia); *Salicornia , Bassia* salt flat (Harvill 1965, Virginia); Salicornietum ambiguae (Conard 1935, New York); salt flat (Schafale and Weakley 1990, North Carolina); salt panne and stunted *Spartina alterniflora* community (Miller and Egler 1950, Connecticut); panne marsh (Baumann 1978).

REFERENCES:

Baumann, C. 1978. The effects of overwash on the vegetation of a Virginia barrier island. MA thesis. College of William and Mary, Williamsburg, VA. 104 pp.

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Miller, W.R. and F.E. Egler. 1950. Vegetation of the Wequetequock-Pawcatuck tidal-marshes, Connecticut. Ecol. Monogr. 20: 143-172.

Nichols, G.E. 1920. The vegetation of Connecticut. III. The associations of depositing areas along the seacoast. Bull. Torr. Bot. Club 47: 511-548.

Reschke, C. 1990. Ecological communities of New York State. New York Natural Heritage Program. New York State Dept. of Environmental Conservation. Latham, NY. 96 p.

Schafale, M.P. and A.S. Weakley. 1990. Classification of the natural communities of North Carolina. Third Approximation. North Carolina Natural Heritage Program, Division of Parks and Recreation, N.C. Dept. of Environment, Health, and Natural Resources. Raleigh, NC. 325 p.

Webber, E.E. 1967. Bluegreen algae from a Massachusetts salt marsh. Bull. Torr. Bot. Club 94: 99-106.

PLOTS:

72AB03
62AB03
32RR08
32RR13

Cakile edentula ssp. edentula, Salsola caroliniana Sparse Vegetation

COMMON NAME: Sea Rocket, Saltwort Sparsely Vegetated Community

SYNONYM: Beach community; Upper ocean beach

TNC SYSTEM: Terrestrial

PHYSIOGNOMIC CLASS: Sparsely vegetated

PHYSIOGNOMIC SUBCLASS: Sparsely vegetated sand accumulations

PHYSIOGNOMIC GROUP: Sparsely vegetated sand dunes

FORMATION: Storm tide irregularly flooded upper beaches

ALLIANCE: *Cakile edentula* Sparsely Vegetated Alliance

CLASSIFICATION CONFIDENCE LEVEL: 2

RANGE: This community occurs in maritime coastal areas from southern Maine to Cape Hatteras, North Carolina.

ENVIRONMENTAL DESCRIPTION: This community occurs on maritime beaches that are subject to irregular tidal flooding, generally spring or storm tides in maritime settings. Vegetation cover is variable, depending on the amount of exposure to wave and wind action, but on average is sparse. At Assateague Island NS, this community occurs on the unconsolidated sands of the beach and foredunes.

USFWS WETLAND SYSTEM: Not applicable

MOST ABUNDANT SPECIES:

Globally:

Strata	Species
Herbaceous	*Cakile edentula* ssp. *edentula, Salsola caroliniana, Chamaesyce polygonifolia, Atriplex arenaria*

ASIS:

Strata	Species
Herbaceous	*Cakile edentula* ssp. *edentula, Salsola caroliniana, Triplasis purpurea, Chamaesyce polygonifolia*

DIAGNOSTIC SPECIES: *Cakile edentula* ssp. *edentula, Salsola caroliniana, Atriplex arenaria, Chamaesyce polygonifolia*

VEGETATION DESCRIPTION: This community is sparsely vegetated on average, so no species can be considered dominant. Annual or biennial species more or less restricted to beach habitats are characteristic of this community, including *Cakile edentula* ssp. *edentula*, as well as *Salsola caroliniana, Chamaesyce polygonifolia, Honckenya peploides, Cenchrus tribuloides, Amaranthus retroflexus, Chenopodium album, Erechtites hieracifolia* and *Atriplex arenaria*. Sparse *Ammophila breviligulata* is also a common associate.

At Assateague Island NS, this community is sparsely vegetated with *Cakile edentula* ssp. *edentula*, covering approximately one percent of the area. Other associated species in this community are just as sparse and generally adapted to a low growth form, given the exposed windy conditions of their environment. Associated species include *Ammophila breviligulata, Chamaesyce polygonifolia, Salsola caroliniana,* and *Triplasis purpurea*; constituting less than additional percentage of vegetation cover, combined. 95 to 99 percent of the substrate is unvegetated sand.

OTHER NOTEWORTHY SPECIES: *Amaranthus pumilus* is a globally rare species restricted to this community but is thought to have been extirpated from Assateague Island.

CONSERVATION RANK: G4G5

RANK JUSTIFICATION: This community is common on maritime dunes of the northeast, but is vulnerable to development and shifting wave action due to jetties.

COMMENTS: The following names have been applied to vegetation that are considered to be synonymous: beach community (Hill 1986, Assateague Island); beach (Higgins et al. 1971, Assateague Island); beach community (Johnson 1985); pioneer beach community (Boule 1979, Virginia); beach (Fender 1937, New Jersey); dune-strand area (Clovis 1968, Virginia); dune community (Jenkins 1974, Chesapeake Bay); beach community (Baumann 1978, Virginia); middle beach (Shreve et al. 1910, Maryland); *Cakiletum edentulae* (Conard 1935, New York); sea-strand vegetation, beach formation (Harshberger 1900, New Jersey); middle beach (Nichols 1920, Connecticut); embryo dune (Klotz 1986); beach (McDonnell 1979, Massachusetts); maritime beach (Reschke 1990, New York); beach vegetation (Moul 1969, Massachusetts); marine sandy beach (Clancy 1993, Delaware); marine intertidal gravel / sand beach community (Breden 1989, New Jersey); coastal beach strand (Sperduto 1994, New Hampshire); Beach strand community (Maine Natural Heritage Program 1991); *Cakile edentula , Chenopodium album* community (Metzler and Barrett 1992, Connecticut). The dune and swale community described from the Virginia portion of Assateague (Stalter 1992) is partially contained within this community.

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PLOTS:

17RR02
67AB03
22RR04
62AB05

VEGETATION KEY

1a. Vegetation woody, tall (height 2m or taller)..... 2
1b. Vegetation generally shorter than 2m 8

2a. Vegetation predominantly needle-leaved..... 3
2b. Vegetation predominantly deciduous..... 5

3a. Vegetation more or less densely shaded 4
3b. Vegetation more open, with patches of bare sand prevalent.....
***Pinus taeda /Hudsonia tomentosa* Woodland**

4a. Soils characterized by duff overlying sands; not influenced by water table.....
***Pinus taeda / Myrica cerifera / Vitis rotundifolia* Forest**
4b. Soils characterized by moderately deep muck, surface water often present.....
***Pinus taeda / Myrica cerifera / Osmunda regalis* Forest**

5a. Tree species dominant (*Prunus serotina, Aronia arbutifolia*) (although individuals may exhibit multiple trunks)..... 6
5b. Shrub species dominant 7

6a. Soils not influenced by water table .....
***Prunus serotina / Myrica cerifera / Smilax rotundifolia* Forest**
6b. Soils wet..... ***Acer rubrum - Nyssa sylvatica - Magnolia virginiana* Forest**

7a. Soils deep mucks with surface water common; hydrophytes present.....
***Myrica cerifera / Hydrocotyle* spp. Shrubland**
7b. Soils drier (but still may be influenced by water table) .....
***Myrica cerifera - Baccharis halimifolia / Spartina patens* Shrubland**

8a. Vegetation characterized by shrubs (>25% cover) < 2m tall, or vines 9
8b. Vegetation characterized by herbs 14

9a. *Myrica pensylvanica* dominant shrub 10
9b. Vegetation not as above 11

10a. Vegetation of foredunes; patchy, sparse, with open sand patches common .....
***Myrica pensylvanica / Diodia teres* Shrubland**
10b. Vegetation of more stable substrate; bunch grasses (*Schizachyrium scoparium, Andropogon virginicus*) and herbs *Eupatorium hyssopifolium, E. rotundifolium, Gnaphalium* common .....
***Myrica pensylvanica / Schizachyrium scoparium* ssp. *littorale - Eupatorium hyssopifolium* Sparse Shrubland**

11a. *Myrica cerifera* dominant shrub.....
***Myrica (cerifera, pensylvanica) - Vaccinium corymbosum* Shrubland**
11b. Vegetation not as above 12

12a. Vines dominant ..... ***Smilax glauca - Toxicodendron radicans* Shrubland**
12b. Shrubs dominant 13

13a. Dwarf-shrubs dominant.....
Hudsonia tomentosa / Panicum (amarum, amarulum) **Dwarf-shrubland**
13b. Shrubs > 0.25m tall dominant.....
Baccharis halimifolia - Iva frutescens / Spartina patens **Shrubland**

14a. Herbaceous vegetation restricted to salt or brackish marshes (influenced by tidal flooding)..... 15
14b. Herbaceous vegetation not tidally influenced..... 21

15a. *Spartina alterniflora* present in quantity or in lesser amounts with *Distichlis spicata* 16
15b. *Spartina alterniflora* nearly to totally absent 18

16a. *Spartina alterniflora* monotypic with little bare substrate.....
Spartina alterniflora / Ascophyllym nodosum **Herbaceous Vegetation**
16b. Vegetation not as above..... 17

17a. *Distichlis spicata* prevalent.....
Spartina alterniflora / Ascophyllumnodosum **Herbaceous Vegetation, *Distichlis spicata* variant**
17b. Large algal mats present; *Salicornia* spp. usually present.....
Salicornia spp. *Sarcocornia perennis - Spartina alterniflora* Herbaceous Vegetation

18a. *Juncus roemerianus* dominant .....***Juncus roemerianus*** **Herbaceous Vegetation**
18b. *Spartina patens* prevalent..... 19

19a. *Scirpus robustus* prevalent.....
Spartina patens - Distichlis spicata - Borrichia frutescens **Herbaceous Vegetation, *Scirpus robustus* variant**
19b. *Scirpus robustus* absent..... 20

20a. Tall graminoids prevalent.....
Typha angustifolia - Hibiscus moscheutos **Herbaceous Vegetation**
20b. Short grasses prevalent .....
Spartina patens - Distichlis spicata - Borrichia frutescens **Herbaceous Vegetation**

21a. Vegetation very sparse, dominated by forbs.....
Cakile edentula **ssp. *edentula - Salsola caroliniana*** **Herbaceous Vegetation**
21b. Vegetation >10% cover..... 22

22a. Vegetation of dry sandy beaches and flats..... 23
22b. Vegetation of sheltered areas influenced by seasonal water table 24

23a. Vegetation of foredunes, *Ammophila breviligulata* present in quantity .....
Ammophila breviligulata - Panicum (amarum, amarulum) **Herbaceous Vegetation**
23b. Vegetation of overwash areas, *Scirpus pungens* or *Spartina patens* present in quantity.....
Spartina patens - Scirpus pungens - Solidago sempervirens **(upland) Herbaceous Vegetation**

24a. Tall graminoid, depauperate, strongly dominated by Phragmites australis .....
Phragmites australis **Herbaceous Vegetation**
24b. Vegetation of greater diversity..... 25

25a. *Panicum virgatum* prevalent to strongly dominant.....
***Panicum virgatum* - *Spartina patens* Herbaceous Vegetation**
25b. *Panicum virgatum* minor to absent.....26

26a. *Drosera intermedia* very common; *Scirpus pungens* minor to absent.....
***Juncus dichotomus* - *Drosera intermedia* Herbaceous Vegetation**
26b. *Drosera intermedia* absent; *Scirpus pungens* common .....
***Scirpus pungens* - *Fimbristylis castanea* Herbaceous Vegetation**

Discussion

Overall, the sampling of vegetation and development of a classification for Assateague Island were successful. There were a number of minor difficulties (to be expected in a pilot project), and the lessons learned should prove valuable for future mapping projects. Following are some specific recommendations that should improve future vegetation mapping projects:

1. Make sure that there is enough time to complete the up-front ground work, so that everyone has a good idea of the vegetation types and the environmental gradients. This is essential to determine where the sampling should occur across the Park unit.

2. Analysis of the time requirements for this project should be better incorporated to develop realistic deadlines for the vegetation sampling, vegetation classification and the development of the descriptive products.

3. Vegetation sampling should ideally be conducted by two person teams, an ecologist/botanist and an assistant. Having a second person to help haul equipment, lay out plots, record data, and take GPS readings may more than double the efficiency of the operation.

4. Make sure that there is a well thought-out and documented plan for what the Park will be able to provide in terms of on-site logistics, and for the training, use and post-processing associated with GPS applications.

Appendix H. Local and global vegetation descriptions for Assateague Island National Seashore

U.S. National Vegetation Classification

Associations of
Assateague Island National Seashore

14 May 2013

by

NatureServe

4600 North Fairfax Drive, 7th Floor
Arlington, VA 22203

c/o University of Massachusetts at Boston
Biology Department
100 Morrissey Blvd.
Boston, MA 02125-3393

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



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Citations

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NatureServe
4600 North Fairfax Drive, 7th floor
Arlington, VA 22203

About NatureServe

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

United States

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

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

Canada

Alberta Natural Heritage Information Centre, Edmonton, AB, Canada; Atlantic Canada Conservation Data Centre, Sackville, New Brunswick, Canada; British Columbia Conservation Data Centre, Victoria, BC, Canada; Manitoba Conservation Data Centre. Winnipeg, MB, Canada; Ontario Natural Heritage Information Centre, Peterborough, ON, Canada; Quebec Conservation Data Centre, Quebec, QC, Canada; Saskatchewan Conservation Data Centre, Regina, SK, Canada; Yukon Conservation Data Centre, Yukon, Canada

Latin American and Caribbean

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

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

Association Descriptions

1. Forest to Open Woodland

1.B.2. Cool Temperate Forest

1.B.2.Na. Eastern North American Cool Temperate Forest

M502. Appalachian & Northeastern Oak - Hardwood & Pine Forest

G495. North Atlantic Maritime Scrub Forest

Deciduous Maritime Scrub Forest

***Prunus serotina / Morella cerifera / Smilax rotundifolia* Scrub Forest**
Black Cherry / Wax-myrtle / Roundleaf Greenbrier Scrub Forest
Identifier: CEGL006319

USNVC CLASSIFICATION

Division	Eastern North American Cool Temperate Forest (1.B.2.Na)
Macrogroup	Appalachian & Northeastern Oak - Hardwood & Pine Forest (M502)
Group	North Atlantic Maritime Scrub Forest (G495)
Association	Maritime Deciduous Scrub Forest

ELEMENT CONCEPT

Global Summary: This association comprises tall, temperate, deciduous maritime shrublands or scrub forests of the mid-Atlantic coast. It generally occurs on the lee side of sand dunes along the coast and is subject to salt spray and winds. The substrate varies from pure sand directly adjacent to the ocean to loamy sands in more sheltered areas of the coast. Although placed within the shrubland class at one time, the physiognomy of this vegetation can be variable and ranges from open woodland to stunted forest to dense nearly impenetrable thicket (this association has been placed back in the forest class). Individual trees tend to be wind-pruned and multi-stemmed. The vegetation is dominated by *Prunus serotina* (black cherry), *Amelanchier canadensis* (Canadian serviceberry), *Pinus taeda* (loblolly pine), *Sassafras albidum* (sassafras), *Photinia pyrifolia* (red chokeberry), and *Diospyros virginiana* (common persimmon) in varying proportions. *Morella cerifera* (wax-myrtle) and *Vaccinium corymbosum* (highbush blueberry) may form a subcanopy, but if the community is particularly stunted, this species may contribute substantially to the canopy. Lianas are abundant in the canopy or over the ground layer, and species include *Smilax rotundifolia* (roundleaf greenbrier), *Smilax glauca* (cat greenbrier), *Parthenocissus quinquefolia* (Virginia creeper), and *Toxicodendron radicans* (eastern poison-ivy). Herbs are generally scarce to lacking entirely, and when present are generally made up of tree and vine seedlings.

ENVIRONMENTAL DESCRIPTION

Assateague Island National Seashore Environment: This association generally occurs behind the interdunes on Assateague Island National Seashore in a relatively low topographic position, often in association with Wax-myrtle Shrub Swamp (CEGL003840). Analysis of lidar-derived data of Brock et al. (2007) indicates an average elevation of 0.88 m.

Global Environment: This association occurs on naturally stabilized dunes, generally occurring leeward of secondary dunes. It is subject to wind and salt spray to varying degrees. The substrate varies from pure sand directly adjacent to the ocean to loamy sands in more sheltered areas of the coast.

VEGETATION DESCRIPTION

Assateague Island National Seashore Vegetation: This vegetation is characterized by variable species composition and physiognomy. The tree canopy is patchy, comprised of *Prunus serotina* (black cherry), *Acer rubrum* (red maple), *Amelanchier canadensis* (Canadian serviceberry), *Diospyros virginiana* (common persimmon), and *Malus angustifolia* (southern crabapple). In some areas, *Prunus serotina* (black cherry) contributes only minor cover in comparison to *Acer rubrum* (red maple) and *Photinia pyrifolia* (red chokeberry). Stunted trees are evenly mixed with tall *Morella cerifera* (wax-myrtle) and *Vaccinium corymbosum* (highbush blueberry) to form a dense scrub forest or tall shrub thicket. To a much lesser extent, *Pinus taeda* (loblolly pine) and *Ilex opaca* (American holly) may occur locally, although *Pinus taeda* (loblolly pine) can sometimes contribute up to 50% canopy cover. The dense tall-shrub layer is dominated by *Morella cerifera* (wax-myrtle) with *Vaccinium corymbosum* (highbush blueberry) as a common associate. Less common, yet scattered throughout, are individuals of *Photinia pyrifolia* (red chokeberry) or *Rhus copallinum* (winged sumac). Tangled over most of the subcanopy and shrub layers of this community is a dense cover of vines, predominantly *Smilax rotundifolia* (roundleaf greenbrier), *Smilax glauca* (cat greenbrier), *Parthenocissus quinquefolia* (Virginia creeper), and *Toxicodendron radicans* (eastern poison-ivy), making this vegetation almost impenetrable. Herb cover is sparse to nonexistent due to heavy shading from the dense canopy. Most obvious are *Festuca rubra* (red fescue), *Rumex acetosella* (common sheep sorrel), and vine seedlings sparsely scattered on the dry leaf litter. Other occasional herbaceous associates may include *Chasmanthium laxum* (slender woodoats), *Panicum virgatum* (switchgrass), *Andropogon virginicus* (broomsedge bluestem), and *Andropogon glomeratus* (bushy bluestem).

Global Vegetation: This is a tall, deciduous shrubland or scrub forest, although physiognomy can vary dramatically, ranging from open woodland to stunted forest to dense nearly impenetrable thicket. Individual trees tend to be wind-pruned and multi-stemmed. The vegetation is dominated by *Prunus serotina* (black cherry), *Amelanchier canadensis* (Canadian serviceberry), *Pinus taeda* (loblolly pine), *Sassafras albidum* (sassafras), *Photinia pyrifolia* (red chokeberry), and *Diospyros virginiana* (common persimmon) in varying proportions. *Morella cerifera* (wax-myrtle) and *Vaccinium corymbosum* (highbush blueberry) may form a subcanopy, but if the community is particularly stunted, this species may contribute substantially to the canopy. Lianas are abundant in the canopy or over the ground layer, and species include *Smilax rotundifolia* (roundleaf greenbrier), *Smilax glauca* (cat greenbrier), *Parthenocissus quinquefolia* (Virginia creeper), and *Toxicodendron radicans* (eastern poison-ivy). Herbs are generally scarce to lacking entirely, and when present are generally made up of tree and vine seedlings. At the southern end of the range in Virginia, this community occurs as a woodland variably dominated by *Prunus serotina* (black cherry), *Sassafras albidum* (sassafras), *Diospyros virginiana* (common persimmon), and *Malus angustifolia var. angustifolia* (southern crabapple). Vine tangles are patchy and interspersed with areas of open sand

dominated by *Schizachyrium littorale* (shore little bluestem) and also containing *Opuntia humifusa* (devil's-tongue), *Conyza canadensis* (Canadian horseweed), *Nuttallanthus canadensis* (Canada toadflax), *Cirsium horridulum var. horridulum* (yellow thistle), and other xerophytic herbs at lower cover.

MOST ABUNDANT SPECIES

Assateague Island National Seashore

Stratum	Lifeform	Species
Tree canopy	Broad leaved deciduous tree	*Prunus serotina* (black cherry)
Shrub/sapling (tall & short)	Vine/Liana	*Smilax glauca* (cat greenbrier), *Smilax rotundifolia* (roundleaf greenbrier)
Tall shrub/sapling	Broad leaved deciduous shrub	*Photinia pyrifolia* (red chokeberry), *Vaccinium corymbosum* (highbush blueberry)
Tall shrub/sapling	Broad leaved evergreen shrub	*Morella cerifera* (wax myrtle)
Herb (field)	Graminoid	*Chasmanthium laxum* (slender woodoats)

Global

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

CHARACTERISTIC SPECIES

Assateague Island National Seashore: *Morella cerifera* (wax-myrtle), *Pinus taeda* (loblolly pine), *Prunus serotina* (black cherry)

Global: *Morella cerifera* (wax-myrtle), *Pinus taeda* (loblolly pine), *Prunus serotina* (black cherry)

CONSERVATION STATUS RANK

Global Rank & Reasons: G1G2 (18-Nov-1997). This maritime shrubland association is restricted to a narrow range on coastal dunes of barrier islands on the mid-Atlantic coast. It does not occur north of southern New Jersey or south of Virginia. Occurrences are naturally small (a few acres), confined to the oceanward portion of barrier islands. Potential or historic habitat has been reduced by extensive human development such as residential or commercial building, recreation, or road expansion.

CLASSIFICATION

Status: Standard
Classification Confidence: 2 - Moderate

Global Comments: This community is similar to *Prunus serotina - Sassafras albidum - Amelanchier canadensis - Quercus velutina / Smilax rotundifolia* Forest (CEGL006145) of the same alliance (Sneddon et al. 1994), which ranges from southern New Hampshire to New Jersey but is differentiated from this community by the absence of *Pinus taeda* (loblolly pine) and *Morella cerifera* (wax-myrtle).

Global Similar Associations:

- *Pinus taeda - Quercus (falcata, nigra) / Morella cerifera / Vitis rotundifolia* Forest (CEGL006040)
- *Prunus serotina - Sassafras albidum - Amelanchier canadensis - Quercus velutina / Smilax rotundifolia* Forest (CEGL006145)

Global Related Concepts:

- *Prunus serotina / Morella cerifera / Smilax rotundifolia* Shrubland (Harrison 2004) =
- *Prunus serotina / Myrica cerifera / Smilax rotundifolia* Forest (TNC 1997a) =
- *Prunus serotina / Myrica cerifera / Smilax rotundifolia* Forest (Bartgis 1986) =
- *Prunus serotina / Smilax rotundifolia / Schizachyrium littorale* Woodland (Fleming et al. 2006) =
- Dune woodland/dune shrubland (Breden 1989) >
- Maritime Dune Scrub (Harrison 2004) >
- Maritime Dune Woodland (Fleming et al. 2001) >
- Mixed woodland (Higgins et al. 1971) >
- Oligotrophic woodland (Rawinski 1992) >
- Sunken Forest (Stalter 1979) ><
- Sunken Forest (Dunlop and Crow 1985) ><
- Upland forest (Klotz 1986) ><
- Woodland (Boule 1979) =
- Woodland community (Hill 1986) >

ELEMENT DISTRIBUTION

Assateague Island National Seashore Range: This vegetation occurs in small patches along the length of the park in the central, more protected portion.

Global Range: This association occurs along the mid-Atlantic coast from Virginia north to Cape May, New Jersey.

Nations: US

States/Provinces: DE, MD:S1, NJ:S1, VA:S1

TNC Ecoregions: 58:C, 62:C

USFS Ecoregions (1994/95): 232Ab:CCC, 232Bz:CCC, 232Ch:CCC

Federal Lands: NPS (Assateague Island); USFWS (Cape May, Chincoteague, Wallops)

ELEMENT SOURCES

Assateague Island National Seashore Plots and Observation Points: Plots: ASIS.5 (72AB01), ASIS.6 (42AB03), ASIS.7 (42AB01); **Observation Points:** AA168, AA177, AA191, AA208, AA279, AA402, AA720, AA781.

Local Description Authors: L.A. Sneddon and A. Berdine

Global Description Authors: S.L. Neid, mod. L.A. Sneddon and G.P. Fleming

References: Bartgis 1986, Bellis 1992, Berdine 1998, Boule 1979, Bowman 2000, Breden 1989, Breden et al. 2001, Brock et al. 2007, Coxe 2009, Dunlop and Crow 1985, Eastern Ecology Working Group n.d., Fleming and Patterson 2011a, Fleming et al. 2001, Fleming et al. 2006, Harrison 2004, Harrison 2011, Higgins et al. 1971, Hill 1986, Klotz 1986, Rawinski 1992, Sneddon et al. 1994, Stalter 1979, TNC 1995c, TNC 1997a



Deciduous Maritime Scrub Forest, AA Point 191, September 9, 2009 (UTM X: 485529; UTM Y: 4226143)

Loblolly Pine Maritime Forest

***Pinus taeda - Quercus (falcata, nigra) / Morella cerifera / Vitis rotundifolia* Forest**
Loblolly Pine - (Southern Red Oak, Water Oak) / Wax-myrtle / Muscadine Forest
Identifier: CEGL006040

USNVC CLASSIFICATION

Division	Eastern North American Cool Temperate Forest (1.B.2.Na)
Macrogroup	Appalachian & Northeastern Oak - Hardwood & Pine Forest (M502)
Group	North Atlantic Maritime Scrub Forest (G495)
Association	Loblolly Pine Forest

ELEMENT CONCEPT

Global Summary: This mid-Atlantic coastal upland loblolly pine forest occurs on the Outer Coastal Plain and on barrier islands in sheltered backdunes protected from salt spray and overwash. The substrate is rapidly drained, nutrient-poor sands or sandy loams. This community is dominated by *Pinus taeda* (loblolly pine), which can be the sole canopy component or can be associated with *Quercus falcata* (southern red oak), *Prunus serotina var. serotina* (black cherry), *Quercus nigra* (water oak), and *Sassafras albidum* (sassafras). The tall-shrub layer, when present, is composed of *Morella cerifera* (wax-myrtle) and *Vaccinium corymbosum* (highbush blueberry). Vines and lianas are nearly always present in abundance; *Vitis rotundifolia* (muscadine) is most common, but *Toxicodendron radicans* (eastern poison-ivy), *Smilax rotundifolia* (roundleaf greenbrier), *Smilax glauca* (cat greenbrier), and *Parthenocissus quinquefolia* (Virginia creeper) are often present in abundance as well. The herbaceous layer is typically sparse, particularly if shrubs and vines are dense, but *Chasmanthium laxum* (slender woodoats) may be fairly abundant in this community. Other herbs include *Panicum amarum var. amarulum* (coastal panicgrass), *Eupatorium hyssopifolium* (hyssopleaf thoroughwort), and *Elephantopus nudatus* (smooth elephantsfoot). In southern Virginia, *Quercus virginiana* (live oak) and *Gelsemium sempervirens* (evening trumpetflower) may also be present, but *Quercus virginiana* (live oak) is never abundant and when present is usually restricted to the understory. In the Chesapeake Marshlands, small patches of this community were observed on Smith Island and north of Bishops Head Point near the Chesapeake Bay Foundation lodge. Vegetation at Bishops Head occupied a small upland hummock which was presumably an old homesite and therefore very fragmented.

ENVIRONMENTAL DESCRIPTION

Assateague Island National Seashore Environment: This association occurs on crests and upper bayside slopes of backdunes protected by salt spray and overwash. It occurs more frequently towards the western or bayside, often adjacent to High Salt Marsh (CEGL004197). Loblolly Pine Dune Woodland (CEGL006052) often occurs as large distinct inclusions within the forest. Loblolly Pine Wetland Forest (CEGL006137) often occurs in close association with this type. Analysis of lidar-derived data of Brock et al. (2007) indicates an average elevation of 0.5 m for the combined

map unit. Soil is sand or sandy loam, with evidence of mottling. The soil surface is usually covered with a thick layer of duff. The water table is often within a meter of the surface.

Global Environment: This community occurs on the outer coastal plain and on barrier islands in sheltered backdunes protected from salt spray and overwash. Sites are generally restricted to relict dunes within a few hundred meters of ocean or bay beaches. The substrate is rapidly drained sands or sandy loams which are nutrient poor.

VEGETATION DESCRIPTION

Assateague Island National Seashore Vegetation: Assateague Island National Seashore occurrences of this community are characterized by mature forests of *Pinus taeda* (loblolly pine) (dbh ranging from 20-55 cm) with canopy closures up to 85% with very few, or no, other associated canopy species. Scattered deciduous trees make up a sparse subcanopy tree layer, comprising less than 15% cover and more often even less than 5%. Subcanopy trees include such species as *Sassafras albidum* (sassafras), *Acer rubrum* (red maple), *Juniperus virginiana var. virginiana* (eastern red-cedar), *Diospyros virginiana* (common persimmon), *Amelanchier canadensis* (Canadian serviceberry), *Ilex opaca* (American holly), and *Magnolia virginiana* (sweetbay). Typically, no *Pinus taeda* (loblolly pine) is found in the subcanopy of the mature forests at Assateague Island. Shrub cover is variable but generally not prevalent. *Morella cerifera* (wax-myrtle) is common in clumps and scattered individuals of *Vaccinium corymbosum* (highbush blueberry), *Diospyros virginiana* (common persimmon), *Amelanchier* (serviceberry) *canadensis*, and *Sassafras albidum* (sassafras) are local in the shrub layer. These forests have various densities of vine cover ranging from very dense (80%) to sparse (15%). *Smilax rotundifolia* (roundleaf greenbrier) and *Vitis rotundifolia* (muscadine) are characteristic, often climbing into the lower tree canopy. Also, *Toxicodendron radicans* (eastern poison-ivy), *Smilax glauca* (cat greenbrier), *Campsis radicans* (trumpet creeper), *Mikania scandens* (climbing hempvine), *Vitis rotundifolia* (muscadine), and *Parthenocissus quinquefolia* (Virginia creeper) are other common vines in this community. The herb layer is generally sparse, falling below 30% cover. Tree seedlings (*Sassafras albidum* (sassafras), *Pinus taeda* (loblolly pine), *Acer rubrum* (red maple)) are common, and the grass *Chasmanthium laxum* (slender woodoats) is almost always present. *Panicum virgatum* (switchgrass), *Mitchella repens* (partridgeberry), *Andropogon glomeratus* (bushy bluestem), *Carex albolutescens* (greenwhite sedge), and *Elephantopus nudatus* (smooth elephantsfoot) are present, but are much less frequent.

Global Vegetation: This community is a mid-Atlantic coastal upland loblolly pine forest dominated by *Pinus taeda* (loblolly pine). Canopy composition varies from nearly pure *Pinus taeda* (loblolly pine) to mixed stands of *Pinus taeda* (loblolly pine), *Quercus falcata* (southern red oak), *Prunus serotina* (black cherry), *Sassafras albidum* (sassafras), and less frequently *Quercus nigra* (water oak). *Ilex opaca var. opaca* (American holly) and *Diospyros virginiana* (common persimmon) are frequent understory trees. The tall-shrub layer, when present, is comprised of *Morella cerifera* (wax-myrtle) and *Vaccinium corymbosum* (highbush blueberry). Vines and lianas are nearly always present in abundance; *Vitis rotundifolia* (muscadine) is most commonly present, but *Toxicodendron radicans* (eastern poison-ivy), *Smilax rotundifolia* (roundleaf greenbrier), *Smilax glauca* (cat greenbrier), and *Parthenocissus quinquefolia* (Virginia creeper) are often present in abundance as well. The

herbaceous layer is typically sparse, particularly if shrubs and vines are dense, but *Chasmanthium laxum* (slender woodoats) may be fairly abundant in this community. Other herbs include *Mitchella repens* (partridgeberry), *Pityopsis graminifolia var. latifolia* (narrowleaf silkgrass), *Dichanthelium ovale* (eggleaf rosette grass), *Panicum amarum* (bitter panicgrass), *Eupatorium hyssopifolium* (hyssopleaf thoroughwort), and *Elephantopus nudatus* (smooth elephantsfoot). In southern Virginia and North Carolina, *Quercus virginiana* (live oak) and *Gelsemium sempervirens* (evening trumpetflower) may also be present, but *Quercus virginiana* (live oak) is never abundant and when present is usually restricted to the understory. Stands on sheltered flats that have been subject to frequent fires at Chincoteague National Wildlife Refuge and False Cape State Park in Virginia are rather open, with sparse cover of shrubs and vines and moderately high cover of *Chasmanthium laxum* (slender woodoats) in the herb layer.

MOST ABUNDANT SPECIES

Assateague Island National Seashore

Stratum	Lifeform	Species
Tree canopy	Needle leaved tree	*Pinus taeda* (loblolly pine)
Shrub/sapling (tall & short)	Vine/Liana	*Smilax rotundifolia* (roundleaf greenbrier), *Toxicodendron radicans* (eastern poison ivy), *Vitis rotundifolia* (muscadine)
Tall shrub/sapling	Broad leaved deciduous shrub	*Vaccinium corymbosum* (highbush blueberry)
Tall shrub/sapling	Broad leaved evergreen shrub	*Morella cerifera* (wax myrtle)
Herb (field)	Graminoid	*Chasmanthium laxum* (slender woodoats)

Global

Stratum	Lifeform	Species
Tree canopy	Needle leaved tree	*Pinus taeda* (loblolly pine)
Tree canopy	Broad leaved deciduous tree	*Quercus falcata* (southern red oak)
Shrub/sapling (tall & short)	Vine/Liana	*Smilax rotundifolia* (roundleaf greenbrier), *Toxicodendron radicans* (eastern poison ivy), *Vitis rotundifolia* (muscadine)
Tall shrub/sapling	Broad leaved deciduous shrub	*Vaccinium corymbosum* (highbush blueberry)
Tall shrub/sapling	Broad leaved evergreen shrub	*Morella cerifera* (wax myrtle)
Herb (field)	Graminoid	*Chasmanthium laxum* (slender woodoats)

CHARACTERISTIC SPECIES

Assateague Island National Seashore: *Chasmanthium laxum* (slender woodoats), *Pinus taeda* (loblolly pine), *Vitis rotundifolia* (muscadine)

Global: *Chasmanthium laxum* (slender woodoats), *Pinus taeda* (loblolly pine), *Vitis rotundifolia* (muscadine)

CONSERVATION STATUS RANK

Global Rank & Reasons: G2 (10-Jun-2008). This coastal forest is limited to the immediate vicinity of the coast in southern New Jersey, Delaware, Maryland, and Virginia. EO Rank Estimator v.6.03 was used to assess the global rank. This community has a relatively small geographic range, very narrow environmental specificity, and a substantial overall threat factor from widespread coastal development. Moreover, many existing occurrences have been disturbed by cutting and grazing, and there are relatively few large, protected occurrences.

CLASSIFICATION

Status: Standard

Classification Confidence: 2 - Moderate

Global Comments: This community has floristic affinity with communities of the *Quercus virginiana - (Sabal palmetto)* Forest Alliance (A.55) but is differentiated by a strong dominance by *Pinus taeda* (loblolly pine) and lack of species of southern maritime forests such as *Sabal minor* (dwarf palmetto) and *Osmanthus americanus* (devilwood). This community also shares a number of species in common with *Prunus serotina / Morella cerifera / Smilax rotundifolia* Scrub Forest (CEGL006319) but is differentiated by a strong dominance by *Pinus taeda* (loblolly pine), a structure characterized by generally taller and straighter trees, a better developed herbaceous layer, and in general, a more protected position in backdunes. In 2008, Virginia Heritage staff conducted an analysis of 65 maritime forest and woodland plots from across the range in Virginia, plus 12 North Carolina plots representing *Quercus falcata - Pinus taeda - (Fagus grandifolia, Quercus nigra) / Persea palustris* Maritime Forest (CEGL007540). The 22 plots representing this association (CEGL006040) had significantly lower mean species richness (n = 15) than the 19 plots representing CEGL007540 in Virginia and North Carolina (n = 35). Another analysis of plot data from 174 loblolly pine-hardwood stands from across the Virginia Eastern Shore clearly indicated that the plots representing CEGL006040 were all located within a few hundred meters of either bay or ocean beaches, both on the mainland and barrier islands, on coarse sands of old dune ridges. None were located where large marshes occur between the mainland edge and the ocean of the bay. These were further distinguished compositionally from the remaining 152 plots of successional pine-hardwood forests by a suite of species with significantly higher constancy and mean cover, by a group of obligate dune species, and by the absence or rarity of numerous widespread species that are characteristic of the successional assemblages. Jason Harrison indicates that, in Maryland, this association is similarly restricted in distribution and similarly distinct from inland forests.

Global Similar Associations:

- *Pinus taeda / Morella cerifera / Osmunda regalis var. spectabilis* Forest (CEGL006137) occurs in wetter dune flats and swales.

- *Pinus taeda / Saccharum alopecuroidum - (Andropogon* spp.) Forest (CEGL007109) often occurs as inclusions within this association.
- *Prunus serotina / Morella cerifera / Smilax rotundifolia* Scrub Forest (CEGL006319)
- *Quercus falcata - Pinus taeda - (Fagus grandifolia, Quercus nigra) / Persea palustris* Maritime Forest (CEGL007540) has greater diversity of and dominance by hardwoods and significantly higher species richness overall; distributed primarily south of the range of CEGL006040.
- *Quercus virginiana - Quercus hemisphaerica - Pinus taeda / Persea palustris - Ilex vomitoria* Forest (CEGL007027) is strongly dominated by *Quercus virginiana* and distributed primarily south of the range of CEGL006040.

Global Related Concepts:

- *Pinus - Juniperus* Community (Harvill 1965) =
- *Pinus taeda - (Quercus falcata, Prunus serotina) / Myrica cerifera / Vitis rotundifolia* Forest (Fleming et al. 2006) =
- *Pinus taeda / Morella cerifera / Vitis rotundifolia* Forest (Harrison 2004) =
- *Pinus taeda / Myrica cerifera / Vitis rotundifolia* Forest (Clancy 1996) =
- *Pinus taeda / Myrica cerifera / Vitis rotundifolia* Forest (TNC 1997a) =
- *Pinus taeda / Myrica* spp. coastal forest association (Clancy 1993b) ?
- *Pinus taeda* community (Harvill 1967) =
- Dune Forests (Clampitt 1991) =
- Forest Community (Stalter and Lamont 1990) >
- Maritime Forest (Harrison 2004) >
- Maritime Upland Forest (Fleming et al. 2006) >
- Mature loblolly pine forest of dry sites (Bratton and Davison 1987) =
- Mature loblolly pine stand (Fleming 1978) =
- Pine - Deciduous Mixed Woodland (Higgins et al. 1971) =
- Pine Woodlands (Higgins et al. 1971) >
- Pine woodland (Stalter 1990) <
- Pine-deciduous hardwood woodland (Stalter 1990) <
- Upland forest (Klotz 1986) >
- Woodland community (Hill 1986) >

ELEMENT DISTRIBUTION

Assateague Island National Seashore Range: This association is common throughout the park, except at the northern portion. It occurs behind primary dunes and on larger bayside peninsulas.

Global Range: This association occurs along the mid-Atlantic coast from Delaware to North Carolina.

Nations: US

States/Provinces: DE:S3, MD, VA:S2

TNC Ecoregions: 57:C, 58:C, 62:C

USFS Ecoregions (1994/95): 232Ac:CCC, 232Bx:CC?, 232Bz:CCC, 232Ci:CCC

Federal Lands: NPS (Assateague Island, Cape Hatteras); USFWS (Back Bay?, Chesapeake Marshlands, Chincoteague, Prime Hook, Wallops)

ELEMENT SOURCES

Assateague Island National Seashore Plots and Observation Points: Plots: ASIS.68 (67AB01), ASIS.69 (67AB06), ASIS.70 (62AB01), ASIS.71 (67AB04), ASIS.72 (52AB07); **Observation Points:** AA059, AA072A, AA109, AA136, AA142, AA162, AA163, AA170, AA175, AA176, AA183B, AA253, AA298, AA358, AA363, AA427, AA551, AA554, AA556, AA567, AA579, AA600, AA601, AA605, AA608, AA611, AA619, AA630, AA632, AA640, AA641, AA738, AA744, AA769.

Local Description Authors: L.A. Sneddon and A. Berdine

Global Description Authors: L.A. Sneddon, mod. G.P. Fleming

References: Bartgis 1986, Bratton and Davison 1987, Breden et al. 2001, Brock et al. 2007, Clampitt 1991, Clancy 1993b, Clancy 1996, Coxe 2009, Eastern Ecology Working Group n.d., Fleming 1978, Fleming 1998, Fleming and Patterson 2011a, Fleming et al. 2001, Fleming et al. 2006, Fleming pers. comm., Harrison 2004, Harrison 2011, Harvill 1965, Harvill 1967, Higgins et al. 1971, Hill 1986, J. Harrison pers. comm., Klotz 1986, Schafale and Weakley 1990, Sneddon et al. 1997, Stalter 1990, Stalter and Lamont 1990, TNC 1995c, TNC 1997a



Loblolly Pine Forest, AA Point 363, October 1, 2009 (UTM X: 483644, UTM Y: 4221541)

Loblolly Pine Dune Woodland

***Pinus taeda / Hudsonia tomentosa* Woodland**
Loblolly Pine / Woolly Beach-heather Woodland
Identifier: CEGL006052

USNVC CLASSIFICATION

Division	Eastern North American Cool Temperate Forest (1.B.2.Na)
Macrogroup	Appalachian & Northeastern Oak - Hardwood & Pine Forest (M502)
Group	North Atlantic Maritime Scrub Forest (G495)
Association	Loblolly Pine Dune Woodland

ELEMENT CONCEPT

Global Summary: This maritime woodland occurs on large, xeric sand dunes of barrier islands in Delaware, Maryland, and Virginia. Soils in this community are sandy and rapidly drained. It often occurs directly adjacent to actively shifting foredunes and is exposed to salt spray, winds and storms. The community also occurs on unstable sands of protected backdunes. In the denser woodlands, more pine duff accumulates, and herb diversity and cover are generally higher. Where woodlands are more open and trees sparse, growing conditions are harsh, less duff accumulates, and vast areas of exposed white sand are characteristic. Trees are generally characterized by low spreading branches and multiple trunks. A shrub layer is sparse or lacking; herbaceous cover is usually low. *Pinus taeda* (loblolly pine) dominates the canopy, but hardwoods such as *Quercus falcata* (southern red oak), *Quercus nigra*, and *Ilex opaca* (American holly) are frequent but have low stature and cover. Younger, smaller pines make up a sparse subcanopy. Tall shrubs are also sparse, although an occasional *Morella cerifera* (wax-myrtle), *Pinus taeda* (loblolly pine) sapling, hardwood sapling, or *Vaccinium corymbosum* (highbush blueberry) can be found. Sparse low shrubs of *Hudsonia tomentosa* (woolly beach-heather) are more common. *Smilax glauca* (cat greenbrier), *Smilax rotundifolia* (roundleaf greenbrier), and *Toxicodendron radicans* (eastern poison-ivy) are typical vines. Herbs are sparse, yet much varied; *Schizachyrium littorale* (shore little bluestem) is commonly present. The typical pattern of herb distribution is on dry open sand, in direct sunlight. Here, small patches of *Dichanthelium ovale*, *Dichanthelium scoparium* (velvet panicum), *Schizachyrium littorale* (shore little bluestem), *Cyperus grayi* (Gray's flatsedge), *Lechea maritima var. virginica* (Virginia pinweed), *Eupatorium rotundifolium* (roundleaf thoroughwort), *Erigeron* (fleabane) sp., *Euthamia caroliniana* (slender goldentop), *Solidago sempervirens* (seaside goldenrod), *Aristida tuberculosa* (seaside threeawn), *Polygonella articulata* (coastal jointweed), *Panicum amarum* (bitter panicgrass), and *Pseudognaphalium obtusifolium* (rabbit-tobacco) are typically mixed with scattered *Hudsonia tomentosa* (woolly beach-heather) and *Smilax rotundifolia* (roundleaf greenbrier).

ENVIRONMENTAL DESCRIPTION

Assateague Island National Seashore Environment: This association is a maritime woodland of sand dunes. Soils in this community are sandy and rapidly drained. It often occurs directly adjacent to actively shifting foredunes and is exposed to salt spray, winds, and storms. The association also occurs on unstable sands of protected backdunes. In the denser woodlands, more pine duff

accumulates, and herb diversity and cover are generally higher. Where woodlands are more open and trees sparse, growing conditions are harsh, less duff accumulates, and vast areas of exposed white sand are characteristic. Average elevation of this type was determined to be 0.67 m from analysis of lidar-derived data of Brock et al. (2007).

Global Environment: This community is a maritime woodland of large, xeric sand dunes. Soils in this community are sandy and rapidly drained. This community often occurs directly adjacent to actively shifting foredune and is exposed to salt spray, winds, and storms. The community also occurs on unstable sands of protected backdunes. In the denser woodlands, more pine duff accumulates and herb diversity and cover is generally higher. Where woodlands are more open and trees sparse, growing conditions are harsh, less duff accumulates, and vast areas of exposed white sand are characteristic.

VEGETATION DESCRIPTION

Assateague Island National Seashore Vegetation: This community is characterized by a very open canopy created by sparsely distributed *Pinus taeda* (loblolly pine). The tree canopy ranges from 10-50% closure, and tree diameter and height are generally less, ranging from 10-30 cm and 6-10 m, respectively. *Pinus taeda* (loblolly pine) dominates the canopy, but hardwoods such as *Prunus serotina* (black cherry) and *Ilex opaca* (American holly) are frequent. Oaks such as *Quercus falcata* (southern red oak) are infrequent, but where present, exhibit low spreading multiple trunks. Younger, smaller pines make up a sparse subcanopy. Tall shrubs are also sparse, although an occasional *Morella cerifera* (wax-myrtle), *Pinus taeda* (loblolly pine) sapling, or *Vaccinium corymbosum* (highbush blueberry) can be found. Sparse low shrubs of *Hudsonia tomentosa* (woolly beach-heather) are more common (contributing less than 5% cover). *Smilax glauca* (cat greenbrier) and *Toxicodendron radicans* (eastern poison-ivy) are typical vine species but also make up less than 5% cover. Herbs are sparse, yet much varied. *Andropogon virginicus* (broomsedge bluestem) and *Smilax rotundifolia* (roundleaf greenbrier) are commonly present. The typical pattern of herb distribution is on dry open sand, in direct sunlight. Here, small patches of *Dichanthelium acuminatum* (tapered rosette grass), *Dichanthelium scoparium* (velvet panicum), *Aristida tuberculosa* (seaside threeawn), *Andropogon virginicus* (broomsedge bluestem), *Cyperus grayi* (Gray's flatsedge), *Eupatorium rotundifolium* (roundleaf thoroughwort), *Erigeron* (fleabane) sp., *Euthamia caroliniana* (slender goldentop), *Polygonella articulata* (coastal jointweed), *Hypericum gentianoides* (orangegrass), *Solidago sempervirens* (seaside goldenrod), and *Pseudognaphalium obtusifolium* (rabbit-tobacco) are typically mixed with scattered *Hudsonia tomentosa* (woolly beach-heather), *Smilax rotundifolia* (roundleaf greenbrier), and *Smilax glauca* (cat greenbrier). In total, herb cover ranges from 5-40%, generally near the lower end of the scale. Small depressions under shading trees may hold *Juncus dichotomus* (forked rush), *Juncus canadensis* (Canadian rush), *Schoenoplectus pungens* (common threesquare), *Chasmanthium laxum* (slender woodoats), *Panicum virgatum* (switchgrass), or *Andropogon virginicus* (broomsedge bluestem) and *Andropogon glomeratus* (bushy bluestem). These comprise very low cover but reflect a tendency for low moist sandy depressions to occur within the woodland.

Global Vegetation: This community is characterized by a very open canopy created by sparsely distributed *Pinus taeda* (loblolly pine). Hardwoods such as *Quercus falcata* (southern red oak), *Quercus nigra* (water oak), and *Ilex opaca* (American holly) are frequent but have low stature and cover. At the southern end of the range, small individuals of *Quercus virginiana* (live oak) and *Quercus incana* (bluejack oak) may be associated. Pines make up a sparse subcanopy. Tall shrubs are also sparse, although an occasional *Morella cerifera* (wax-myrtle), *Pinus taeda* (loblolly pine) sapling, hardwood sapling, or *Vaccinium corymbosum* (highbush blueberry) can be found. Sparse low shrubs of *Hudsonia tomentosa* (woolly beach-heather) are common. *Smilax glauca* (cat greenbrier) and *Toxicodendron radicans* (eastern poison-ivy) are typical vine species but make up less than 5% cover. Herbs are sparse, yet much varied. *Schizachyrium littorale* (shore little bluestem) and *Smilax rotundifolia* (roundleaf greenbrier) are commonly present. The typical pattern of herb distribution is on dry open sand, in direct sunlight. Here, small patches of *Dichanthelium ovale* (eggleaf rosette grass), *Dichanthelium scoparium* (velvet panicum), *Schizachyrium littorale* (shore little bluestem), *Cyperus grayi* (Gray's flatsedge), *Lechea maritima var. virginica* (Virginia pinweed), *Eupatorium rotundifolium* (roundleaf thoroughwort), *Erigeron* (fleabane) sp., *Euthamia caroliniana* (slender goldentop), *Solidago sempervirens* (seaside goldenrod), *Aristida tuberculosa* (seaside threeawn), *Polygonella articulata* (coastal jointweed), *Panicum amarum* (bitter panicgrass), and *Pseudognaphalium obtusifolium* (rabbit-tobacco) are typically mixed with scattered *Hudsonia tomentosa* (woolly beach-heather) and *Smilax rotundifolia* (roundleaf greenbrier). In total, herb cover ranges from 5-40%, generally near the lower end of the scale.

MOST ABUNDANT SPECIES

Assateague Island National Seashore

Stratum	Lifeform	Species
Tree canopy	Needle leaved tree	*Pinus taeda* (loblolly pine)
Short shrub/sapling	Broad leaved evergreen shrub	*Hudsonia tomentosa* (woolly beach heather)
Herb (field)	Graminoid	*Andropogon virginicus* (broomsedge bluestem), *Aristida tuberculosa* (seaside threeawn), *Dichanthelium acuminatum* (tapered rosette grass)

Global

Stratum	Lifeform	Species
Tree canopy	Needle leaved tree	*Pinus taeda* (loblolly pine)
Short shrub/sapling	Broad leaved evergreen shrub	*Hudsonia tomentosa* (woolly beach heather)
Herb (field)	Graminoid	*Dichanthelium acuminatum* (tapered rosette grass)

CHARACTERISTIC SPECIES

Assateague Island National Seashore: *Hudsonia tomentosa* (woolly beach-heather), *Pinus taeda* (loblolly pine)

Global: *Hudsonia tomentosa* (woolly beach-heather), *Pinus taeda* (loblolly pine)

CONSERVATION STATUS RANK

Global Rank & Reasons: G1G2 (2-Dec-1998). This maritime woodland community is restricted to major coastal dune systems of the mid-Atlantic region. Only 10-20 occurrences are estimated or known from Maryland, Virginia, and Delaware. Size ranges from about an acre to perhaps 30 acres. The community occurs on a restricted habitat, on back dunes protected from the direct influence of wind and salt spray. This community is threatened by many of the same threats common to coastal dune systems: dune stabilization, commercial and residential development, and road expansion.

CLASSIFICATION

Status: Standard

Classification Confidence: 1 - Strong

Assateague Island National Seashore Comments: The pine woodland of Higgins et al. (1971) and the woodland community of Hill (1986) described from Assateague Island are partially contained within this community. The upland forest described from northern Virginia by Klotz (1986) is suspected to contain this community, but will require further research. Portions of the maritime forest and the dune woodland described by Clampitt (1991) from Virginia Beach are floristically and ecologically related to this vegetation.

Global Comments: This community gained greater extent in some areas of Virginia barrier beaches following logging (Higgins et al. 1971, Bratton and Davison 1987, Schafale and Weakley 1990).

Global Related Concepts:

- *Pinus taeda / Hudsonia tomentosa* Woodland (Harrison 2004) =
- *Pinus taeda / Hudsonia tomentosa* Woodland (TNC 1997a) =
- Dune Woodland (Clampitt 1991) ><
- Loblolly Pine Dune Woodland (Bowman 2000) =
- Loblolly Pine Dune Woodland (Clancy 1996) =
- Maritime Dune Woodland (Harrison 2004) >
- Maritime Dune Woodland (Fleming et al. 2001) >
- Pine woodland (Higgins et al. 1971) >
- Upland forest (Klotz 1986) >
- Woodland community (Hill 1986) >

OTHER COMMENTS

Other Comments: This woodland association often occurs in complex with Beach Heather Dune Shrubland (CEGL003950), and may actually represent a natural succession of dwarf-shrubland to woodland. One stand located during accuracy assessment in 2009 supports trees growing in obvious rows, suggesting its origin as being planted. However, the environmental setting and understory vegetation are consistent with Loblolly Pine Dune Woodland (CEGL006052).

ELEMENT DISTRIBUTION

Assateague Island National Seashore Range: Large areas of this woodland occur on Assateague Island National Seashore, both on foredunes and on protected backdunes. It occurs in abundance on the central portion of the island, from Tingles to Pope Bay campgrounds.

Global Range: This maritime woodland occurs on sand dunes of barrier islands in Delaware, Maryland, and Virginia. The southernmost known occurrence is at False Cape State Park in extreme southeastern Virginia.

Nations: US

States/Provinces: DE:S2, MD:S1, VA:S1S2

TNC Ecoregions: 58:C

USFS Ecoregions (1994/95): 232Ac:CCP, 232Bt:CCC, 232Bz:CCC, 232Ch:CCC

Federal Lands: NPS (Assateague Island); USFWS (Back Bay?, Chincoteague)

ELEMENT SOURCES

Assateague Island National Seashore Plots and Observation Points: Plots: ASIS.102 (32RR03), ASIS.103 (47AB01), ASIS.104 (52AB03), ASIS.105 (42AB04), ASIS.106 (62AB02); **Observation Points:** AA020, AA204, AA209, AA249, AA352, AA377, AA386, AA414, AA424, AA426, AA455, AA456, AA558, AA560, AA564, AA572, AA574, AA578, AA581, AA633, AA651, AA654.

Local Description Authors: L.A. Sneddon and A. Berdine

Global Description Authors: A. Berdine, mod. G.P. Fleming

References: Berdine 1998, Bowman 2000, Bratton and Davison 1987, Brock et al. 2007, Clampitt 1991, Clancy 1996, Coxe 2009, Eastern Ecology Working Group n.d., Fleming and Patterson 2011a, Fleming et al. 2001, Harrison 2004, Harrison 2011, Higgins et al. 1971, Hill 1986, Klotz 1986, Schafale and Weakley 1990, TNC 1995c, TNC 1997a



Loblolly Pine Dune Woodland, AA Point 560, October 3, 2009 (UTM X: 482296, UTM Y: 4216383)

Loblolly Pine Tidal Woodland

***Pinus taeda / Morella cerifera / Spartina patens* Tidal Woodland**
Loblolly Pine / Wax-myrtle / Saltmeadow Cordgrass Tidal Woodland
Identifier: CEGL006849

USNVC CLASSIFICATION

Division	Eastern North American Cool Temperate Forest (1.B.2.Na)
Macrogroup	Appalachian & Northeastern Oak - Hardwood & Pine Forest (M502)
Group	North Atlantic Maritime Scrub Forest (G495)
Association	Loblolly Pine Tidal Woodland

ELEMENT CONCEPT

Global Summary: This loblolly pine tidal woodland occurs in narrow fringes on Maryland's Coastal Plain along tidal rivers and creeks, and occasionally upland of high salt marshes in nonriverine habitats. These open woodlands experience varying frequencies of tidal flooding and lack significant microtopographic features. The monospecific overstory is comprised of *Pinus taeda* (loblolly pine), which also dominates the subcanopy, although successional hardwoods may be present. Scattered patches of *Morella cerifera* (wax-myrtle) dominate the shrub layer, and the herbaceous layer is comprised of halophytic vegetation, including *Spartina patens* (saltmeadow cordgrass), *Panicum virgatum* (switchgrass), and *Distichlis spicata* (saltgrass). Many loblolly pines may be dead or dying in some stands due to tidal encroachment.

ENVIRONMENTAL DESCRIPTION

Assateague Island National Seashore Environment: This vegetation occurs in low-lying area subjected to tidal flooding. It usually occurs adjacent to salt marshes, where tidal marsh grasses have clearly encroached on upland or palustrine loblolly pine forests. It may also occur as small islands within salt marshes. The substrate is peaty or mucky.

Global Environment: These are fringing tidal woodlands characteristic of diurnal to irregularly flooded mesohaline (5.0-18.0 ppt) systems. This community occurs along tidal rivers and creeks but can also occupy narrow ecotones between "high salt marshes" and adjacent uplands and islands in brackish nonriverine habitats. Soils consist of a mixture of silt, fine sands and decomposed organic peat underlain by dark gray, black or greenish-gray silty clayey fine sands and carbonaceous clays.

VEGETATION DESCRIPTION

Assateague Island National Seashore Vegetation: The canopy is usually open, exhibiting a woodland appearance. Flood-killed trees and shrubs may be present, but in general the woodland is dominated by live trees of 8-10 m in height. The dominant tree is *Pinus taeda* (loblolly pine); associated canopy trees are essentially absent. A tall-shrub layer reaching 3 m in height is dominated by *Morella cerifera* (wax-myrtle); *Ilex opaca* (American holly) is occasionally present. The field layer is dominated by grasses and sedges, with scattered short shrubs and vines. The dominant graminoids are *Spartina patens* (saltmeadow cordgrass) and *Distichlis spicata* (saltgrass);

Schoenoplectus robustus (sturdy bulrush) is not always present but characteristic. Other associates include *Pluchea odorata* (sweetscent), *Festuca rubra* (red fescue), *Andropogon glomeratus* (bushy bluestem), *Spartina alterniflora* (smooth cordgrass), and *Panicum virgatum* (switchgrass). The shrub *Iva frutescens* (Jesuit's bark) is often present, and the vines *Smilax rotundifolia* (roundleaf greenbrier) and *Toxicodendron radicans* (eastern poison-ivy) are usually present.

Global Vegetation: These tidal woodlands are species-poor, structurally open and dominated by *Pinus taeda* (loblolly pine) in the canopy and subcanopy. Occasionally, *Juniperus virginiana* (eastern red-cedar), *Acer rubrum* (red maple), *Diospyros virginiana* (common persimmon), *Quercus phellos* (willow oak), and/or *Liquidambar styraciflua* (sweetgum) may occur in the subcanopy. Scattered patches of *Morella cerifera* (wax-myrtle) dominate the shrub stratum, along with occasional individuals of *Iva frutescens* (Jesuit's bark), *Baccharis halimifolia* (eastern baccharis), *Ilex opaca* (American holly), *Prunus serotina* (black cherry), *Acer rubrum* (red maple), and *Juniperus virginiana* (eastern red-cedar). *Toxicodendron radicans* (eastern poison-ivy) is the predominant vine in these woodlands. The herbaceous community is low in species diversity and primarily comprised of *Spartina patens* (saltmeadow cordgrass), *Panicum virgatum* (switchgrass), and *Distichlis spicata* (saltgrass). *Phragmites australis* (common reed) can be abundant in some stands.

MOST ABUNDANT SPECIES

Assateague Island National Seashore

Stratum	Lifeform	Species
Tree canopy	Needle leaved tree	*Pinus taeda* (loblolly pine)
Short shrub/sapling	Broad leaved evergreen shrub	*Morella cerifera* (wax myrtle)
Herb (field)	Graminoid	*Distichlis spicata* (saltgrass), *Spartina patens* (saltmeadow cordgrass)

Global

Stratum	Lifeform	Species
Tree canopy	Needle leaved tree	*Pinus taeda* (loblolly pine)
Shrub/sapling (tall & short)	Broad leaved evergreen shrub	*Morella cerifera* (wax myrtle)
Shrub/sapling (tall & short)	Vine/Liana	*Toxicodendron radicans* (eastern poison ivy)
Herb (field)	Graminoid	*Distichlis spicata* (saltgrass), *Panicum virgatum* (switchgrass), *Spartina patens* (saltmeadow cordgrass)

CHARACTERISTIC SPECIES

Assateague Island National Seashore: *Pinus taeda* (loblolly pine)

Global: *Distichlis spicata* (saltgrass), *Morella cerifera* (wax-myrtle), *Panicum virgatum* (switchgrass), *Pinus taeda* (loblolly pine), *Spartina patens* (saltmeadow cordgrass), *Toxicodendron radicans* (eastern poison-ivy)

OTHER NOTEWORTHY SPECIES

Global: Vulnerable: *Eleocharis fallax* (creeping spikerush, rare/uncommon, G4G5), *Smilax bona-nox* (saw greenbrier, rare/uncommon, G5); **Invasive/Exotic**: *Phragmites australis* (common reed, invasive, High)

CONSERVATION STATUS RANK

Global Rank & Reasons: GNR (21-Sep-2005).

CLASSIFICATION

Status: Standard

Classification Confidence: 3 - Weak

Assateague Island National Seashore Comments: This association was not classified as a separate entity in the USNVC until 2004; prior to that it was mapped incorrectly as Loblolly Pine Dune Woodland (CEGL006052). Subsequent to the first accuracy assessment conducted in 1998, review of the forms against the aerial photography suggested the presence of this type as Assateague Island National Seashore.

Global Similar Associations:

- *Pinus taeda / Morella cerifera / Osmunda regalis var. spectabilis* Forest (CEGL006137)

Global Related Concepts:

- Estuarine Fringe Pine Forest (Loblolly Pine Subtype) (Schafale 2000) **?**
- Tidal Loblolly Pine Woodland (Harrison 2004) **>**

ELEMENT DISTRIBUTION

Assateague Island National Seashore Range: This association occurs sparingly on the island and is documented from the peninsula just to the north of Green Run Bay.

Global Range: This community occurs within mesohaline systems along the shoreline of Maryland's Coastal Plain and possibly Delaware.

Nations: US

States/Provinces: DE:S3, MD:S5

TNC Ecoregions: 58:C, 62:C

USFS Ecoregions (1994/95): 232Ac:CCC, 232Ad:CCC, 232Bx:CCC, 232Bz:CCC

Federal Lands: NPS (Assateague Island); USFWS (Blackwater, Chesapeake Marshlands)

ELEMENT SOURCES

Assateague Island National Seashore Plots and Observation Points: Plots: None; **Observation Points:** AA591, AA596, AA602, AA603.

Local Description Authors: L.A. Sneddon

Global Description Authors: J.W. Harrison

References: Coxe 2009, Eastern Ecology Working Group n.d., Harrison 2004, Harrison 2011, Harrison et al. 2004, Schafale 2000



Loblolly Pine Tidal Woodland, AA Point 591, October 6, 2009 (UTM X: 481176, UTM Y: 4215687)

1.B.3. Temperate Flooded & Swamp Forest

1.B.3.Na. Eastern North American Flooded & Swamp Forest

M504. Northern Swamp Forest

G045. Northern Conifer & Hardwood Acidic Swamp

Inland Red Maple Swamp

***Acer rubrum - Nyssa sylvatica - Magnolia virginiana / Viburnum nudum var. nudum / Osmunda cinnamomea - Woodwardia areolata* Forest**

Red Maple - Blackgum - Sweetbay / Possumhaw / Cinnamon Fern - Netted Chainfern Forest

Identifier: CEGL006238

USNVC CLASSIFICATION

Division	Eastern North American Flooded & Swamp Forest (1.B.3.Na)
Macrogroup	Northern Swamp Forest (M504)
Group	Northern Conifer & Hardwood Acidic Swamp (G045)
Association	Red Maple - Blackgum Swamp Forest

ELEMENT CONCEPT

Global Summary: This acidic swamp forest of the eastern middle-latitude states is a nutrient-poor wetland forest occurring in groundwater-saturated stream bottoms and poorly drained depressions. Soils are typically moderately deep to deep muck over mineral soil, with pools of standing water at the surface. Acidic waters originate from groundwater seepage, with little to no overland seasonal flooding. Most sites can be characterized as "groundwater slope wetlands" (*sensu* Golet et al. 1993) with a flow-through hydrology. This community is characterized by *Acer rubrum* (red maple) and *Nyssa sylvatica* (blackgum) in the canopy, which may be quite open in some examples. Canopy associates include *Magnolia virginiana* (sweetbay), *Liquidambar styraciflua* (sweetgum), and *Persea palustris* (swamp bay), plus occasional incidental *Liriodendron tulipifera* (tuliptree) or *Pinus taeda* (loblolly pine). Upland trees may occur on drier hummocks. The shrub layer is characterized by *Vaccinium corymbosum* (highbush blueberry), as well as *Clethra alnifolia* (coastal sweet-pepperbush), *Ilex verticillata* (common winterberry), *Ilex opaca* (American holly), *Viburnum nudum var. nudum* (possumhaw), *Lindera benzoin* (northern spicebush), and *Rhododendron viscosum* (swamp azalea). The herbaceous layer varies from dense to sparse and may include *Symplocarpus foetidus* (skunk-cabbage), *Triadenum virginicum* (Virginia marsh St. Johnswort), *Osmunda regalis var. spectabilis* (royal fern), *Woodwardia areolata* (netted chainfern), *Carex folliculata* (northern long sedge), *Carex lonchocarpa* (southern long sedge), *Carex collinsii* (Collins' sedge), *Carex atlantica* (prickly bog sedge), *Bartonia paniculata* (twining screwstem), *Parnassia asarifolia* (kidneyleaf grass of Parnassus), *Helonias bullata* (swamppink), *Chelone glabra* (white turtlehead), *Oxypolis rigidior* (stiff cowbane), and *Osmunda cinnamomea* (cinnamon fern). *Sphagnum* (sphagnum) spp. and other mosses are common.

ENVIRONMENTAL DESCRIPTION

Assateague Island National Seashore Environment: Standing water is not generally visible on the surface, but the water table is close to the surface.

Global Environment: This association is generally restricted to groundwater-saturated stream bottoms, seeping toeslopes, and poorly drained depressions with seepage inputs. Most sites can be characterized as "groundwater slope wetlands" (*sensu* Golet et al. 1993) with a flow-through hydrology. Sites typically have hummock-and-hollow microtopography with braided channels, *Sphagnum* (sphagnum)-covered hummocks, mucky depressions, and areas of exposed sand and gravel. Soils are extremely acidic and low in base status.

VEGETATION DESCRIPTION

Assateague Island National Seashore Vegetation: This community occurs in small isolated patches and is characterized by scattered individuals of *Acer rubrum* (red maple) and a dense understory of *Vaccinium corymbosum* (highbush blueberry), *Morella cerifera* (wax-myrtle), and *Smilax rotundifolia* (roundleaf greenbrier). Occasional tree associates include *Liquidambar styraciflua* (sweetgum), *Ilex opaca* (American holly), *Diospyros virginiana* (common persimmon), *Quercus phellos* (willow oak), and *Nyssa sylvatica* (blackgum).

Global Vegetation: Canopy closure ranges from closed to quite open. Plot data from 38 Virginia and Maryland stands indicate that *Acer rubrum* (red maple) and *Nyssa sylvatica* (blackgum) are consistently dominant overstory species. *Liriodendron tulipifera* (tuliptree) is a frequent but minor overstory associate, and *Pinus taeda* (loblolly pine) or *Liquidambar styraciflua* (sweetgum) is occasional in the canopy. *Magnolia virginiana* (sweetbay) is a frequent overstory associate and usually dominant in a subcanopy layer or codominant with *Ilex opaca* (American holly). Trees tend to be slow-growing and of less than optimal stature in the wet, unstable habitats. Shrub layers tend to be dense and diverse, characteristically containing *Viburnum nudum var. nudum* (possumhaw), *Vaccinium corymbosum* (highbush blueberry), *Smilax rotundifolia* (roundleaf greenbrier), *Ilex verticillata* (common winterberry), and *Lindera benzoin* (northern spicebush). In parts of the range, *Clethra alnifolia* (coastal sweet-pepperbush) is a dominant shrub, while in New Jersey, *Chamaedaphne calyculata* (leatherleaf) and *Gaylussacia frondosa* (blue huckleberry) are present. Additional, less constant shrub associates are *Rhododendron viscosum* (swamp azalea), *Leucothoe racemosa* (swamp doghobble), *Chionanthus virginicus* (white fringetree), *Viburnum dentatum* (southern arrow-wood), *Toxicodendron vernix* (poison-sumac), and *Carpinus caroliniana* (American hornbeam). The herb layer varies from dense to sparse. *Osmunda cinnamomea* (cinnamon fern) and *Woodwardia areolata* (netted chainfern) are generally the most constant and abundant herbs, but *Symplocarpus foetidus* (skunk-cabbage) is a patch-dominant in approximately two-thirds of the Virginia and Maryland stands. Additional characteristic herbs occurring at low cover include *Arisaema triphyllum ssp. pusillum* (Jack in the pulpit), *Carex atlantica* (prickly bog sedge), *Carex debilis var. debilis* (white edge sedge), *Carex folliculata* (northern long sedge), *Carex intumescens* (greater bladder sedge), *Carex lonchocarpa* (southern long sedge), *Carex seorsa* (weak stellate sedge), *Carex styloflexa* (bent sedge), *Chelone glabra* (white turtlehead), *Impatiens capensis* (jewelweed), *Lycopus virginicus* (Virginia water horehound), *Mitchella repens* (partridgeberry),

Osmunda regalis var. spectabilis (royal fern), *Platanthera clavellata* (small green wood orchid), *Viola cucullata* (marsh blue violet), and *Viola X primulifolia* (primroseleaf violet). Regionally uncommon or rare species that may be locally abundant in this type include *Helonias bullata* (swamppink), *Parnassia asarifolia* (kidneyleaf grass of Parnassus), *Carex collinsii* (Collins' sedge), and *Bartonia paniculata* (twining screwstem).

MOST ABUNDANT SPECIES

Assateague Island National Seashore

Stratum	Lifeform	Species
Tree canopy	Broad leaved deciduous tree	*Acer rubrum* (red maple)
Tall shrub/sapling	Broad leaved deciduous shrub	*Vaccinium corymbosum* (highbush blueberry)
Tall shrub/sapling	Broad leaved evergreen shrub	*Morella cerifera* (wax myrtle)
Tall shrub/sapling	Vine/Liana	*Smilax rotundifolia* (roundleaf greenbrier)

Global

Stratum	Lifeform	Species
Tree canopy	Broad leaved deciduous tree	*Acer rubrum* (red maple), *Liquidambar styraciflua* (sweetgum), *Nyssa sylvatica* (blackgum)
Tall shrub/sapling	Broad leaved deciduous shrub	*Clethra alnifolia* (coastal sweet pepperbush), *Vaccinium corymbosum* (highbush blueberry)
Herb (field)	Fern or fern ally	*Osmunda cinnamomea* (cinnamon fern), *Osmunda regalis* (royal fern), *Woodwardia areolata* (netted chainfern)

CHARACTERISTIC SPECIES

Assateague Island National Seashore: *Acer rubrum* (red maple)

Global: *Acer rubrum* (red maple), *Magnolia virginiana* (sweetbay), *Nyssa sylvatica* (blackgum), *Osmunda cinnamomea* (cinnamon fern)

OTHER NOTEWORTHY SPECIES

Global: Vulnerable: *Helonias bullata* (swamppink, G3)

CONSERVATION STATUS RANK

Global Rank & Reasons: G3? (30-Mar-2004). The type is restricted to an uncommon wetland habitat in a limited region. It is vulnerable to alteration or destruction by beavers and various anthropogenic activities, including hydrologic modifications.

CLASSIFICATION

Status: Standard

Classification Confidence: 2 - Moderate

Assateague Island National Seashore Comments: This community always occurs as a complex on Assateague Island National Seashore, most commonly in close association with Loblolly Pine Wetland Forest (CEGL006137) with Maritime Deciduous Scrub Forest (CEGL006319) as small inclusions or on the periphery of these forests. The inland red maple swamp and the Cape May lowland swamp described by Breden (1989), the broadleaf swamp forest described from Cumberland County, New Jersey (Heckscher 1994), the *Acer rubrum - Quercus nigra - Nyssa sylvatica* swamp of Harvill (1967) described from the Virginia portion of Assateague Island and the woodland fresh marsh community of Hill (1986) are either contained within this community or synonymous with it.

Global Similar Associations:

- *Acer rubrum - Fraxinus pennsylvanica - Liquidambar styraciflua / Carex laevivaginata - Carex stricta - Glyceria septentrionalis - (Symplocarpus foetidus*) Forest (CEGL006965)
- *Acer rubrum - Nyssa sylvatica - Betula alleghaniensis / Sphagnum spp*. Forest (CEGL006014)
- *Acer rubrum - Nyssa sylvatica / Ilex verticillata - Vaccinium fuscatum / Osmunda cinnamomea* Forest (CEGL007853)
- *Acer rubrum var. trilobum / Viburnum nudum var. nudum / Osmunda cinnamomea - Saururus cernuus - Impatiens capensis* Forest (CEGL004426)
- *Pinus taeda / Morella cerifera / Osmunda regalis var. spectabilis* Forest (CEGL006137)

Global Related Concepts:

- *Acer rubrum - Liquidambar styraciflua - Nyssa sylvatica* Swamp Forest (Clancy 1996) >
- *Acer rubrum - Nyssa sylvatica - Magnolia virginiana / Viburnum nudum / Osmunda cinnamomea - Woodwardia areolata* Forest (Fleming et al. 2006) =
- *Acer rubrum - Nyssa sylvatica - Magnolia virginiana / Viburnum nudum var. nudum / Osmunda cinnamomea - Woodwardia areolata* Forest (Fleming and Patterson 2003) =
- *Acer rubrum - Nyssa sylvatica - Magnolia virginiana / Viburnum nudum var. nudum / Osmunda cinnamomea - Woodwardia areolata* Forest (Fleming pers. comm.) =
- *Acer rubrum - Nyssa sylvatica - Magnolia virginiana* Forest (Harrison 2004) =
- *Acer rubrum - Nyssa sylvatica / Magnolia virginiana / Woodwardia areolata - Symplocarpus foetidus* Forest (Fleming 2002a) =
- *Acer rubrum - Nyssa sylvatica / Magnolia virginiana / Woodwardia areolata - Symplocarpus foetidus* Saturated Forest (Patterson pers. comm.) **?**
- *Acer rubrum - Quercus nigra - Nyssa sylvatica* swamp (Harvill 1967) **?**

- *Acer rubrum / Magnolia virginiana / Symplocarpus foetidus - Osmunda cinnamomea* Saturated Forest (McCoy and Fleming 2000) =
- Broadleaf swamp forest (Heckscher 1994) **?**
- Cape May lowland swamp (Breden 1989) >
- Coastal Plain - Piedmont Acidic Seepage Swamp (Harrison 2004) >
- Coastal Plain / Piedmont Acidic Seepage Swamp (Fleming et al. 2001) =
- Coastal Plain / Piedmont Acidic Seepage Swamp (Fleming et al. 2006) =
- Inland red maple swamp (Breden 1989) **?**
- Pine barrens hardwood swamp (Breden 1989) >
- Red Maple - Magnolia Coastal Plain Palustrine Forest (Fike 1999) **?**
- Woodland fresh marsh community (Hill 1986) **?**

ELEMENT DISTRIBUTION

Assateague Island National Seashore Range: This association occurs sparingly on Assateague Island National Seashore on the central and southern thirds of the park and always below 0.25 ha in size.

Global Range: This community ranges from southeastern New York and New Jersey to southeastern Virginia on the Coastal Plain. In Virginia, it extends into the extreme eastern portion of the Piedmont.

Nations: US

States/Provinces: DC, DE:S2, MD:S3S4, NJ:S3S4, PA:S1, VA:S3

TNC Ecoregions: 52:C, 58:C, 59:C, 61:C, 62:C

USFS Ecoregions (1994/95): 221Am:CCC, 221Da:CCC, 221Db:CCC, 231Ae:CCC, 231Ak:CCC, 231An:CCC, 232Aa:CCP, 232Ab:CCC, 232Ac:CCC, 232Ad:CCC, 232Ae:CCC, 232Br:CCC, 232Bt:CCC, 232Bz:CCC, 232Ch:CP?, M221Da:CCC

Federal Lands: DOD (Fort A.P. Hill, Fort Belvoir); NPS (Assateague Island, Fredericksburg-Spotsylvania, George Washington Birthplace, National Capital-East, Petersburg, Prince William, Richmond, Thomas Stone); USFWS (Cape May, E.B. Forsythe, Patuxent)

ELEMENT SOURCES

Assateague Island National Seashore Plots and Observation Points: Plots: None; **Observation Points:** AA365, AA412, AA440, AA615, AA618.

Local Description Authors: L.A. Sneddon and A. Berdine

Global Description Authors: G. Fleming

References: Breden 1989, Breden et al. 2001, Clancy 1996, Coxe 2009, Eastern Ecology Working Group n.d., Ehrenfeld and Gulick 1981, Eichelberger 2011o, Fike 1999, Fleming 2002a, Fleming 2002b, Fleming and Coulling 2001, Fleming and Patterson 2003, Fleming and Patterson 2011a, Fleming et al. 2001, Fleming et al. 2006, Fleming et al. 2007b, Fleming pers. comm., Golet et al. 1993, Harrison 2004, Harrison 2011, Harrison and Stango 2003, Harvill 1967, Heckscher 1994, Hill 1986, McCormick 1979, McCoy and Fleming 2000, NatureServe 2009, Patterson 2008d, Patterson 2008e, Patterson 2008f, Patterson pers. comm., Robichaud and Buell 1973, Sipple and Klockner 1984, TNC 1995c, Taverna and Patterson 2008, VDNH 2003, Windisch 1995b, Zimmerman et al. 2012



Inland Red Maple Swamp, AA Point 440, October 1, 2009 (UTM X: 483660, UTM Y: 4219858)

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

M033. Southern Coastal Plain Basin Swamp

G038. Coastal Plain Hardwood Basin Swamp

Loblolly Pine Wetland Forest

***Pinus taeda / Morella cerifera / Osmunda regalis var. spectabilis* Forest**

Loblolly Pine / Wax-myrtle / Royal Fern Forest

Identifier: CEGL006137

USNVC CLASSIFICATION

Division	Southeastern North American Flooded & Swamp Forest (1.B.3.Nb)
Macrogroup	Southern Coastal Plain Basin Swamp (M033)
Group	Coastal Plain Hardwood Basin Swamp (G038)
Association	Loblolly Pine Wetland Forest

ELEMENT CONCEPT

Global Summary: This maritime/coastal wetland forest occurs in backdune depressions with high water tables and fringing estuaries from Delaware to North Carolina. Examples are characterized by a closed to partially open canopy dominated by *Pinus taeda* (loblolly pine). Other canopy associates may be absent, or may include *Acer rubrum* (red maple), *Persea palustris* (swamp bay), or *Liquidambar styraciflua* (sweetgum). The understory is made up of vines, strongly dominated by *Smilax rotundifolia* (roundleaf greenbrier), with lesser amounts of *Toxicodendron radicans* (eastern poison-ivy) and *Parthenocissus quinquefolia* (Virginia creeper). In addition to comprising the majority of the ground layer of these forests, these vines are relatively large-stemmed lianas that contribute significant cover to the canopy by covering the lower branches of trees. *Morella cerifera* (wax-myrtle) is a typical shrub of this community. The herbaceous layer is usually relatively sparse, characterized most frequently by ferns such as *Woodwardia areolata* (netted chainfern), *Osmunda regalis var. spectabilis* (royal fern), or *Osmunda cinnamomea* (cinnamon fern), and farther south (in North Carolina) by *Chasmanthium laxum* (slender woodoats). *Polygonum pensylvanicum* (Pennsylvania smartweed) may also occur. On Assateague Island National Seashore, *Pinus taeda* (loblolly pine) dominates the canopy, with occasional *Acer rubrum* (red maple). *Smilax rotundifolia* (roundleaf greenbrier) is the strongly dominant vine of the understory, with lesser amounts of *Toxicodendron radicans* (eastern poison-ivy) and *Parthenocissus quinquefolia* (Virginia creeper). *Morella cerifera* (wax-myrtle) is also a minor component of this vegetation. Trees tend to occur on slightly elevated hummocks, with standing water evident in hollows. *Phragmites australis* (common reed), *Rubus argutus* (sawtooth blackberry), *Panicum virgatum* (switchgrass), and *Polygonum pensylvanicum* (Pennsylvania smartweed) also occur within this community on Assateague Island National Seashore. Tree diameters range from 12-36 cm dbh. This community occurs primarily on the bayside of the island adjacent to salt marsh. Soils are characterized by moderately shallow muck (15 cm) overlying organic matter-stained sands. This vegetation occurs adjacent to salt marshes, sometimes even forming small 'islands' within high salt marsh. In North Carolina, it may extend well inland fringing bays and sounds on wet saturated flats that are flooded by storm tides.

ENVIRONMENTAL DESCRIPTION

Assateague Island National Seashore Environment: The vegetation occurs in backdune depressions intersecting the water table. Soils are characterized by moderately shallow muck (15 cm) overlying organic matter-stained sands. This vegetation occurs adjacent to salt marshes, sometimes even forming small "islands" within High Salt Marsh (CEGL004197). This forest occurs almost exclusively in association with upland Loblolly Pine Forest (CEGL006040) as a result of the relatively high water table and natural undulations on the dune surface. Both associations are included as a single map unit. Analysis of lidar-derived data of Brock et al. (2007) indicates an average elevation of 0.5 m. Where sand has accumulated to a depth of 0.5 m or more above the water table, leaf litter accumulates as undecomposed duff, but where the substrate intersects the water table, organic material accumulates as muck.

Global Environment: This maritime/coastal wetland forest occurs in backdune depressions with high water and as an estuarine fringe along bays and sounds. Tree diameters range from 12-36 cm dbh. This community occurs primarily on the bayside of islands, barrier spits and on mainlands adjacent to salt marsh. Soils are characterized by moderately shallow muck (15 cm) overlying organic matter-stained sands. This vegetation occurs adjacent to salt marshes, sometimes even forming small "islands" within high salt marsh. In North Carolina, it may extend well inland fringing bays and sounds on wet saturated flats that are flooded by storm tides. Trees tend to occur on slightly elevated hummocks, with standing water evident in hollows.

VEGETATION DESCRIPTION

Assateague Island National Seashore Vegetation: *Pinus taeda* (loblolly pine) dominates the canopy, with occasional *Acer rubrum* (red maple), *Quercus phellos* (willow oak), and *Nyssa sylvatica* (blackgum). *Smilax rotundifolia* (roundleaf greenbrier) is the strongly dominant vine of the understory, with lesser amounts of *Toxicodendron radicans* (eastern poison-ivy) and *Parthenocissus quinquefolia* (Virginia creeper). *Morella cerifera* (wax-myrtle) is also a minor component of this vegetation; *Vaccinium corymbosum* (highbush blueberry) also sometimes occurs. Trees tend to occur on slightly elevated hummocks, with standing water evident in hollows. Wetland species such as *Hydrocotyle americana* (American marshpennywort), *Polygonum pensylvanicum* (Pennsylvania smartweed), and others are characteristic. Other common species include *Chasmanthium laxum* (slender woodoats), *Rubus argutus* (sawtooth blackberry), and *Panicum virgatum* (switchgrass). Toxicodendron radicans is often abundant in the field layer. Less common associates may include *Typha angustifolia* (narrowleaf cattail), *Fimbristylis castanea* (marsh fimbry), *Juncus canadensis* (Canadian rush), *Spartina patens* (saltmeadow cordgrass), *Mikania scandens* (climbing hempvine), and *Schoenoplectus pungens* (common threesquare). Tree diameters range from 12-36 cm at breast height. Examples of this association occur primarily on the bayside of the island adjacent to salt marsh.

Global Vegetation: Examples are characterized by a closed to partially open canopy dominated by *Pinus taeda* (loblolly pine). Other canopy associates may be absent or may include *Acer rubrum* (red maple), *Persea palustris* (swamp bay), or *Liquidambar styraciflua* (sweetgum). The understory is made up of vines, strongly dominated by *Smilax rotundifolia* (roundleaf greenbrier), with lesser

amounts of *Toxicodendron radicans* (eastern poison-ivy) and *Parthenocissus quinquefolia* (Virginia creeper). In addition to comprising the majority of the ground layer of these forests, these vines are relatively large-stemmed lianas that contribute significant cover to the canopy by covering the lower branches of trees. *Morella cerifera* (wax-myrtle) is a typical shrub of this community. The herbaceous layer is usually relatively sparse, characterized most frequently by ferns such as *Woodwardia areolata* (netted chainfern), *Osmunda regalis var. spectabilis* (royal fern), or *Osmunda cinnamomea* (cinnamon fern), and farther south (in North Carolina) by *Chasmanthium laxum* (slender woodoats). *Polygonum pensylvanicum* (Pennsylvania smartweed) may also occur. On Assateague Island National Seashore, *Pinus taeda* (loblolly pine) dominates the canopy, with occasional *Acer rubrum* (red maple). *Smilax rotundifolia* (roundleaf greenbrier) is the strongly dominant vine of the understory, with lesser amounts of *Toxicodendron radicans* (eastern poison-ivy) and *Parthenocissus quinquefolia* (Virginia creeper). *Morella cerifera* (wax-myrtle) is also a minor component of this vegetation. *Phragmites australis* (common reed), *Rubus argutus* (sawtooth blackberry), *Panicum virgatum* (switchgrass), and *Polygonum pensylvanicum* (Pennsylvania smartweed) also occur within this community on Assateague Island National Seashore.

MOST ABUNDANT SPECIES

Assateague Island National Seashore

Stratum	Lifeform	Species
Tree canopy	Needle leaved tree	*Pinus taeda* (loblolly pine)
Shrub/sapling (tall & short)	Broad leaved evergreen shrub	*Morella cerifera* (wax myrtle)
Shrub/sapling (tall & short)	Vine/Liana	*Smilax rotundifolia* (roundleaf greenbrier), *Toxicodendron radicans* (eastern poison ivy)
Herb (field)	Forb	*Polygonum pensylvanicum* (Pennsylvania smartweed)

Global

Stratum	Lifeform	Species
Tree canopy	Needle leaved tree	*Pinus taeda* (loblolly pine)
Shrub/sapling (tall & short)	Vine/Liana	*Smilax glauca* (cat greenbrier), *Smilax rotundifolia* (roundleaf greenbrier), *Toxicodendron radicans* (eastern poison ivy)
Tall shrub/sapling	Broad leaved evergreen shrub	*Morella cerifera* (wax myrtle)
Herb (field)	Fern or fern ally	*Osmunda cinnamomea* (cinnamon fern), *Osmunda regalis* (royal fern)

CHARACTERISTIC SPECIES

Assateague Island National Seashore: *Morella cerifera* (wax-myrtle), *Pinus taeda* (loblolly pine), *Smilax rotundifolia* (roundleaf greenbrier)

Global: *Morella cerifera* (wax-myrtle), *Pinus taeda* (loblolly pine), *Smilax rotundifolia* (roundleaf greenbrier)

CONSERVATION STATUS RANK

Global Rank & Reasons: G3 (31-Jan-2005). This community is restricted to barrier islands and coastal areas of the mainland that are directly influenced by the maritime climate. The range is restricted and includes coastal areas from Cape May, New Jersey, to northern North Carolina. As a community in large part restricted to barrier islands, it is faced with threats to barrier islands in general: intense development pressures where it remains unprotected.

CLASSIFICATION

Status: Standard

Classification Confidence: 2 - Moderate

Global Similar Associations:

- *Acer rubrum - Nyssa sylvatica - Magnolia virginiana / Viburnum nudum var. nudum / Osmunda cinnamomea - Woodwardia areolata* Forest (CEGL006238)
- *Pinus serotina / Magnolia virginiana / Vaccinium corymbosum / Carex atlantica* Woodland (CEPS006470)
- *Pinus taeda - Nyssa biflora - Liquidambar styraciflua / Lyonia lucida* Saturated Forest (CEGL007560)
- *Pinus taeda - Quercus (falcata, nigra) / Morella cerifera / Vitis rotundifolia* Forest (CEGL006040)
- *Pinus taeda / Morella cerifera / Spartina patens* Tidal Woodland (CEGL006849)

Global Related Concepts:

- *Pinus taeda / Morella cerifera / Osmunda regalis var. spectabilis* Forest (Harrison 2004) =
- *Pinus taeda / Myrica cerifera / Juncus coriaceus - Chasmanthium laxum* Saturated Forest (Fleming and Moorhead 1998) =
- *Pinus taeda / Myrica cerifera / Osmunda regalis var. spectabilis* Forest (Sneddon et al. 1997) =
- *Pinus taeda / Myrica cerifera / Osmunda regalis var. spectabilis* Forest (Fleming et al. 2006) =
- *Pinus taeda / Myrica cerifera / Osmunda regalis var. spectabilis* Forest (Bartgis 1986) **?**
- *Pinus taeda* Forested Wetland Series (Clancy 1996) **?**
- Coniferous swamp (Shreve et al. 1910) =
- Estuarine Fringe Loblolly Pine Forest (Schafale and Weakley 1990) **?**
- Estuarine Fringe Pine Forest (Loblolly Pine Subtype) (Schafale 2000) **?**
- Loblolly Pine: 81 (Eyre 1980) >

- Loblolly pine association (Brush et al. 1980) >
- Maritime Wet Pine Forest (Fleming et al. 2001) **?**
- Maritime Wet Pine Forest (Harrison 2004) >
- Mature loblolly pine stands of wet sites (Bratton and Davison 1987) >
- Pine woodland (Higgins et al. 1971) >
- Woodland community (Hill 1986) >

ELEMENT DISTRIBUTION

Assateague Island National Seashore Range: This forest occurs on Assateague Island National Seashore almost exclusively in association with the upland Loblolly Pine Forest (CEGL006040) as a result of the relatively high water table and natural undulations on the dune surface. Where sand has accumulated to a depth of 0.5 m or more above the water table, leaf litter accumulates as undecomposed duff, but where the substrate intersects the water table, organic material accumulates as muck.

Global Range: This community ranges from the coast of Delaware and New Jersey to North Carolina.

Nations: US

States/Provinces: DE:S3, MD, NC, NJ:S1?, VA:S2?

TNC Ecoregions: 57:C, 58:C, 62:C

USFS Ecoregions (1994/95): 232Ab:CCP, 232Ac:CCC, 232Bx:CCP, 232Bz:CCC, 232Ch:CCC, 232Ci:CCC

Federal Lands: NPS (Assateague Island, Cape Hatteras); USFWS (Alligator River, Back Bay, Chesapeake Marshlands, Currituck, Prime Hook, Swanquarter)

ELEMENT SOURCES

Assateague Island National Seashore Plots and Observation Points: Plots: ASIS.78 (42AB05); **Observation Points:** AA433, AA621, AA639, AA642.

Local Description Authors: L.A. Sneddon and A. Berdine

Global Description Authors: mod. J. Teague

References: Bartgis 1986, Bratton and Davison 1987, Breden et al. 2001, Brock et al. 2007, Brush et al. 1980, Clancy 1996, Coxe 2009, Eastern Ecology Working Group n.d., Eyre 1980, Fleming and Moorhead 1998, Fleming and Patterson 2011a, Fleming et al. 2001, Fleming et al. 2006, Harrison 2004, Harrison 2011, Higgins et al. 1971, Hill 1986, Schafale 2000, Schafale 2011, Schafale and Weakley 1990, Shreve et al. 1910, Sneddon et al. 1997, TNC 1995c



Loblolly Pine Wetland Forest, AA Point 642, October 6, 2009 (UTM X: 481775, UTM Y: 4214776)

2. Shrubland & Grassland

2.B.4. Temperate & Boreal Scrub & Herb Coastal Vegetation

2.B.4.Na. Eastern North American Dune & Coastal Grassland & Shrubland

M060. Eastern North American Coastal Beach

G660. North Atlantic Coastal Beach

Upper Ocean Beach

Cakile edentula ssp. edentula - Chamaesyce polygonifolia Sparse Vegetation
American Searocket - Seaside Sandmat Sparse Vegetation
Identifier: CEGL004400

USNVC CLASSIFICATION

Division	Eastern North American Dune & Coastal Grassland & Shrubland (2.B.4.Na)
Macrogroup	Eastern North American Coastal Beach (M060)
Group	North Atlantic Coastal Beach (G660)
Association	Upper Ocean Beach

ELEMENT CONCEPT

Global 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 cocklebur), 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

Assateague Island National Seashore Environment: At Assateague Island, this association occurs on the unconsolidated sands of the upper beach and foredunes.

Global Environment: 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

Assateague Island National Seashore Vegetation: At Assateague Island National Seashore, this association is sparsely vegetated with *Cakile edentula ssp. edentula* (American searocket), covering approximately 1% of the area. Other associated species are just as sparse and generally adapted to a low growth form, given the exposed windy conditions of their environment. Associated species include *Ammophila breviligulata* (American beachgrass), *Chamaesyce polygonifolia* (seaside sandmat), *Salsola kali* (Russian thistle), and *Triplasis purpurea* (purple sandgrass), constituting less than additional percentage of vegetation cover, combined. Usually 95-99% of the substrate is unvegetated sand. *Amaranthus pumilus* (seaside amaranth) is a globally rare species characterizing this vegetation. This species was thought to have been extirpated from Assateague Island, but a single plant was rediscovered in 1998. The National Park Service and other state and Federal agencies instituted a restoration effort in which offspring from the rediscovered plant were established at several locations within the park. Additional populations planted as a result of this effort have become established.

Global Vegetation: 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 cocklebur), 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

Assateague Island National Seashore

Stratum	Lifeform	Species
Herb (field)	Forb	*Cakile edentula ssp. edentula* (American searocket), *Chamaesyce polygonifolia* (seaside sandmat), *Salsola kali* (Russian thistle)
Herb (field)	Graminoid	*Triplasis purpurea* (purple sandgrass)

Global

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

Assateague Island National Seashore: *Amaranthus pumilus* (seaside amaranth), *Atriplex cristata* (crested saltbush), *Cakile edentula* ssp. *edentula* (American searocket), *Chamaesyce polygonifolia* (seaside sandmat), *Salsola kali* (Russian thistle)

Global: *Atriplex cristata* (crested saltbush), *Cakile edentula* ssp. *edentula* (American searocket), *Chamaesyce polygonifolia* (seaside sandmat), *Salsola kali* ssp. *kali* (Russian thistle)

OTHER NOTEWORTHY SPECIES

Assateague Island National Seashore: Vulnerable: *Amaranthus pumilus* (seaside amaranth, globally imperiled, G2)

Global: Vulnerable: *Amaranthus pumilus* (seaside amaranth, G2), *Polygonum glaucum* (seaside knotweed, G3); **Invasive/Exotic**: *Chenopodium album* (lambsquarters, invasive/exotic), *Salsola kali* (Russian thistle, invasive/exotic), *Salsola kali* ssp. *kali* (Russian thistle, invasive/exotic)

CONSERVATION STATUS RANK

Global Rank & Reasons: G4G5 (1-Dec-1997).

CLASSIFICATION

Status: Standard

Classification Confidence: 2 - Moderate

Assateague Island National Seashore Comments: The following names have been applied to vegetation that are considered to be synonymous: beach community (Hill 1986, Assateague Island); beach (Higgins et al. 1971, Assateague Island). The dune and swale community described from the Virginia portion of Assateague (Stalter 1992) is partially contained within this community.

Global 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."

Global 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)

Global Related Concepts:

- *Cakile edentula - Chenopodium album* community (Metzler and Barrett 2001) =
- *Cakile edentula - Chenopodium album* community (Metzler and Barrett 1992) =
- *Cakile edentula ssp. edentula - Chamaesyce polygonifolia* Sparse Vegetation (Harrison 2004) =
- *Cakile edentula ssp. edentula - Chamaesyce polygonifolia* Sparse Vegetation (Sneddon and Zaremba 2004) =
- *Cakile edentula ssp. edentula* Sparse Vegetation (Clancy 1996) **?**
- *Cakile edentula* ssp. *edentula - Salsola caroliniana* Sparse Vegetation (Bartgis 1986) =
- *Cakiletum edentula* (Conard 1935) =
- Beach (Higgins et al. 1971) =
- Beach (McDonnell 1979) =
- Beach (Fender 1937) =
- Beach Strand (Gawler 2002) >
- Beach community (Johnson 1985b) **?**
- Beach community (Baumann 1978b) =
- Beach community (Hill 1986) =
- Beach strand community (MENHP 1991) =
- Beach vegetation (Moul 1973) =
- Coastal Beach and Overwash Flat (Harrison 2004) >
- Coastal beach strand (Sperduto 1994) =
- Coastal beach strand community (Rawinski 1984a) **?**
- Dune and swale community (Stalter 1990) >
- 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 (Enser 1999) =

- Maritime beach (Reschke 1990) =
- Middle beach (Shreve et al. 1910) =
- Middle beach (Nichols 1920) =
- Pioneer beach community (Boule 1979) =
- Sea-strand vegetation, beach formation (Harshberger 1900) =
- Upper Beach (Schafale and Weakley 1990) >
- Upper Beach / Overwash Flat (Fleming et al. 2001) >

ELEMENT DISTRIBUTION

Assateague Island National Seashore Range: This vegetation is common on Assateague Island National Seashore. Its sparse and somewhat ephemeral nature generally precludes mapping it from aerial photography.

Global Range: This association ranges from southern Maine to North Carolina.

Nations: US

States/Provinces: CT, DE, MA:S3, MD, ME, NC, NH:S2, NJ:S2, NY:S5, RI, VA:S3

TNC Ecoregions: 57:C, 58:C, 62:C

USFS Ecoregions (1994/95): 221Ab:CCC, 221Ac:CCC, 221Ak:CCC, 232Aa:CCC, 232Ab:CCC, 232Ac:CCC, 232Bz:CCC, 232Ch:CCC, 232Ci:CCC

Federal Lands: NPS (Assateague Island, Boston Harbor Islands, Cape Cod, Cape Hatteras, Fire Island, Gateway, Sagamore Hill); USFWS (Back Bay, Cape May, Chesapeake Marshlands, E.B. Forsythe, Monomoy, Muskeget Island, Nomans Land Island, Parker River)

ELEMENT SOURCES

Assateague Island National Seashore Plots and Observation Points: Plots: ASIS.98 (17RR02), ASIS.99 (67AB03), ASIS.100 (22RR04), ASIS.101 (62AB05); **Observation Points:** AA519.

Local Description Authors: L.A. Sneddon

Global Description Authors: S.L. Neid

References: Bartgis 1986, Baumann 1978b, Berdine 1998, Boule 1979, Bowman 2000, Breden 1989, Breden et al. 2001, Clancy 1993b, Clancy 1996, Clovis 1968, Conard 1935, Coxe 2009, Dowhan and Rozsa 1989, Eastern Ecology Working Group n.d., Edinger et al. 2002, Edinger et al. 2008a, Edinger et al. 2008b, Enser 1999, Enser and Lundgren 2006, Fender 1937, Fleming and Patterson 2011a, Fleming et al. 2001, Gawler 2001, Gawler 2002, Gawler and Cutko 2010, Godfrey et al. 1978, Harrison 2004, Harrison 2011, Harshberger 1900, Higgins et al. 1971, Hill 1986, J. Harrison pers. comm., Jenkins 1974, Johnson 1985b, Klopfer et al. 2002, Klotz 1986, Largay and Sneddon 2010, MENHP 1991, McDonnell 1979, Metzler and Barrett 1992, Metzler and Barrett

2001, Metzler and Barrett 2006, Moul 1973, NatureServe 2009, Nichols 1920, Rawinski 1984a, Reschke 1990, Schafale 2011, Schafale and Weakley 1990, Shreve et al. 1910, Sneddon and Zaremba 2004, Sneddon et al. 2010, Sperduto 1994, Sperduto 2000a, Sperduto 2000b, Sperduto and Nichols 2004, Stalter 1990, Swain and Kearsley 2001, TNC 1995c



Upper Ocean Beach, AA Point 519, October 3, 2009 (UTM X: 483420, UTM Y: 4217693)

Beachgrass Dune

***Ammophila breviligulata - Panicum amarum var. amarum* Herbaceous Vegetation**
American Beachgrass - Bitter Panicgrass Herbaceous Vegetation
Identifier: CEGL004043

USNVC CLASSIFICATION

Division	Eastern North American Dune & Coastal Grassland & Shrubland (2.B.4.Na)
Macrogroup	Eastern North American Coastal Dune Grassland & Shrubland (M057)
Group	North Atlantic Dune & Coastal Grassland & Shrubland (G493)
Association	Beachgrass Dune

ELEMENT CONCEPT

Global 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

Assateague Island National Seashore Environment: Much of the soil surface in this community (40-60% of total area) is exposed, unstable sand. Sands are generally unconsolidated, and the water table at least one meter deep (or beyond, on the foredune proper). This association is best developed on the island foredunes, next to the beach, and extends to the western base of the dunes adjacent to Bayberry Shrubland (CEGL003881) occurring behind the protection of the foredune. Natural dunes

supporting this vegetation are characterized by undulating topography. Average elevation of this association is 2.13 m as calculated from lidar-derived data of Brock et al. (2007).

Global Environment: 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

Assateague Island National Seashore Vegetation: The largest examples of this association occur on both slopes and the summit of the artificial dune on the central portion of the island where *Ammophila breviligulata* (American beachgrass) was extensively planted. In a more natural condition, *Ammophila breviligulata* (American beachgrass) can be the dominant cover (up to 60%), but this generally occurs only in protected enclosures, established to prevent browse by feral horses on the island. Unprotected, high-quality examples of dense *Ammophila breviligulata* (American beachgrass) do occur at the northernmost end of the island. The more typical expression of this community is a mix of *Ammophila breviligulata* (American beachgrass) with other herbaceous species, including a broad mix of *Solidago sempervirens* (seaside goldenrod), *Triplasis purpurea* (purple sandgrass), *Schoenoplectus pungens* (common threesquare) (where overwashed by sand), *Chamaesyce polygonifolia* (seaside sandmat), *Diodia teres* (poorjoe), *Cakile edentula ssp. edentula* (American searocket), *Nuttallanthus canadensis* (Canada toadflax), *Spartina patens* (saltmeadow cordgrass), *Salsola kali* (Russian thistle), *Panicum amarum var. amarulum* (coastal panicgrass), *Lechea maritima* (beach pinweed), and *Oenothera humifusa* (seabeach evening-primrose). Sparse individuals of stunted *Morella pensylvanica* (northern bayberry) shrubs and seedlings occur in this alliance but make up less than 2% of the total vegetation cover.

Global Vegetation: 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

Assateague Island National Seashore

Stratum	Lifeform	Species
Herb (field)	Graminoid	*Ammophila breviligulata* (American beachgrass), *Panicum amarum var. amarulum* (coastal panicgrass)

Global

Stratum	Lifeform	Species
Herb (field)	Graminoid	*Ammophila breviligulata* (American beachgrass), *Panicum amarum var. amarulum* (coastal panicgrass)

CHARACTERISTIC SPECIES

Assateague Island National Seashore: *Ammophila breviligulata* (American beachgrass), *Oenothera humifusa* (seabeach evening-primrose), *Panicum amarum* var. *amarulum* (coastal panicgrass), *Solidago sempervirens* (seaside goldenrod)

Global: *Ammophila breviligulata* (American beachgrass), *Oenothera humifusa* (seabeach evening-primrose), *Panicum amarum* var. *amarulum* (coastal panicgrass), *Solidago sempervirens* (seaside goldenrod)

OTHER NOTEWORTHY SPECIES

Global: Invasive/Exotic: *Salsola kali* ssp. *kali* (Russian thistle, invasive/exotic)

CONSERVATION STATUS RANK

Global Rank & Reasons: G2 (8-Oct-1998). Although 65-100 Element Occurrences 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

Status: Standard

Classification Confidence: 2 - Moderate

Assateague Island National Seashore Comments: The dunegrass community described from Assateague Island by Hill (1986) and Higgins et al. (1971) is synonymous with this community.

Global 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.

Global 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)

Global Related Concepts:

- *Ammophila breviligulata - Panicum amarum var. amarum* Herbaceous Vegetation (Harrison 2004) =
- *Ammophila breviligulata - Panicum amarum* Herbaceous Vegetation (Clancy 1996) =
- *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) >
- Dune Grass (Schafale and Weakley 1990) >
- Dune Grass (Northern Subtype) (Schafale 2000) **?**
- Dune community (Baumann 1978b) =
- Dunegrass community (Clampitt 1991) >
- Dunegrass community (Hill 1986) =
- Dunegrass community (Higgins et al. 1971) =
- Foredune (Klotz 1986) =
- Foredune (Boule 1979) =

- Maritime Dune Grassland (Harrison 2004) >
- Maritime Dune Grassland (Fleming et al. 2001) >
- Mid-Atlantic Ammophila breviligulata, Panicum amarulum dune grassland variant (Clancy 1993a) =
- Primary dune (Stalter and Lamont 1990) >
- Sand dune (Fender 1937) =

ELEMENT DISTRIBUTION

Assateague Island National Seashore Range: This vegetation is best developed on the artificial dunes on the northern section of the park, but discontinuously spans the length of the park south of South Ocean Beach. It is nearly restricted to the oceanside of the island, but was observed at a single site on the bayside of Assateague Island on the very northern tip of the island.

Global Range: This community occurs on maritime dunes from Long Island, New York, south to North Carolina.

Nations: US

States/Provinces: DE:S2?, MD:S3, NC, NJ:S1S2, NY, VA:S2

TNC Ecoregions: 57:C, 58:C, 62:C

USFS Ecoregions (1994/95): 232Aa:CCC, 232Ab:CCC, 232Ac:CCC, 232Bt:CCP, 232Bz:CCC, 232Ch:CCC, 232Ci:CCC

Federal Lands: NPS (Assateague Island, Cape Lookout, Gateway); USFWS (Cape May, Prime Hook)

ELEMENT SOURCES

Assateague Island National Seashore Plots and Observation Points: Plots: ASIS.59 (12RR05), ASIS.60 (37RR03), ASIS.61 (52AB05), ASIS.62 (TNC16), ASIS.63 (TNC14), ASIS.64 (TNC8), ASIS.65 (62AB04), ASIS.66 (32RR02), ASIS.67 (TNC13); **Observation Points:** AA012, AA022, AA023, AA024, AA026, AA036, AA038, AA047, AA054, AA077, AA195, AA224, AA263, AA291, AA293, AA300, AA329, AA501, AA525, AA568, AA606, AA614, AA629, AA635, AA648, AA706.

Local Description Authors: L.A. Sneddon and A. Berdine

Global 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, Brock et al. 2007, Clampitt 1991, Clancy 1993a, Clancy 1996, Coxe 2009, Eastern Ecology Working Group n.d., Edinger et al. 2008a, Egler 1962, Fender 1937, Fleming 2001a, Fleming and Patterson 2011a, Fleming et al. 2001, Harrison 2004, Harrison 2011, Harvill

1965, Higgins et al. 1971, Hill 1986, Klotz 1986, Martin 1959b, NRCS 2001b, Schafale 2000, Schafale 2003b, Schafale 2011, Schafale and Weakley 1990, Stalter and Lamont 1990, TNC 1995c, TNC 1997a, Zaremba and Leatherman 1984



Beachgrass Dune, AA Point 501, October 2, 2009 (UTM X: 483530, UTM Y: 4218182)

Beach Heather Dune

***Hudsonia tomentosa / Panicum amarum var. amarulum* Dwarf-shrubland**
Woolly Beach-heather / Coastal Panicgrass Dwarf-shrubland
Identifier: CEGL003950

USNVC CLASSIFICATION

Division	Eastern North American Dune & Coastal Grassland & Shrubland (2.B.4.Na)
Macrogroup	Eastern North American Coastal Dune Grassland & Shrubland (M057)
Group	North Atlantic Dune & Coastal Grassland & Shrubland (G493)
Association	Beach-Heather Dune Shrubland

ELEMENT CONCEPT

Global Summary: This association is a maritime beach heather community of mid-Atlantic sand dunes. The unstable substrate is influenced by wind-deposited sand and supports no soil development; large patches of sparsely vegetated or unvegetated sand are common. The community is characterized by *Hudsonia tomentosa* (woolly beach-heather) occurring as discrete patches that may coalesce into a dense mat on older, more stabilized dunes. A number of other shrubs such as *Morella pensylvanica* (northern bayberry), *Morella cerifera* (wax-myrtle), *Pinus taeda* (loblolly pine) saplings, and rarely *Prunus maritima* (beach plum) may occur but are low in abundance and cover. *Schizachyrium littorale* (shore little bluestem), *Ammophila breviligulata* (American beachgrass), *Aristida tuberculosa* (seaside threeawn), *Spartina patens* (saltmeadow cordgrass), and *Panicum amarum var. amarulum* (coastal panicgrass) are common grasses of this community, and *Toxicodendron radicans* (eastern poison-ivy) is a common vine. Other herbaceous associates include *Lechea maritima* (beach pinweed), *Cyperus grayi* (Gray's flatsedge), *Artemisia stelleriana* (oldwoman), *Chamaesyce polygonifolia* (seaside sandmat), *Solidago sempervirens* (seaside goldenrod), and *Diodia teres* (poorjoe). This community is locally common on coastal dunes from New Jersey to northern North Carolina.

ENVIRONMENTAL DESCRIPTION

Assateague Island National Seashore Environment: This association occurs on well-drained sands of backdunes and interdunes. Influenced by wind-deposited sand, the substrate is unstable and supports no soil development. Large patches of sparsely vegetated or unvegetated sand are common. Average elevation of this association was determined to be 0.97 m, calculated from lidar-derived data of Brock et al. (2007).

Global Environment: This community is largely confined to maritime interdunes. Influenced by wind-deposited sand, the substrate is unstable and supports no soil development and large patches of sparsely vegetated or unvegetated sand are common.

VEGETATION DESCRIPTION

Assateague Island National Seashore Vegetation: *Hudsonia tomentosa* (woolly beach-heather) generally constitutes 30-70% of the total ground cover with exposed sand remaining. *Morella*

pensylvanica (northern bayberry) shrubs and *Pinus taeda* (loblolly pine) saplings are almost non-existent but can occur as scattered individuals. Herbaceous vegetation is also quite sparse (less than 5% cover) but may include scattered individuals of *Aristida tuberculosa* (seaside threeawn), *Cyperus grayi* (Gray's flatsedge), *Panicum amarum var. amarulum* (coastal panicgrass), *Panicum virgatum* (switchgrass), *Diodia teres* (poorjoe), *Polygonella articulata* (coastal jointweed), *Solidago sempervirens* (seaside goldenrod), *Nuttallanthus canadensis (= Linaria canadensis)*, *Lechea maritima* (beach pinweed), *Ammophila breviligulata* (American beachgrass), *Pseudognaphalium obtusifolium* (rabbit-tobacco), *Schizachyrium littorale* (shore little bluestem), *Dichanthelium acuminatum*, and *Oenothera humifusa* (seabeach evening-primrose). Scattered vines of *Smilax rotundifolia* (roundleaf greenbrier), *Smilax glauca* (cat greenbrier), and canes of *Rubus argutus* (sawtooth blackberry) are occasional.

Global Vegetation: This community is a maritime dwarf-shrubland characterized by *Hudsonia tomentosa* (woolly beach-heather), a species adapted to sand burial. *Hudsonia tomentosa* (woolly beach-heather) is dominant, occurring as discrete patches that may coalesce into a dense mat on older, more stabilized dunes. A number of other shrubs, such as *Morella pensylvanica* (northern bayberry), *Morella cerifera* (wax-myrtle), *Pinus taeda* (loblolly pine) saplings, and *Prunus maritima* (beach plum), may occur but in low abundance and cover. *Schizachyrium littorale* (shore little bluestem), *Ammophila breviligulata* (American beachgrass), *Aristida tuberculosa* (seaside threeawn), *Spartina patens* (saltmeadow cordgrass), and *Panicum amarum* (bitter panicgrass) are common grasses of this community, and *Toxicodendron radicans* (eastern poison-ivy) is a common vine. Other herbaceous associates include *Lechea maritima* (beach pinweed), *Cyperus grayi* (Gray's flatsedge), *Artemisia stelleriana* (oldwoman), *Chamaesyce polygonifolia* (seaside sandmat), *Solidago sempervirens* (seaside goldenrod), and *Diodia teres* (poorjoe).

MOST ABUNDANT SPECIES

Assateague Island National Seashore

Stratum	Lifeform	Species
Short shrub/sapling	Broad leaved evergreen shrub	*Hudsonia tomentosa* (woolly beach heather), *Morella pensylvanica* (northern bayberry)
Herb (field)	Forb	*Diodia teres* (poorjoe), *Lechea maritima* (beach pinweed), *Solidago sempervirens* (seaside goldenrod)

Global

Stratum	Lifeform	Species
Short shrub/sapling	Broad leaved evergreen shrub	*Hudsonia tomentosa* (woolly beach heather)
Herb (field)	Vine/Liana	*Toxicodendron radicans* (eastern poison ivy)
Herb (field)	Forb	*Lechea maritima* (beach pinweed), *Solidago sempervirens* (seaside goldenrod)
Herb (field)	Graminoid	*Aristida tuberculosa* (seaside threeawn), *Schizachyrium littorale* (shore little bluestem)

CHARACTERISTIC SPECIES

Assateague Island National Seashore: *Aristida tuberculosa* (seaside threeawn), *Hudsonia tomentosa* (woolly beach-heather), *Lechea maritima* (beach pinweed), *Panicum amarum* var. *amarulum* (coastal panicgrass)

Global: *Hudsonia tomentosa* (woolly beach-heather), *Lechea maritima* (beach pinweed), *Panicum amarum* var. *amarulum* (coastal panicgrass)

CONSERVATION STATUS RANK

Global Rank & Reasons: G2G3 (31-Jan-2007). Although there are an estimated 75 occurrences of this association rangewide, this small-patch community occupies fewer than 3500 total acres. The range is moderately restricted (New Jersey to northern North Carolina), and the habitat requirements are also relatively restricted (large mid-Atlantic sand dunes). This association has likely declined substantially due to human development and remains threatened by continuing development of prime real estate. The rank was changed from G3 as reported in TNC (1995c) upon completion of more detailed ranking procedure.

CLASSIFICATION

Status: Standard

Classification Confidence: 2 - Moderate

Assateague Island National Seashore Comments: The *Hudsonia* (goldenheather) dunes (Higgins et al. 1971) and the *Hudsonia* (goldenheather) dune community (Hill 1986) described from Assateague Island are synonymous with this association.

Global Similar Associations:

- *Ammophila breviligulata - Panicum amarum var. amarum* Herbaceous Vegetation (CEGL004043)
- *Hudsonia tomentosa - Arctostaphylos uva-ursi* Dwarf-shrubland (CEGL006143) is the northern analog of this beach heather association.

- *Hudsonia tomentosa* Dune Dwarf-shrubland (CEGL004024)

Global Related Concepts:

- *Hudsonia tomentosa - Ammophila breviligulata* dune scrub association (Clancy 1993a) =
- *Hudsonia tomentosa / Panicum (amarum, amarulum)* Dwarf-shrubland (Bartgis 1986) =
- *Hudsonia tomentosa / Panicum amarum var. amarulum* Dwarf-shrubland (Bowman 2000) =
- *Hudsonia tomentosa / Panicum amarum var. amarulum* Dwarf-shrubland (Harrison 2004) =
- *Hudsonia* dune community (Hill 1986) =
- *Hudsonia* dunes (Higgins et al. 1971) =
- Beach heather community (Collins and Anderson 1994) =
- Coastal dune shrubland (Breden 1989) >
- Dune crest community (Clampitt 1991) >
- Dunegrass - beach heather - low thicket mixture (Martin 1959b) ><
- Maritime Dune Scrub (Fleming et al. 2001) >
- Maritime Shrubland (Harrison 2004) >

ELEMENT DISTRIBUTION

Assateague Island National Seashore Range: This vegetation occurs from the National Seashore Entrance south of the Route 611 bridge on interdunes for the length of the park. It occurs sporadically north of the bridge.

Global Range: The association is restricted to barrier beaches from New Jersey to northern North Carolina.

Nations: US

States/Provinces: DE:S2, MD, NC, NJ:S2, VA:S2?

TNC Ecoregions: 57:C, 58:C, 62:C

USFS Ecoregions (1994/95): 232Ab:CCC, 232Ac:CCC, 232Bz:CCC, 232Ci:CCC

Federal Lands: NPS (Assateague Island); USFWS (Back Bay, Currituck, E.B. Forsythe)

ELEMENT SOURCES

Assateague Island National Seashore Plots and Observation Points: Plots: ASIS.73 (52AB02), ASIS.74 (42AB02), ASIS.75 (12RR01), ASIS.76 (57AB02), ASIS.77 (TNC10); **Observation Points:** AA014, AA015, AA018, AA085, AA197, AA199, AA202, AA256, AA262, AA302, AA376, AA416, AA422, AA434, AA458, AA460, AA479, AA521, AA526, AA539, AA565, AA566, AA573, AA580, AA637, AA638, AA707, AA737, AA748, AA752, AA758, AA759, AA771.

Local Description Authors: L.A. Sneddon and A. Berdine

Global Description Authors: L.A. Sneddon

References: Bartgis 1986, Berdine 1998, Bowman 2000, Breden 1989, Breden et al. 2001, Brock et al. 2007, Clampitt 1991, Clancy 1993a, Collins and Anderson 1994, Coxe 2009, Eastern Ecology Working Group n.d., Fleming 2001a, Fleming and Patterson 2011a, Fleming et al. 2001, Harrison 2004, Harrison 2011, Higgins et al. 1971, Hill 1986, Martin 1959b, NatureServe 2009, Schafale 2011, TNC 1995c, TNC 1997a



Beach Heather Dune, AA Point 416, October 1, 2009 (UTM X: 483900, UTM Y: 4220197)

Backdune Grassland

***Morella (pensylvanica, cerifera) / Schizachyrium littorale - Eupatorium hyssopifolium* Shrub Herbaceous Vegetation**

(Northern Bayberry, Wax-myrtle) / Shore Little Bluestem - Hyssopleaf Thoroughwort Shrub Herbaceous Vegetation

Identifier: CEGL004240

USNVC CLASSIFICATION

Division	Eastern North American Dune & Coastal Grassland & Shrubland (2.B.4.Na)
Macrogroup	Eastern North American Coastal Dune Grassland & Shrubland (M057)
Group	North Atlantic Dune & Coastal Grassland & Shrubland (G493)
Association	Backdune Grassland

ELEMENT CONCEPT

Global Summary: These mid-Atlantic maritime grasslands occur on deep well-drained sands of old leveled interdunes and backdunes. They usually occur within the influence of offshore winds and salt spray. Although highly variable in species composition, the typical expression of this community is characterized by a predominance (25-50% cover) of bunch grasses including *Schizachyrium littorale* (shore little bluestem), *Andropogon virginicus* (broomsedge bluestem), *Panicum amarum var. amarulum* (coastal panicgrass), *Ammophila breviligulata* (American beachgrass), *Dichanthelium scoparium* (velvet panicum), and *Dichanthelium acuminatum* (tapered rosette grass). Generally one or two of these species will dominate while the others occur as more infrequent, scattered clumps. Occasionally *Spartina patens* (saltmeadow cordgrass), growing in a dry 'wispy' condition, will form the dominant graminoid cover. Shrubs of *Morella pensylvanica* (northern bayberry) and/or *Morella cerifera* (wax-myrtle) are sparse and stunted *Baccharis halimifolia* (eastern baccharis), *Prunus maritima* (beach plum), and *Diospyros virginiana* (common persimmon) are even less frequent. Dense tangles of *Toxicodendron radicans* (eastern poison-ivy) are very characteristic of this community as they sprawl over the bare ground and sparse vegetation. *Rubus argutus* (sawtooth blackberry) and *Rhus copallinum* (winged sumac) are also scattered throughout. Much of the remaining dry sands are exposed with sparsely distributed herbs. Characteristic herb species include *Cirsium horridulum* (yellow thistle), *Solidago sempervirens* (seaside goldenrod), *Pseudognaphalium obtusifolium* (rabbit-tobacco), *Nuttallanthus canadensis* (Canada toadflax), *Euthamia caroliniana* (slender goldentop), *Oenothera humifusa* (seabeach evening-primrose), *Oenothera oakesiana* (Oakes' evening-primrose), *Pityopsis falcata* (sickleleaf silkgrass), *Opuntia humifusa* (devil's-tongue), and *Diodia teres* (poorjoe). The range of this community is not well known; North Carolina is likely the southern extent. This community is related to maritime grasslands of New England and New York. Further analysis is required to determine the classification, and thus the range, with confidence. Diagnostic species are *Morella pensylvanica* (northern bayberry), *Schizachyrium littorale* (shore little bluestem), *Eupatorium hyssopifolium* (hyssopleaf thoroughwort), and *Eupatorium rotundifolium* (roundleaf thoroughwort).

ENVIRONMENTAL DESCRIPTION

Assateague Island National Seashore Environment: This association occurs on deep well-drained sands of old naturally stabilized interdunes of Assateague Island National Seashore. It also occurs on small "islands" within the salt marsh, where patches of open sand are evident.

Global Environment: This community occurs on deep well-drained sands of old leveled interdunes and backdunes. It usually occurs within the influence of offshore winds and salt spray.

VEGETATION DESCRIPTION

Assateague Island National Seashore Vegetation: Although highly variable in species composition, the typical expression of this association is characterized by a predominance (25-50% cover) of bunch grasses including *Schizachyrium littorale* (shore little bluestem), *Andropogon virginicus* (broomsedge bluestem), *Panicum amarum var. amarulum* (coastal panicgrass), *Aristida tuberculosa* (seaside threeawn), *Ammophila breviligulata* (American beachgrass), *Dichanthelium scoparium* (velvet panicum), and *Dichanthelium acuminatum* (tapered rosette grass). Generally one or two of these species dominate while the others occur as more infrequent, scattered clumps. Occasionally *Spartina patens* (saltmeadow cordgrass) forms the dominant graminoid cover. *Morella pensylvanica* (northern bayberry) is sparse, and stunted *Baccharis halimifolia* (eastern baccharis) and *Diospyros virginiana* (common persimmon) are even less frequent. Dense tangles of *Toxicodendron radicans* (eastern poison-ivy) are very characteristic as they sprawl over the bare ground and sparse vegetation. *Rubus argutus* (sawtooth blackberry) is also scattered throughout. Much of the remaining dry sands are exposed with sparsely distributed herbs. Characteristic herb species include *Cirsium horridulum* (yellow thistle), *Solidago sempervirens* (seaside goldenrod), *Pseudognaphalium obtusifolium* (rabbit-tobacco), *Nuttallanthus canadensis* (Canada toadflax), *Euthamia caroliniana* (slender goldentop), *Oenothera humifusa* (seabeach evening-primrose), and *Diodia teres* (poorjoe), and *Panicum virgatum* (switchgrass). Hudsonia tomentosa is a common dwarf-shrub. Where this vegetation occurs on salt marsh islands, other frequent associates include *Opuntia humifusa* (devil's-tongue), *Ilex opaca* (American holly), *Hypericum gentianoides* (orangegrass), and stunted individuals of *Prunus serotina* (black cherry) and *Juniperus virginiana* (eastern red-cedar).

Global Vegetation: Although highly variable in species composition, the typical expression of this community is characterized by a predominance (25-50% cover) of bunch grasses including *Schizachyrium littorale* (shore little bluestem), *Andropogon virginicus* (broomsedge bluestem), *Panicum amarum* (bitter panicgrass), *Ammophila breviligulata* (American beachgrass), *Dichanthelium scoparium* (velvet panicum) and *Dichanthelium acuminatum* (tapered rosette grass). Generally one or two of these species is dominant while the others occur as more infrequent, scattered clumps. Occasionally *Spartina patens* (saltmeadow cordgrass) forms the dominant graminoid cover. Shrubs of *Morella pensylvanica* (northern bayberry) are sparse and stunted *Baccharis halimifolia* (eastern baccharis), *Prunus maritima* (beach plum), and *Diospyros virginiana* (common persimmon) are even less frequent. Dense tangles of *Toxicodendron radicans* (eastern poison-ivy) are very characteristic of this association as they sprawl over the bare ground and sparse vegetation. *Rubus argutus* (sawtooth blackberry) and *Rhus copallinum* (winged sumac) are also scattered throughout. Much of the remaining dry sands are exposed with sparsely distributed herbs.

Characteristic herb species include *Cirsium horridulum* (yellow thistle), *Solidago sempervirens* (seaside goldenrod), *Pseudognaphalium obtusifolium* (rabbit-tobacco), *Nuttallanthus canadensis* (Canada toadflax), *Euthamia caroliniana* (slender goldentop), *Oenothera humifusa* (seabeach evening-primrose), *Oenothera oakesiana* (Oakes' evening-primrose), *Pityopsis falcata* (sickleleaf silkgrass), *Opuntia humifusa* (devil's-tongue), and *Diodia teres* (poorjoe).

MOST ABUNDANT SPECIES

Assateague Island National Seashore

Stratum	Lifeform	Species
Short shrub/sapling	Broad leaved evergreen shrub	*Morella pensylvanica* (northern bayberry)
Herb (field)	Vine/Liana	*Toxicodendron radicans* (eastern poison ivy)
Herb (field)	Forb	*Eupatorium hyssopifolium* (hyssopleaf thoroughwort), *Eupatorium rotundifolium* (roundleaf thoroughwort), *Solidago sempervirens* (seaside goldenrod)
Herb (field)	Graminoid	*Schizachyrium littorale* (shore little bluestem)

Global

Stratum	Lifeform	Species
Short shrub/sapling	Broad leaved evergreen shrub	*Morella pensylvanica* (northern bayberry)
Herb (field)	Vine/Liana	*Toxicodendron radicans* (eastern poison ivy)
Herb (field)	Forb	*Eupatorium hyssopifolium* (hyssopleaf thoroughwort), *Eupatorium rotundifolium* (roundleaf thoroughwort), *Solidago sempervirens* (seaside goldenrod)
Herb (field)	Graminoid	*Schizachyrium littorale* (shore little bluestem)

CHARACTERISTIC SPECIES

Assateague Island National Seashore: *Eupatorium hyssopifolium* (hyssopleaf thoroughwort), *Eupatorium rotundifolium* (roundleaf thoroughwort), *Morella pensylvanica* (northern bayberry), *Schizachyrium littorale* (shore little bluestem)

Global: *Eupatorium hyssopifolium* (hyssopleaf thoroughwort), *Eupatorium rotundifolium* (roundleaf thoroughwort), *Morella pensylvanica* (northern bayberry), *Schizachyrium littorale* (shore little bluestem)

CONSERVATION STATUS RANK

Global Rank & Reasons: G2 (2-Dec-1998). This grassland community is confined to barrier islands ranging from New Jersey to Virginia. It occurs on dune flats protected from overwash, and is generally small in size with occurrences ranging from less than an acre to approximately 20 acres.

Approximately 100-120 occurrences are thought to occur rangewide, covering a total of less than 1000 acres. The major threats to this community are human development (commercial and residential building), as well as dune stabilization activities.

CLASSIFICATION

Status: Standard

Classification Confidence: 2 - Moderate

Assateague Island National Seashore Comments: The shrub succession community (Hill 1986) and the xeric shrub community (particularly at lower elevations) (Higgins et al. 1971) described from Assateague Island are partially contained within this community. The sandplain grassland (Dunwiddie et al. 1993), the maritime grassland in New York (Reschke 1990), and the *Andropogonetum scoparii* described from Long Island, New York (Blizzard 1931), are similar to this association, but classification will require further work.

Global Similar Associations:

- *(Morella pensylvanica) / Schizachyrium littorale - Aristida tuberculosa* Shrub Herbaceous Vegetation (CEGL006161)
- *Morella pensylvanica / Diodia teres* Shrubland (CEGL003881) is a maritime shrubland with sparse to patchy ground flora and some overlap in species composition.
- *Morella pensylvanica / Schizachyrium littorale - Danthonia spicata* Shrub Herbaceous Vegetation (CEGL006067)

Global Related Concepts:

- *Morella (pensylvanica, cerifera) / Schizachyrium littorale - Eupatorium hyssopifolium* Shrub Herbaceous Vegetation (Harrison 2004) =
- *Morella (pensylvanica, cerifera) / Schizachyrium littorale - Eupatorium hyssopifolium* Shrub Herbaceous Vegetation (TNC 1997a) =
- *Myrica pensylvanica / Schizachyrium scoparium* ssp. *littorale - Eupatorium hyssopifolium* Shrub Herbaceous Vegetation (Bartgis 1986) =
- Maritime Dry Grassland (Northern Bayberry Subtype) (Schafale 2000) **?**
- Maritime Shrubland (Harrison 2004) >
- Shrub succession community (Hill 1986) >
- Xeric shrub community (Higgins et al. 1971) >

OTHER COMMENTS

Other Comments: Small examples of this association occur frequently on raised "islands" within the salt marsh. These islands are a challenge to characterize due to their small size and distinct zonation. This vegetation occurs at the center, on presumably the highest point, and is characterized by patches

of open sand. The vegetation occurs at higher cover in a thin ring separating the island from the surrounding marsh.

ELEMENT DISTRIBUTION

Global Range: This community ranges from New Jersey to Virginia and North Carolina on coastal dunes.

Nations: US

States/Provinces: DE, MD, NC, NJ:S2, VA:S2

TNC Ecoregions: 57:C, 58:C, 62:C

USFS Ecoregions (1994/95): 232Ab:CCC, 232Bz:CCC, 232Ci:CCC

Federal Lands: NPS (Assateague Island); USFWS (Back Bay?, Cape May, E.B. Forsythe)

ELEMENT SOURCES

Assateague Island National Seashore Plots and Observation Points: Plots: ASIS.36 (77AB01), ASIS.37 (77AB03), ASIS.38 (32RR01), ASIS.39 (37RR05), ASIS.40 (TNC4); **Observation Points:** AA102, AA127, AA154, AA174, AA198, AA201, AA211, AA225, AA226, AA321, AA327, AA336, AA491, AA524, AA571, AA589, AA643, AA719, AA724, AA750B, AA770.

Local Description Authors: L.A. Sneddon

Global Description Authors: A. Berdine, mod. S.L. Neid

References: Bartgis 1986, Berdine 1998, Blizzard 1931, Breden et al. 2001, Coxe 2009, Dunwiddie et al. 1993, Eastern Ecology Working Group n.d., Fleming 2001a, Fleming and Patterson 2011a, Fleming et al. 2001, Harrison 2004, Harrison 2011, Higgins et al. 1971, Hill 1986, NatureServe 2009, Reschke 1990, Schafale 2000, Schafale 2011, Sneddon et al. 1996, TNC 1995c, TNC 1997a



Backdune Grassland, AA Point 327, September 30, 2009 (UTM X: 484618, UTM Y: 4222647)

Bayberry Dune Shrubland

***Morella pensylvanica / Diodia teres* Shrubland**

Northern Bayberry / Poorjoe Shrubland

Identifier: CEGL003881

USNVC CLASSIFICATION

Division	Eastern North American Dune & Coastal Grassland & Shrubland (2.B.4.Na)
Macrogroup	Eastern North American Coastal Dune Grassland & Shrubland (M057)
Group	North Atlantic Dune & Coastal Grassland & Shrubland (G493)
Association	Bayberry Shrubland

ELEMENT CONCEPT

Global Summary: This community is a maritime shrubland dominated by *Morella pensylvanica* (northern bayberry), occurring with *Baccharis halimifolia* (eastern baccharis), *Rhus copallinum* (winged sumac), and stunted individuals of *Pinus taeda* (loblolly pine), *Prunus serotina* (black cherry), *Quercus virginiana* (live oak), and *Diospyros virginiana* (common persimmon). The constant movement of sand in this community limits the herbaceous cover. Typical herbaceous species include *Ammophila breviligulata* (American beachgrass), *Panicum amarum var. amarulum* (coastal panicgrass), *Cyperus grayi* (Gray's flatsedge), *Lechea maritima* (beach pinweed), *Dichanthelium acuminatum* (tapered rosette grass), *Spartina patens* (saltmeadow cordgrass), *Triplasis purpurea* (purple sandgrass), *Cenchrus tribuloides* (sanddune sandbur), *Chamaesyce polygonifolia* (seaside sandmat), *Diodia teres* (poorjoe), *Hudsonia tomentosa* (woolly beach-heather), *Oenothera humifusa* (seabeach evening-primrose), *Parthenocissus quinquefolia* (Virginia creeper), *Rumex acetosella* (common sheep sorrel), *Solidago sempervirens* (seaside goldenrod), and *Toxicodendron radicans* (eastern poison-ivy). This maritime shrubland usually occupies the intermediate areas between the very unstable oceanward portions of the dunes and the more protected backdunes, where it forms partially open to dense shrub thickets. The substrate is sand with no soil profile development, and with variable amounts of accumulated leaf litter. Where this community occupies the lee side of foredunes, greater exposure to winds and storms contributes to a shorter stature and more open aspect of the vegetation. Here there are large patches of open unvegetated or sparsely vegetated sand. This community occurs from Delaware south to northern North Carolina.

ENVIRONMENTAL DESCRIPTION

Assateague Island National Seashore Environment: This association occurs on the unstable sands of foredunes and is exposed to winds and salt spray, but is well beyond tidal influence. Storm surges and overwash frequently kill back the shrubs, however, imposing a perpetual long-term disturbance regime. Large expanses of unvegetated sand are characteristic, although the vegetation may be quite patchy and dense in some areas that have remained relatively undisturbed for longer time periods. The substrate is generally deep (greater than 1 m) unconsolidated sands, with the water table usually exceeding this depth. This association occurs on undulating topography at an average elevation of 2.17 m as calculated from lidar-derived data of Brock et al. (2007).

Global Environment: This maritime shrubland community usually occupies the area intermediate between the very unstable oceanward portions of the dunes and the more protected backdunes, where it forms partially open to dense shrub thickets. The substrate is sand with no soil profile development, and with variable amounts of accumulated leaf litter. Where this community occupies the lee side of foredunes, greater exposure to winds and storms contributes to a shorter stature and more open aspect of the vegetation. Here, there are large patches of open unvegetated or sparsely vegetated sand.

VEGETATION DESCRIPTION

Assateague Island National Seashore Vegetation: This association is characterized by sparse (generally less than 50%) cover of low or stunted *Morella pensylvanica* (northern bayberry). The low growth form (less than 1.5 m) of *Morella pensylvanica* (northern bayberry) is partially the result of sand burial, sometimes almost covering individual shrubs. *Morella pensylvanica* (northern bayberry), *Solidago sempervirens* (seaside goldenrod), and *Ammophila breviligulata* (American beachgrass) are the most characteristic species of this vegetation. Much less frequent are individuals of *Baccharis halimifolia* (eastern baccharis), *Diospyros virginiana* (common persimmon), and *Morella cerifera* (wax-myrtle). *Prunus maritima* (beach plum) occurs sparingly, as Assateague Island is the southern range limit of this species, but it can be found in very local patches or as individuals within this foredune community as a shrub or small tree in growth form. The constant movement of sand in this community also limits the herbaceous cover. Species suited to these shifting sands include sparse *Hudsonia tomentosa* (woolly beach-heather) with *Solidago sempervirens* (seaside goldenrod) and *Ammophila breviligulata* (American beachgrass). Other herbaceous species characteristic but sparsely distributed in this community include *Diodia teres* (poorjoe), *Panicum amarum var. amarulum* (coastal panicgrass), *Triplasis purpurea* (purple sandgrass), *Toxicodendron radicans* (eastern poison-ivy), *Chamaesyce polygonifolia* (seaside sandmat), *Cenchrus tribuloides* (sanddune sandbur), *Oenothera humifusa* (seabeach evening-primrose), *Parthenocissus quinquefolia* (Virginia creeper), *Spergularia salina* (salt sandspurry), *Lechea maritima* (beach pinweed), *Dichanthelium acuminatum* (tapered rosette grass), and *Rumex acetosella* (common sheep sorrel) This association also occurs on the northern tip of Assateague Island on artificial habitat created by dredge spoil deposition; here the vegetation is less typical and supports a number of exotic species in addition to those previously mentioned, including *Bromus tectorum* (cheatgrass), *Vulpia myuros* (rat-tail fescue), *Lepidium* (pepperweed) spp., and *Trifolium arvense* (rabbitfoot clover). Total shrub cover is also greater here than in most other occurrences of the more natural manifestation of this association.

Global Vegetation: This community is a maritime shrubland dominated by *Morella pensylvanica* (northern bayberry), occurring with *Baccharis halimifolia* (eastern baccharis), *Rhus copallinum* (winged sumac), and stunted individuals of *Pinus taeda* (loblolly pine). *Prunus maritima* (beach plum) is more characteristic of this community from Delaware northward. The constant movement of sand in this community limits the herbaceous cover. Typical herbaceous species include *Ammophila breviligulata* (American beachgrass), *Panicum amarum var. amarulum* (coastal panicgrass), *Cyperus grayi* (Gray's flatsedge), *Dichanthelium acuminatum* (tapered rosette grass), *Spartina patens* (saltmeadow cordgrass), *Triplasis purpurea* (purple sandgrass), *Cenchrus tribuloides* (sanddune sandbur), *Chamaesyce polygonifolia* (seaside sandmat), *Diodia teres* (poorjoe), *Hudsonia tomentosa*

(woolly beach-heather), *Lechea maritima* (beach pinweed), *Oenothera humifusa* (seabeach evening-primrose), *Cakile edentula* (American searocket), *Parthenocissus quinquefolia* (Virginia creeper), *Rumex acetosella* (common sheep sorrel), *Solidago sempervirens* (seaside goldenrod), and *Toxicodendron radicans* (eastern poison-ivy).

MOST ABUNDANT SPECIES

Assateague Island National Seashore

Stratum	Lifeform	Species
Short shrub/sapling	Broad leaved evergreen shrub	*Morella cerifera* (wax myrtle), *Morella pensylvanica* (northern bayberry)
Herb (field)	Forb	*Oenothera humifusa* (seabeach evening primrose), *Solidago sempervirens* (seaside goldenrod)
Herb (field)	Graminoid	*Ammophila breviligulata* (American beachgrass), *Triplasis purpurea* (purple sandgrass)

Global

Stratum	Lifeform	Species
Short shrub/sapling	Broad leaved evergreen shrub	*Morella cerifera* (wax myrtle), *Morella pensylvanica* (northern bayberry)
Herb (field)	Forb	*Diodia teres* (poorjoe), *Solidago sempervirens* (seaside goldenrod)
Herb (field)	Graminoid	*Ammophila breviligulata* (American beachgrass)

CHARACTERISTIC SPECIES

Assateague Island National Seashore: *Diodia teres* (poorjoe), *Morella pensylvanica* (northern bayberry)

Global: *Diodia teres* (poorjoe), *Morella pensylvanica* (northern bayberry)

CONSERVATION STATUS RANK

Global Rank & Reasons: G2 (28-Jan-1999). This maritime shrubland community is restricted to large coastal dune systems from Delaware to Nag's Head, North Carolina. The community is confined to primary dunes subjected to wind and salt spray; these dynamic forces cause natural decimation of some occurrences while building habitat for other new occurrences. For this reason, the community depends on the existence of large expanses of habitat to support the naturally shifting mosaic. As a maritime community, it is faced with many threats common to all maritime systems: dune stabilization, commercial and residential development, road expansion. Approximately 50 occurrences covering 1200-1500 acres is estimated rangewide.

CLASSIFICATION

Status: Standard

Classification Confidence: 2 - Moderate

Global Comments: This community is a maritime shrubland dominated by *Morella pensylvanica* (northern bayberry). It supports the following species characteristic of the *Morella pensylvanica - (Prunus maritima)* Shrubland Alliance (A.902), including *Solidago sempervirens* (seaside goldenrod), *Oenothera humifusa* (seabeach evening-primrose), *Cyperus grayi* (Gray's flatsedge), *Ammophila breviligulata* (American beachgrass), *Chamaesyce polygonifolia* (seaside sandmat), *Rhus copallinum* (winged sumac), and from Maryland and north, *Prunus maritima* (beach plum). This association is further characterized by species that differentiate it from other communities in the alliance, most notably *Morella cerifera* (wax-myrtle), *Panicum amarum* (bitter panicgrass), *Spartina patens* (saltmeadow cordgrass), *Baccharis halimifolia* (eastern baccharis), and stunted individuals of *Pinus taeda* (loblolly pine). *Morella pensylvanica - Prunus maritima* Shrubland (CEGL006295) is the northern analog of this association.

Global Similar Associations:

- *Morella (pensylvanica, cerifera) / Schizachyrium littorale - Eupatorium hyssopifolium* Shrub Herbaceous Vegetation (CEGL004240) is a maritime grassland with scattered shrubs and some overlap in species composition.
- *Morella pensylvanica - Prunus maritima* Shrubland (CEGL006295)
- *Morella pensylvanica / Panicum virgatum* Shrubland (CEGL006457)

Global Related Concepts:

- *Morella pensylvanica / Diodia teres* Shrubland (Harrison 2004) =
- *Morella pensylvanica / Diodia teres* Shrubland (TNC 1997a) =
- *Myrica pensylvanica - (Prunus maritima)* Shrubland (Clancy 1996) =
- *Myrica pensylvanica / Diodia teres* Shrubland (Bartgis 1986) ?
- *Prunus maritima, Myrica pensylvanica* coastal dune scrub association (Clancy 1993a) =
- Dunegrass-shrub transition zone (Higgins et al. 1971) =
- Maritime Dune Scrub (Fleming et al. 2001) >
- Maritime Shrub (Schafale and Weakley 1990) >
- Maritime Shrub (Northern Subtype) (Schafale 2003b) =
- Maritime Shrubland (Harrison 2004) >
- Shrub succession community (Hill 1986) >
- Upland (dune) thicket (Klotz 1986) >

OTHER COMMENTS

Other Comments: The *Prunus maritima - Myrica pensylvanica* coastal dune scrub association described from Delaware (Clancy 1993b) and the dunegrass-shrub transition zone of Assateague Island described by Higgins et al. (1971) are synonymous with this community. The shrub succession community (Hill 1986) and the dunegrass-shrub transition zone (Higgins et al. 1971) described from Assateague Island, and the upland (dune) thicket described from Virginia (Klotz 1986) are partially contained within this community.

ELEMENT DISTRIBUTION

Assateague Island National Seashore Range: This association commonly occurs most frequently on the southern portion of the island beyond the limits of the artificially created and maintained foredune planted with *Ammophila breviligulata* (American beachgrass). This association occurs on or just behind the primary dune, in a linear fashion, along the length of the park with the exception of a small portion of the north end. This community also occurs on the northern tip of the island on artificial habitat created by dredge spoil deposition; here the vegetation is less typical and supports a number of exotic species.

Global Range: This association is restricted to backdunes of shorelines from Delaware to Nag's Head, North Carolina.

Nations: US

States/Provinces: DE:S2S3, MD, NC, VA:S2?

TNC Ecoregions: 57:C, 58:C, 62:C

USFS Ecoregions (1994/95): 232Ab:CPP, 232Ac:CPP, 232Bz:CCC, 232Ch:CCP, 232Ci:CCC

Federal Lands: NPS (Assateague Island); USFWS (Back Bay?, Currituck)

ELEMENT SOURCES

Assateague Island National Seashore Plots and Observation Points: Plots: ASIS.12 (57AB08), ASIS.13 (47AB06), ASIS.14 (52AB06), ASIS.15 (32CEF01), ASIS.16 (77AB05), ASIS.17 (22RR01), ASIS.18 (12RR04), ASIS.19 (12RR02), ASIS.20 (12RR03); **Observation Points:** AA001, AA002A, AA002B, AA004, AA011, AA016, AA025, AA028, AA079, AA120, AA130, AA207, AA268, AA304, AA341, AA523, AA527, AA534, AA542, AA550, AA557, AA588, AA612, AA644, AA723, AA743, AA753, AA761.

Local Description Authors: A. Berdine and L.A. Sneddon

Global Description Authors: L.A. Sneddon

References: Bartgis 1986, Berdine 1998, Bowman 2000, Brock et al. 2007, Clancy 1993a, Clancy 1993b, Clancy 1996, Coxe 2009, Eastern Ecology Working Group n.d., Fleming 2001a, Fleming and Patterson 2011a, Fleming et al. 2001, Harrison 2004, Harrison 2011, Higgins et al. 1971, Hill 1986,

Klotz 1986, Schafale 2003b, Schafale 2011, Schafale and Weakley 1990, Sneddon et al. 1996, TNC 1995c, TNC 1997a



Bayberry Dune Shrubland, AA Point 11, August 13, 2009 (UTM X: 491005, UTM Y: 4240835)

Beach Heather Dune

***Hudsonia tomentosa / Panicum amarum var. amarulum* Dwarf-shrubland**
Woolly Beach-heather / Coastal Panicgrass Dwarf-shrubland
Identifier: CEGL003950

USNVC CLASSIFICATION

Division	Eastern North American Dune & Coastal Grassland & Shrubland (2.B.4.Na)
Macrogroup	Eastern North American Coastal Dune Grassland & Shrubland (M057)
Group	North Atlantic Dune & Coastal Grassland & Shrubland (G493)
Association	Beach-Heather Dune Shrubland

ELEMENT CONCEPT

Global Summary: This association is a maritime beach heather community of mid-Atlantic sand dunes. The unstable substrate is influenced by wind-deposited sand and supports no soil development; large patches of sparsely vegetated or unvegetated sand are common. The community is characterized by *Hudsonia tomentosa* (woolly beach-heather) occurring as discrete patches that may coalesce into a dense mat on older, more stabilized dunes. A number of other shrubs such as *Morella pensylvanica* (northern bayberry), *Morella cerifera* (wax-myrtle), *Pinus taeda* (loblolly pine) saplings, and rarely *Prunus maritima* (beach plum) may occur but are low in abundance and cover. *Schizachyrium littorale* (shore little bluestem), *Ammophila breviligulata* (American beachgrass), *Aristida tuberculosa* (seaside threeawn), *Spartina patens* (saltmeadow cordgrass), and *Panicum amarum var. amarulum* (coastal panicgrass) are common grasses of this community, and *Toxicodendron radicans* (eastern poison-ivy) is a common vine. Other herbaceous associates include *Lechea maritima* (beach pinweed), *Cyperus grayi* (Gray's flatsedge), *Artemisia stelleriana* (oldwoman), *Chamaesyce polygonifolia* (seaside sandmat), *Solidago sempervirens* (seaside goldenrod), and *Diodia teres* (poorjoe). This community is locally common on coastal dunes from New Jersey to northern North Carolina.

ENVIRONMENTAL DESCRIPTION

Assateague Island National Seashore Environment: This association occurs on well-drained sands of backdunes and interdunes. Influenced by wind-deposited sand, the substrate is unstable and supports no soil development. Large patches of sparsely vegetated or unvegetated sand are common. Average elevation of this association was determined to be 0.97 m, calculated from lidar-derived data of Brock et al. (2007).

Global Environment: This community is largely confined to maritime interdunes. Influenced by wind-deposited sand, the substrate is unstable and supports no soil development and large patches of sparsely vegetated or unvegetated sand are common.

VEGETATION DESCRIPTION

Assateague Island National Seashore Vegetation: *Hudsonia tomentosa* (woolly beach-heather) generally constitutes 30-70% of the total ground cover with exposed sand remaining. *Morella*

pensylvanica (northern bayberry) shrubs and *Pinus taeda* (loblolly pine) saplings are almost non-existent but can occur as scattered individuals. Herbaceous vegetation is also quite sparse (less than 5% cover) but may include scattered individuals of *Aristida tuberculosa* (seaside threeawn), *Cyperus grayi* (Gray's flatsedge), *Panicum amarum var. amarulum* (coastal panicgrass), *Panicum virgatum* (switchgrass), *Diodia teres* (poorjoe), *Polygonella articulata* (coastal jointweed), *Solidago sempervirens* (seaside goldenrod), *Nuttallanthus canadensis (= Linaria canadensis)*, *Lechea maritima* (beach pinweed), *Ammophila breviligulata* (American beachgrass), *Pseudognaphalium obtusifolium* (rabbit-tobacco), *Schizachyrium littorale* (shore little bluestem), *Dichanthelium acuminatum*, and *Oenothera humifusa* (seabeach evening-primrose). Scattered vines of *Smilax rotundifolia* (roundleaf greenbrier), *Smilax glauca* (cat greenbrier), and canes of *Rubus argutus* (sawtooth blackberry) are occasional.

Global Vegetation: This community is a maritime dwarf-shrubland characterized by *Hudsonia tomentosa* (woolly beach-heather), a species adapted to sand burial. *Hudsonia tomentosa* (woolly beach-heather) is dominant, occurring as discrete patches that may coalesce into a dense mat on older, more stabilized dunes. A number of other shrubs, such as *Morella pensylvanica* (northern bayberry), *Morella cerifera* (wax-myrtle), *Pinus taeda* (loblolly pine) saplings, and *Prunus maritima* (beach plum), may occur but in low abundance and cover. *Schizachyrium littorale* (shore little bluestem), *Ammophila breviligulata* (American beachgrass), *Aristida tuberculosa* (seaside threeawn), *Spartina patens* (saltmeadow cordgrass), and *Panicum amarum* (bitter panicgrass) are common grasses of this community, and *Toxicodendron radicans* (eastern poison-ivy) is a common vine. Other herbaceous associates include *Lechea maritima* (beach pinweed), *Cyperus grayi* (Gray's flatsedge), *Artemisia stelleriana* (oldwoman), *Chamaesyce polygonifolia* (seaside sandmat), *Solidago sempervirens* (seaside goldenrod), and *Diodia teres* (poorjoe).

MOST ABUNDANT SPECIES

Assateague Island National Seashore

Stratum	Lifeform	Species
Short shrub/sapling	Broad leaved evergreen shrub	*Hudsonia tomentosa* (woolly beach heather), *Morella pensylvanica* (northern bayberry)
Herb (field)	Forb	*Diodia teres* (poorjoe), *Lechea maritima* (beach pinweed), *Solidago sempervirens* (seaside goldenrod)

Global

Stratum	Lifeform	Species
Short shrub/sapling	Broad leaved evergreen shrub	*Hudsonia tomentosa* (woolly beach heather)
Herb (field)	Vine/Liana	*Toxicodendron radicans* (eastern poison ivy)
Herb (field)	Forb	*Lechea maritima* (beach pinweed), *Solidago sempervirens* (seaside goldenrod)
Herb (field)	Graminoid	*Aristida tuberculosa* (seaside threeawn), *Schizachyrium littorale* (shore little bluestem)

CHARACTERISTIC SPECIES

Assateague Island National Seashore: *Aristida tuberculosa* (seaside threeawn), *Hudsonia tomentosa* (woolly beach-heather), *Lechea maritima* (beach pinweed), *Panicum amarum* var. *amarulum* (coastal panicgrass)

Global: *Hudsonia tomentosa* (woolly beach-heather), *Lechea maritima* (beach pinweed), *Panicum amarum* var. *amarulum* (coastal panicgrass)

CONSERVATION STATUS RANK

Global Rank & Reasons: G2G3 (31-Jan-2007). Although there are an estimated 75 occurrences of this association rangewide, this small-patch community occupies fewer than 3500 total acres. The range is moderately restricted (New Jersey to northern North Carolina), and the habitat requirements are also relatively restricted (large mid-Atlantic sand dunes). This association has likely declined substantially due to human development and remains threatened by continuing development of prime real estate. The rank was changed from G3 as reported in TNC (1995c) upon completion of more detailed ranking procedure.

CLASSIFICATION

Status: Standard

Classification Confidence: 2 - Moderate

Assateague Island National Seashore Comments: The *Hudsonia* (goldenheather) dunes (Higgins et al. 1971) and the *Hudsonia* (goldenheather) dune community (Hill 1986) described from Assateague Island are synonymous with this association.

Global Similar Associations:

- *Ammophila breviligulata - Panicum amarum var. amarum* Herbaceous Vegetation (CEGL004043)
- *Hudsonia tomentosa - Arctostaphylos uva-ursi* Dwarf-shrubland (CEGL006143) is the northern analog of this beach heather association.

- *Hudsonia tomentosa* Dune Dwarf-shrubland (CEGL004024)

Global Related Concepts:

- *Hudsonia tomentosa - Ammophila breviligulata* dune scrub association (Clancy 1993a) =
- *Hudsonia tomentosa / Panicum (amarum, amarulum)* Dwarf-shrubland (Bartgis 1986) =
- *Hudsonia tomentosa / Panicum amarum var. amarulum* Dwarf-shrubland (Bowman 2000) =
- *Hudsonia tomentosa / Panicum amarum var. amarulum* Dwarf-shrubland (Harrison 2004) =
- *Hudsonia* dune community (Hill 1986) =
- *Hudsonia* dunes (Higgins et al. 1971) =
- Beach heather community (Collins and Anderson 1994) =
- Coastal dune shrubland (Breden 1989) >
- Dune crest community (Clampitt 1991) >
- Dunegrass - beach heather - low thicket mixture (Martin 1959b) ><
- Maritime Dune Scrub (Fleming et al. 2001) >
- Maritime Shrubland (Harrison 2004) >

ELEMENT DISTRIBUTION

Assateague Island National Seashore Range: This vegetation occurs from the National Seashore Entrance south of the Route 611 bridge on interdunes for the length of the park. It occurs sporadically north of the bridge.

Global Range: The association is restricted to barrier beaches from New Jersey to northern North Carolina.

Nations: US

States/Provinces: DE:S2, MD, NC, NJ:S2, VA:S2?

TNC Ecoregions: 57:C, 58:C, 62:C

USFS Ecoregions (1994/95): 232Ab:CCC, 232Ac:CCC, 232Bz:CCC, 232Ci:CCC

Federal Lands: NPS (Assateague Island); USFWS (Back Bay, Currituck, E.B. Forsythe)

ELEMENT SOURCES

Assateague Island National Seashore Plots and Observation Points: Plots: ASIS.73 (52AB02), ASIS.74 (42AB02), ASIS.75 (12RR01), ASIS.76 (57AB02), ASIS.77 (TNC10); **Observation Points:** AA014, AA015, AA018, AA085, AA197, AA199, AA202, AA256, AA262, AA302, AA376, AA416, AA422, AA434, AA458, AA460, AA479, AA521, AA526, AA539, AA565, AA566, AA573, AA580, AA637, AA638, AA707, AA737, AA748, AA752, AA758, AA759, AA771.

Local Description Authors: L.A. Sneddon and A. Berdine

Global Description Authors: L.A. Sneddon

References: Bartgis 1986, Berdine 1998, Bowman 2000, Breden 1989, Breden et al. 2001, Brock et al. 2007, Clampitt 1991, Clancy 1993a, Collins and Anderson 1994, Coxe 2009, Eastern Ecology Working Group n.d., Fleming 2001a, Fleming and Patterson 2011a, Fleming et al. 2001, Harrison 2004, Harrison 2011, Higgins et al. 1971, Hill 1986, Martin 1959b, NatureServe 2009, Schafale 2011, TNC 1995c, TNC 1997a



Beach Heather Dune, AA Point 416, October 1, 2009 (UTM X: 483900, UTM Y: 4220197)

Backdune Grassland

***Morella (pensylvanica, cerifera) / Schizachyrium littorale - Eupatorium hyssopifolium* Shrub Herbaceous Vegetation**

(Northern Bayberry, Wax-myrtle) / Shore Little Bluestem - Hyssopleaf Thoroughwort Shrub Herbaceous Vegetation

Identifier: CEGL004240

USNVC CLASSIFICATION

Division	Eastern North American Dune & Coastal Grassland & Shrubland (2.B.4.Na)
Macrogroup	Eastern North American Coastal Dune Grassland & Shrubland (M057)
Group	North Atlantic Dune & Coastal Grassland & Shrubland (G493)
Association	Backdune Grassland

ELEMENT CONCEPT

Global Summary: These mid-Atlantic maritime grasslands occur on deep well-drained sands of old leveled interdunes and backdunes. They usually occur within the influence of offshore winds and salt spray. Although highly variable in species composition, the typical expression of this community is characterized by a predominance (25-50% cover) of bunch grasses including *Schizachyrium littorale* (shore little bluestem), *Andropogon virginicus* (broomsedge bluestem), *Panicum amarum var. amarulum* (coastal panicgrass), *Ammophila breviligulata* (American beachgrass), *Dichanthelium scoparium* (velvet panicum), and *Dichanthelium acuminatum* (tapered rosette grass). Generally one or two of these species will dominate while the others occur as more infrequent, scattered clumps. Occasionally *Spartina patens* (saltmeadow cordgrass), growing in a dry 'wispy' condition, will form the dominant graminoid cover. Shrubs of *Morella pensylvanica* (northern bayberry) and/or *Morella cerifera* (wax-myrtle) are sparse and stunted *Baccharis halimifolia* (eastern baccharis), *Prunus maritima* (beach plum), and *Diospyros virginiana* (common persimmon) are even less frequent. Dense tangles of *Toxicodendron radicans* (eastern poison-ivy) are very characteristic of this community as they sprawl over the bare ground and sparse vegetation. *Rubus argutus* (sawtooth blackberry) and *Rhus copallinum* (winged sumac) are also scattered throughout. Much of the remaining dry sands are exposed with sparsely distributed herbs. Characteristic herb species include *Cirsium horridulum* (yellow thistle), *Solidago sempervirens* (seaside goldenrod), *Pseudognaphalium obtusifolium* (rabbit-tobacco), *Nuttallanthus canadensis* (Canada toadflax), *Euthamia caroliniana* (slender goldentop), *Oenothera humifusa* (seabeach evening-primrose), *Oenothera oakesiana* (Oakes' evening-primrose), *Pityopsis falcata* (sickleleaf silkgrass), *Opuntia humifusa* (devil's-tongue), and *Diodia teres* (poorjoe). The range of this community is not well known; North Carolina is likely the southern extent. This community is related to maritime grasslands of New England and New York. Further analysis is required to determine the classification, and thus the range, with confidence. Diagnostic species are *Morella pensylvanica* (northern bayberry), *Schizachyrium littorale* (shore little bluestem), *Eupatorium hyssopifolium* (hyssopleaf thoroughwort), and *Eupatorium rotundifolium* (roundleaf thoroughwort).

ENVIRONMENTAL DESCRIPTION

Assateague Island National Seashore Environment: This association occurs on deep well-drained sands of old naturally stabilized interdunes of Assateague Island National Seashore. It also occurs on small "islands" within the salt marsh, where patches of open sand are evident.

Global Environment: This community occurs on deep well-drained sands of old leveled interdunes and backdunes. It usually occurs within the influence of offshore winds and salt spray.

VEGETATION DESCRIPTION

Assateague Island National Seashore Vegetation: Although highly variable in species composition, the typical expression of this association is characterized by a predominance (25-50% cover) of bunch grasses including *Schizachyrium littorale* (shore little bluestem), *Andropogon virginicus* (broomsedge bluestem), *Panicum amarum var. amarulum* (coastal panicgrass), *Aristida tuberculosa* (seaside threeawn), *Ammophila breviligulata* (American beachgrass), *Dichanthelium scoparium* (velvet panicum), and *Dichanthelium acuminatum* (tapered rosette grass). Generally one or two of these species dominate while the others occur as more infrequent, scattered clumps. Occasionally *Spartina patens* (saltmeadow cordgrass) forms the dominant graminoid cover. *Morella pensylvanica* (northern bayberry) is sparse, and stunted *Baccharis halimifolia* (eastern baccharis) and *Diospyros virginiana* (common persimmon) are even less frequent. Dense tangles of *Toxicodendron radicans* (eastern poison-ivy) are very characteristic as they sprawl over the bare ground and sparse vegetation. *Rubus argutus* (sawtooth blackberry) is also scattered throughout. Much of the remaining dry sands are exposed with sparsely distributed herbs. Characteristic herb species include *Cirsium horridulum* (yellow thistle), *Solidago sempervirens* (seaside goldenrod), *Pseudognaphalium obtusifolium* (rabbit-tobacco), *Nuttallanthus canadensis* (Canada toadflax), *Euthamia caroliniana* (slender goldentop), *Oenothera humifusa* (seabeach evening-primrose), and *Diodia teres* (poorjoe), and *Panicum virgatum* (switchgrass). Hudsonia tomentosa is a common dwarf-shrub. Where this vegetation occurs on salt marsh islands, other frequent associates include *Opuntia humifusa* (devil's-tongue), *Ilex opaca* (American holly), *Hypericum gentianoides* (orangegrass), and stunted individuals of *Prunus serotina* (black cherry) and *Juniperus virginiana* (eastern red-cedar).

Global Vegetation: Although highly variable in species composition, the typical expression of this community is characterized by a predominance (25-50% cover) of bunch grasses including *Schizachyrium littorale* (shore little bluestem), *Andropogon virginicus* (broomsedge bluestem), *Panicum amarum* (bitter panicgrass), *Ammophila breviligulata* (American beachgrass), *Dichanthelium scoparium* (velvet panicum) and *Dichanthelium acuminatum* (tapered rosette grass). Generally one or two of these species is dominant while the others occur as more infrequent, scattered clumps. Occasionally *Spartina patens* (saltmeadow cordgrass) forms the dominant graminoid cover. Shrubs of *Morella pensylvanica* (northern bayberry) are sparse and stunted *Baccharis halimifolia* (eastern baccharis), *Prunus maritima* (beach plum), and *Diospyros virginiana* (common persimmon) are even less frequent. Dense tangles of *Toxicodendron radicans* (eastern poison-ivy) are very characteristic of this association as they sprawl over the bare ground and sparse vegetation. *Rubus argutus* (sawtooth blackberry) and *Rhus copallinum* (winged sumac) are also scattered throughout. Much of the remaining dry sands are exposed with sparsely distributed herbs.

Characteristic herb species include *Cirsium horridulum* (yellow thistle), *Solidago sempervirens* (seaside goldenrod), *Pseudognaphalium obtusifolium* (rabbit-tobacco), *Nuttallanthus canadensis* (Canada toadflax), *Euthamia caroliniana* (slender goldentop), *Oenothera humifusa* (seabeach evening-primrose), *Oenothera oakesiana* (Oakes' evening-primrose), *Pityopsis falcata* (sickleleaf silkgrass), *Opuntia humifusa* (devil's-tongue), and *Diodia teres* (poorjoe).

MOST ABUNDANT SPECIES

Assateague Island National Seashore

Stratum	Lifeform	Species
Short shrub/sapling	Broad leaved evergreen shrub	*Morella pensylvanica* (northern bayberry)
Herb (field)	Vine/Liana	*Toxicodendron radicans* (eastern poison ivy)
Herb (field)	Forb	*Eupatorium hyssopifolium* (hyssopleaf thoroughwort), *Eupatorium rotundifolium* (roundleaf thoroughwort), *Solidago sempervirens* (seaside goldenrod)
Herb (field)	Graminoid	*Schizachyrium littorale* (shore little bluestem)

Global

Stratum	Lifeform	Species
Short shrub/sapling	Broad leaved evergreen shrub	*Morella pensylvanica* (northern bayberry)
Herb (field)	Vine/Liana	*Toxicodendron radicans* (eastern poison ivy)
Herb (field)	Forb	*Eupatorium hyssopifolium* (hyssopleaf thoroughwort), *Eupatorium rotundifolium* (roundleaf thoroughwort), *Solidago sempervirens* (seaside goldenrod)
Herb (field)	Graminoid	*Schizachyrium littorale* (shore little bluestem)

CHARACTERISTIC SPECIES

Assateague Island National Seashore: *Eupatorium hyssopifolium* (hyssopleaf thoroughwort), *Eupatorium rotundifolium* (roundleaf thoroughwort), *Morella pensylvanica* (northern bayberry), *Schizachyrium littorale* (shore little bluestem)

Global: *Eupatorium hyssopifolium* (hyssopleaf thoroughwort), *Eupatorium rotundifolium* (roundleaf thoroughwort), *Morella pensylvanica* (northern bayberry), *Schizachyrium littorale* (shore little bluestem)

CONSERVATION STATUS RANK

Global Rank & Reasons: G2 (2-Dec-1998). This grassland community is confined to barrier islands ranging from New Jersey to Virginia. It occurs on dune flats protected from overwash, and is generally small in size with occurrences ranging from less than an acre to approximately 20 acres.

Approximately 100-120 occurrences are thought to occur rangewide, covering a total of less than 1000 acres. The major threats to this community are human development (commercial and residential building), as well as dune stabilization activities.

CLASSIFICATION

Status: Standard

Classification Confidence: 2 - Moderate

Assateague Island National Seashore Comments: The shrub succession community (Hill 1986) and the xeric shrub community (particularly at lower elevations) (Higgins et al. 1971) described from Assateague Island are partially contained within this community. The sandplain grassland (Dunwiddie et al. 1993), the maritime grassland in New York (Reschke 1990), and the *Andropogonetum scoparii* described from Long Island, New York (Blizzard 1931), are similar to this association, but classification will require further work.

Global Similar Associations:

- *(Morella pensylvanica) / Schizachyrium littorale - Aristida tuberculosa* Shrub Herbaceous Vegetation (CEGL006161)
- *Morella pensylvanica / Diodia teres* Shrubland (CEGL003881) is a maritime shrubland with sparse to patchy ground flora and some overlap in species composition.
- *Morella pensylvanica / Schizachyrium littorale - Danthonia spicata* Shrub Herbaceous Vegetation (CEGL006067)

Global Related Concepts:

- *Morella (pensylvanica, cerifera) / Schizachyrium littorale - Eupatorium hyssopifolium* Shrub Herbaceous Vegetation (Harrison 2004) =
- *Morella (pensylvanica, cerifera) / Schizachyrium littorale - Eupatorium hyssopifolium* Shrub Herbaceous Vegetation (TNC 1997a) =
- *Myrica pensylvanica / Schizachyrium scoparium* ssp. *littorale - Eupatorium hyssopifolium* Shrub Herbaceous Vegetation (Bartgis 1986) =
- Maritime Dry Grassland (Northern Bayberry Subtype) (Schafale 2000) **?**
- Maritime Shrubland (Harrison 2004) >
- Shrub succession community (Hill 1986) >
- Xeric shrub community (Higgins et al. 1971) >

OTHER COMMENTS

Other Comments: Small examples of this association occur frequently on raised "islands" within the salt marsh. These islands are a challenge to characterize due to their small size and distinct zonation. This vegetation occurs at the center, on presumably the highest point, and is characterized by patches

of open sand. The vegetation occurs at higher cover in a thin ring separating the island from the surrounding marsh.

ELEMENT DISTRIBUTION

Global Range: This community ranges from New Jersey to Virginia and North Carolina on coastal dunes.

Nations: US

States/Provinces: DE, MD, NC, NJ:S2, VA:S2

TNC Ecoregions: 57:C, 58:C, 62:C

USFS Ecoregions (1994/95): 232Ab:CCC, 232Bz:CCC, 232Ci:CCC

Federal Lands: NPS (Assateague Island); USFWS (Back Bay?, Cape May, E.B. Forsythe)

ELEMENT SOURCES

Assateague Island National Seashore Plots and Observation Points: Plots: ASIS.36 (77AB01), ASIS.37 (77AB03), ASIS.38 (32RR01), ASIS.39 (37RR05), ASIS.40 (TNC4); **Observation Points:** AA102, AA127, AA154, AA174, AA198, AA201, AA211, AA225, AA226, AA321, AA327, AA336, AA491, AA524, AA571, AA589, AA643, AA719, AA724, AA750B, AA770.

Local Description Authors: L.A. Sneddon

Global Description Authors: A. Berdine, mod. S.L. Neid

References: Bartgis 1986, Berdine 1998, Blizzard 1931, Breden et al. 2001, Coxe 2009, Dunwiddie et al. 1993, Eastern Ecology Working Group n.d., Fleming 2001a, Fleming and Patterson 2011a, Fleming et al. 2001, Harrison 2004, Harrison 2011, Higgins et al. 1971, Hill 1986, NatureServe 2009, Reschke 1990, Schafale 2000, Schafale 2011, Sneddon et al. 1996, TNC 1995c, TNC 1997a



Backdune Grassland, AA Point 327, September 30, 2009 (UTM X: 484618, UTM Y: 4222647)

Bayberry Dune Shrubland

***Morella pensylvanica / Diodia teres* Shrubland**

Northern Bayberry / Poorjoe Shrubland

Identifier: CEGL003881

USNVC CLASSIFICATION

Division	Eastern North American Dune & Coastal Grassland & Shrubland (2.B.4.Na)
Macrogroup	Eastern North American Coastal Dune Grassland & Shrubland (M057)
Group	North Atlantic Dune & Coastal Grassland & Shrubland (G493)
Association	Bayberry Shrubland

ELEMENT CONCEPT

Global Summary: This community is a maritime shrubland dominated by *Morella pensylvanica* (northern bayberry), occurring with *Baccharis halimifolia* (eastern baccharis), *Rhus copallinum* (winged sumac), and stunted individuals of *Pinus taeda* (loblolly pine), *Prunus serotina* (black cherry), *Quercus virginiana* (live oak), and *Diospyros virginiana* (common persimmon). The constant movement of sand in this community limits the herbaceous cover. Typical herbaceous species include *Ammophila breviligulata* (American beachgrass), *Panicum amarum var. amarulum* (coastal panicgrass), *Cyperus grayi* (Gray's flatsedge), *Lechea maritima* (beach pinweed), *Dichanthelium acuminatum* (tapered rosette grass), *Spartina patens* (saltmeadow cordgrass), *Triplasis purpurea* (purple sandgrass), *Cenchrus tribuloides* (sanddune sandbur), *Chamaesyce polygonifolia* (seaside sandmat), *Diodia teres* (poorjoe), *Hudsonia tomentosa* (woolly beach-heather), *Oenothera humifusa* (seabeach evening-primrose), *Parthenocissus quinquefolia* (Virginia creeper), *Rumex acetosella* (common sheep sorrel), *Solidago sempervirens* (seaside goldenrod), and *Toxicodendron radicans* (eastern poison-ivy). This maritime shrubland usually occupies the intermediate areas between the very unstable oceanward portions of the dunes and the more protected backdunes, where it forms partially open to dense shrub thickets. The substrate is sand with no soil profile development, and with variable amounts of accumulated leaf litter. Where this community occupies the lee side of foredunes, greater exposure to winds and storms contributes to a shorter stature and more open aspect of the vegetation. Here there are large patches of open unvegetated or sparsely vegetated sand. This community occurs from Delaware south to northern North Carolina.

ENVIRONMENTAL DESCRIPTION

Assateague Island National Seashore Environment: This association occurs on the unstable sands of foredunes and is exposed to winds and salt spray, but is well beyond tidal influence. Storm surges and overwash frequently kill back the shrubs, however, imposing a perpetual long-term disturbance regime. Large expanses of unvegetated sand are characteristic, although the vegetation may be quite patchy and dense in some areas that have remained relatively undisturbed for longer time periods. The substrate is generally deep (greater than 1 m) unconsolidated sands, with the water table usually exceeding this depth. This association occurs on undulating topography at an average elevation of 2.17 m as calculated from lidar-derived data of Brock et al. (2007).

Global Environment: This maritime shrubland community usually occupies the area intermediate between the very unstable oceanward portions of the dunes and the more protected backdunes, where it forms partially open to dense shrub thickets. The substrate is sand with no soil profile development, and with variable amounts of accumulated leaf litter. Where this community occupies the lee side of foredunes, greater exposure to winds and storms contributes to a shorter stature and more open aspect of the vegetation. Here, there are large patches of open unvegetated or sparsely vegetated sand.

VEGETATION DESCRIPTION

Assateague Island National Seashore Vegetation: This association is characterized by sparse (generally less than 50%) cover of low or stunted *Morella pensylvanica* (northern bayberry). The low growth form (less than 1.5 m) of *Morella pensylvanica* (northern bayberry) is partially the result of sand burial, sometimes almost covering individual shrubs. *Morella pensylvanica* (northern bayberry), *Solidago sempervirens* (seaside goldenrod), and *Ammophila breviligulata* (American beachgrass) are the most characteristic species of this vegetation. Much less frequent are individuals of *Baccharis halimifolia* (eastern baccharis), *Diospyros virginiana* (common persimmon), and *Morella cerifera* (wax-myrtle). *Prunus maritima* (beach plum) occurs sparingly, as Assateague Island is the southern range limit of this species, but it can be found in very local patches or as individuals within this foredune community as a shrub or small tree in growth form. The constant movement of sand in this community also limits the herbaceous cover. Species suited to these shifting sands include sparse *Hudsonia tomentosa* (woolly beach-heather) with *Solidago sempervirens* (seaside goldenrod) and *Ammophila breviligulata* (American beachgrass). Other herbaceous species characteristic but sparsely distributed in this community include *Diodia teres* (poorjoe), *Panicum amarum var. amarulum* (coastal panicgrass), *Triplasis purpurea* (purple sandgrass), *Toxicodendron radicans* (eastern poison-ivy), *Chamaesyce polygonifolia* (seaside sandmat), *Cenchrus tribuloides* (sanddune sandbur), *Oenothera humifusa* (seabeach evening-primrose), *Parthenocissus quinquefolia* (Virginia creeper), *Spergularia salina* (salt sandspurry), *Lechea maritima* (beach pinweed), *Dichanthelium acuminatum* (tapered rosette grass), and *Rumex acetosella* (common sheep sorrel) This association also occurs on the northern tip of Assateague Island on artificial habitat created by dredge spoil deposition; here the vegetation is less typical and supports a number of exotic species in addition to those previously mentioned, including *Bromus tectorum* (cheatgrass), *Vulpia myuros* (rat-tail fescue), *Lepidium* (pepperweed) spp., and *Trifolium arvense* (rabbitfoot clover). Total shrub cover is also greater here than in most other occurrences of the more natural manifestation of this association.

Global Vegetation: This community is a maritime shrubland dominated by *Morella pensylvanica* (northern bayberry), occurring with *Baccharis halimifolia* (eastern baccharis), *Rhus copallinum* (winged sumac), and stunted individuals of *Pinus taeda* (loblolly pine). *Prunus maritima* (beach plum) is more characteristic of this community from Delaware northward. The constant movement of sand in this community limits the herbaceous cover. Typical herbaceous species include *Ammophila breviligulata* (American beachgrass), *Panicum amarum var. amarulum* (coastal panicgrass), *Cyperus grayi* (Gray's flatsedge), *Dichanthelium acuminatum* (tapered rosette grass), *Spartina patens* (saltmeadow cordgrass), *Triplasis purpurea* (purple sandgrass), *Cenchrus tribuloides* (sanddune sandbur), *Chamaesyce polygonifolia* (seaside sandmat), *Diodia teres* (poorjoe), *Hudsonia tomentosa*

(woolly beach-heather), *Lechea maritima* (beach pinweed), *Oenothera humifusa* (seabeach evening-primrose), *Cakile edentula* (American searocket), *Parthenocissus quinquefolia* (Virginia creeper), *Rumex acetosella* (common sheep sorrel), *Solidago sempervirens* (seaside goldenrod), and *Toxicodendron radicans* (eastern poison-ivy).

MOST ABUNDANT SPECIES

Assateague Island National Seashore

Stratum	Lifeform	Species
Short shrub/sapling	Broad leaved evergreen shrub	*Morella cerifera* (wax myrtle), *Morella pensylvanica* (northern bayberry)
Herb (field)	Forb	*Oenothera humifusa* (seabeach evening primrose), *Solidago sempervirens* (seaside goldenrod)
Herb (field)	Graminoid	*Ammophila breviligulata* (American beachgrass), *Triplasis purpurea* (purple sandgrass)

Global

Stratum	Lifeform	Species
Short shrub/sapling	Broad leaved evergreen shrub	*Morella cerifera* (wax myrtle), *Morella pensylvanica* (northern bayberry)
Herb (field)	Forb	*Diodia teres* (poorjoe), *Solidago sempervirens* (seaside goldenrod)
Herb (field)	Graminoid	*Ammophila breviligulata* (American beachgrass)

CHARACTERISTIC SPECIES

Assateague Island National Seashore: *Diodia teres* (poorjoe), *Morella pensylvanica* (northern bayberry)

Global: *Diodia teres* (poorjoe), *Morella pensylvanica* (northern bayberry)

CONSERVATION STATUS RANK

Global Rank & Reasons: G2 (28-Jan-1999). This maritime shrubland community is restricted to large coastal dune systems from Delaware to Nag's Head, North Carolina. The community is confined to primary dunes subjected to wind and salt spray; these dynamic forces cause natural decimation of some occurrences while building habitat for other new occurrences. For this reason, the community depends on the existence of large expanses of habitat to support the naturally shifting mosaic. As a maritime community, it is faced with many threats common to all maritime systems: dune stabilization, commercial and residential development, road expansion. Approximately 50 occurrences covering 1200-1500 acres is estimated rangewide.

CLASSIFICATION

Status: Standard

Classification Confidence: 2 - Moderate

Global Comments: This community is a maritime shrubland dominated by *Morella pensylvanica* (northern bayberry). It supports the following species characteristic of the *Morella pensylvanica - (Prunus maritima)* Shrubland Alliance (A.902), including *Solidago sempervirens* (seaside goldenrod), *Oenothera humifusa* (seabeach evening-primrose), *Cyperus grayi* (Gray's flatsedge), *Ammophila breviligulata* (American beachgrass), *Chamaesyce polygonifolia* (seaside sandmat), *Rhus copallinum* (winged sumac), and from Maryland and north, *Prunus maritima* (beach plum). This association is further characterized by species that differentiate it from other communities in the alliance, most notably *Morella cerifera* (wax-myrtle), *Panicum amarum* (bitter panicgrass), *Spartina patens* (saltmeadow cordgrass), *Baccharis halimifolia* (eastern baccharis), and stunted individuals of *Pinus taeda* (loblolly pine). *Morella pensylvanica - Prunus maritima* Shrubland (CEGL006295) is the northern analog of this association.

Global Similar Associations:

- *Morella (pensylvanica, cerifera) / Schizachyrium littorale - Eupatorium hyssopifolium* Shrub Herbaceous Vegetation (CEGL004240) is a maritime grassland with scattered shrubs and some overlap in species composition.
- *Morella pensylvanica - Prunus maritima* Shrubland (CEGL006295)
- *Morella pensylvanica / Panicum virgatum* Shrubland (CEGL006457)

Global Related Concepts:

- *Morella pensylvanica / Diodia teres* Shrubland (Harrison 2004) =
- *Morella pensylvanica / Diodia teres* Shrubland (TNC 1997a) =
- *Myrica pensylvanica - (Prunus maritima)* Shrubland (Clancy 1996) =
- *Myrica pensylvanica / Diodia teres* Shrubland (Bartgis 1986) ?
- *Prunus maritima, Myrica pensylvanica* coastal dune scrub association (Clancy 1993a) =
- Dunegrass-shrub transition zone (Higgins et al. 1971) =
- Maritime Dune Scrub (Fleming et al. 2001) >
- Maritime Shrub (Schafale and Weakley 1990) >
- Maritime Shrub (Northern Subtype) (Schafale 2003b) =
- Maritime Shrubland (Harrison 2004) >
- Shrub succession community (Hill 1986) >
- Upland (dune) thicket (Klotz 1986) >

OTHER COMMENTS

Other Comments: The *Prunus maritima - Myrica pensylvanica* coastal dune scrub association described from Delaware (Clancy 1993b) and the dunegrass-shrub transition zone of Assateague Island described by Higgins et al. (1971) are synonymous with this community. The shrub succession community (Hill 1986) and the dunegrass-shrub transition zone (Higgins et al. 1971) described from Assateague Island, and the upland (dune) thicket described from Virginia (Klotz 1986) are partially contained within this community.

ELEMENT DISTRIBUTION

Assateague Island National Seashore Range: This association commonly occurs most frequently on the southern portion of the island beyond the limits of the artificially created and maintained foredune planted with *Ammophila breviligulata* (American beachgrass). This association occurs on or just behind the primary dune, in a linear fashion, along the length of the park with the exception of a small portion of the north end. This community also occurs on the northern tip of the island on artificial habitat created by dredge spoil deposition; here the vegetation is less typical and supports a number of exotic species.

Global Range: This association is restricted to backdunes of shorelines from Delaware to Nag's Head, North Carolina.

Nations: US

States/Provinces: DE:S2S3, MD, NC, VA:S2?

TNC Ecoregions: 57:C, 58:C, 62:C

USFS Ecoregions (1994/95): 232Ab:CPP, 232Ac:CPP, 232Bz:CCC, 232Ch:CCP, 232Ci:CCC

Federal Lands: NPS (Assateague Island); USFWS (Back Bay?, Currituck)

ELEMENT SOURCES

Assateague Island National Seashore Plots and Observation Points: Plots: ASIS.12 (57AB08), ASIS.13 (47AB06), ASIS.14 (52AB06), ASIS.15 (32CEF01), ASIS.16 (77AB05), ASIS.17 (22RR01), ASIS.18 (12RR04), ASIS.19 (12RR02), ASIS.20 (12RR03); **Observation Points:** AA001, AA002A, AA002B, AA004, AA011, AA016, AA025, AA028, AA079, AA120, AA130, AA207, AA268, AA304, AA341, AA523, AA527, AA534, AA542, AA550, AA557, AA588, AA612, AA644, AA723, AA743, AA753, AA761.

Local Description Authors: A. Berdine and L.A. Sneddon

Global Description Authors: L.A. Sneddon

References: Bartgis 1986, Berdine 1998, Bowman 2000, Brock et al. 2007, Clancy 1993a, Clancy 1993b, Clancy 1996, Coxe 2009, Eastern Ecology Working Group n.d., Fleming 2001a, Fleming and Patterson 2011a, Fleming et al. 2001, Harrison 2004, Harrison 2011, Higgins et al. 1971, Hill 1986,

Klotz 1986, Schafale 2003b, Schafale 2011, Schafale and Weakley 1990, Sneddon et al. 1996, TNC 1995c, TNC 1997a



Bayberry Dune Shrubland, AA Point 11, August 13, 2009 (UTM X: 491005, UTM Y: 4240835)

Vine Dune

***Smilax glauca* - *Toxicodendron radicans* Vine-Shrubland**
Cat Greenbrier - Eastern Poison-ivy Vine-Shrubland
Identifier: CEGL003886

USNVC CLASSIFICATION

Division	Eastern North American Dune & Coastal Grassland & Shrubland (2.B.4.Na)
Macrogroup	Eastern North American Coastal Dune Grassland & Shrubland (M057)
Group	North Atlantic Dune & Coastal Grassland & Shrubland (G493)
Association	Vine Dune

ELEMENT CONCEPT

Global 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 beach-heather). 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.

ENVIRONMENTAL DESCRIPTION

Assateague Island National Seashore Environment: Generally confined to barrier beach systems, this vegetation is comprised of dense vines that cover the crests of dunes that are exposed to salt spray and winds. Very little soil development occurs and the water table is considerably deeper than 1 m. The average elevation of this association is 0.92 m as calculated from lidar-derived data of Brock et al. (2007).

Global Environment: 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

Assateague Island National Seashore Vegetation: Vegetation characteristic of this community is dominated by dense vines (up to 70% cover), primarily *Smilax glauca* (cat greenbrier). Usually present, but providing much less cover, are other vines including *Vitis rotundifolia* (muscadine), *Toxicodendron radicans* (eastern poison-ivy), *Smilax rotundifolia* (roundleaf greenbrier), and *Parthenocissus quinquefolia* (Virginia creeper). Associated herbs are sparse and may include scattered individuals of *Nuttallanthus canadensis* (Canada toadflax), *Lechea maritima* (beach pinweed), *Rumex acetosella* (common sheep sorrel), *Schizachyrium littorale* (shore little bluestem), and *Solidago sempervirens* (seaside goldenrod). Shrub species constitute very little cover and are much less common, but occasional *Rubus argutus* (sawtooth blackberry), *Rubus flagellaris* (northern dewberry), *Hudsonia tomentosa* (woolly beach-heather), *Morella pensylvanica* (northern bayberry), and *Morella cerifera* (wax-myrtle) can be found. Overall, vegetation is low to the ground (less than half a meter tall) and generally covers 70 to 80% of the community, with exposed sand remaining.

Global Vegetation: 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 beach-heather). 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

Assateague Island National Seashore

Stratum	Lifeform	Species
Shrub/sapling (tall & short)	Vine/Liana	*Parthenocissus quinquefolia* (Virginia creeper), *Smilax glauca* (cat greenbrier), Smilax *rotundifolia* (roundleaf greenbrier), *Vitis rotundifolia* (muscadine)

Global

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

CHARACTERISTIC SPECIES

Assateague Island National Seashore: *Parthenocissus quinquefolia* (Virginia creeper), *Smilax glauca* (cat greenbrier), *Smilax rotundifolia* (roundleaf greenbrier), *Toxicodendron radicans* (eastern poison-ivy)

Global: *Parthenocissus quinquefolia* (Virginia creeper), *Smilax glauca* (cat greenbrier), *Smilax rotundifolia* (roundleaf greenbrier), *Toxicodendron radicans* (eastern poison-ivy)

OTHER NOTEWORTHY SPECIES

Global: Invasive/Exotic: *Celastrus orbiculata* (Asian bittersweet, invasive/exotic, High/Medium), *Lonicera japonica* (Japanese honeysuckle, invasive/exotic, High/Medium)

CONSERVATION STATUS RANK

Global Rank & Reasons: G1G2 (18-Jan-2006). 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

Status: Standard

Classification Confidence: 2 - Moderate

Global Similar Associations:

- *Smilax auriculata - Toxicodendron radicans* Vine-Shrubland (CEGL003885) is the southern analog of this association.

Global Related Concepts:

- *Smilax glauca - Toxicodendron radicans* Vine-Shrubland (Harrison 2004) =
- *Smilax glauca - Toxicodendron radicans* Vine-Shrubland (Bowman 2000) =
- Coastal dune community (Rawinski 1984a) **?**
- Greenbrier thicket (Martin 1959b) <
- Maritime Shrubland (Harrison 2004) >

OTHER COMMENTS

Other Comments: Neither Hill (1986) nor Higgins et al. (1971) describe this community per se on Assateague Island.

ELEMENT DISTRIBUTION

Assateague Island National Seashore Range: This association occurs sparingly in the park; it is restricted to areas where dunes are well-developed. Largest occurrences are on the dunes in the Fox Hills area.

Global Range: This type is likely to occur in New England south to Maryland.

Nations: US

States/Provinces: DE, MA, MD:S1, NJ, NY

TNC Ecoregions: 58:C, 62:C

USFS Ecoregions (1994/95): 221Ab:CCC, 232Aa:CCC, 232Ab:CCC, 232Ac:CCC, 232Bt:CCP, 232Bz:CCC

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

ELEMENT SOURCES

Assateague Island National Seashore Plots and Observation Points: Plots: ASIS.32 (57AB07), ASIS.33 (57AB06), ASIS.34 (57AB05), ASIS.35 (42RR02); **Observation Points:** AA708.

Local Description Authors: L.A. Sneddon and A. Berdine

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

References: Berdine 1998, Bowman 2000, Brock et al. 2007, Coxe 2009, Dowhan and Rozsa 1989, Eastern Ecology Working Group n.d., Edinger et al. 2002, Edinger et al. 2008a, Harrison 2004, Harrison 2011, Harrison and Stango 2003, Higgins et al. 1971, Hill 1986, Klopfer et al. 2002, Martin 1959b, NRCS 2001b, Rawinski 1984a, Reschke 1990, Sneddon and Lundgren 2001, Sneddon et al. 2010, Swain and Kearsley 2001, TNC 1995c, Walz et al. 2008



Vine Dune, AA Point 708, October 7, 2009 (UTM X: 480287, UTM Y: 4211991)

Overwash Dune Grassland

***Spartina patens - Schoenoplectus pungens - Solidago sempervirens* Herbaceous Vegetation**
Saltmeadow Cordgrass - Common Threesquare - Seaside Goldenrod Herbaceous Vegetation
Identifier: CEGL004097

USNVC CLASSIFICATION

Division	Eastern North American Dune & Coastal Grassland & Shrubland (2.B.4.Na)
Macrogroup	Eastern North American Coastal Dune Grassland & Shrubland (M057)
Group	North Atlantic Dune & Coastal Grassland & Shrubland (G493)
Association	Overwash Dune Grassland

ELEMENT CONCEPT

Global 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* (rabbit-tobacco), 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* (sea-oats) 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

Assateague Island National Seashore Environment: Storm overwash is a prevalent natural disturbance to this association. It occurs in areas of overwash and in the interdunes behind foredune "blowouts" created after large storm events. In many cases, it is likely that storm overwash buried an interdunal wetland where *Schoenoplectus pungens* (common threesquare) is prevalent. In these areas, dark organic soils of a buried wetland are seen approximately 10 to 20 cm below the sandy surface of this vegetation. In other areas, the water table is deeper below deep sands.

Global Environment: 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 (sea-oats), which are primarily impacted by wind-deposited sand. Storm overwash is a prevalent natural disturbance to this community.

VEGETATION DESCRIPTION

Assateague Island National Seashore Vegetation: This association is characterized by *Spartina patens* (saltmeadow cordgrass). *Schoenoplectus pungens* (common threesquare), often stunted, may occur where storm overwash recently covered an interdunal wetland. The two species can grow separately or together; separately they tend to be more sparse in their total cover than in areas where they occur together. Very few other species occur in this association and constitute little additional ground cover. These may include scattered individuals of *Solidago sempervirens* (seaside goldenrod), *Ammophila breviligulata* (American beachgrass), *Cenchrus tribuloides* (sanddune sandbur), *Triplasis purpurea* (purple sandgrass), and *Cakile edentula* (American searocket).

Global Vegetation: *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* (rabbit-tobacco), and occasional scattered individuals of *Toxicodendron radicans* (eastern poison-ivy) and seedlings of *Baccharis halimifolia* (eastern baccharis). *Ammophila breviligulata* (American beachgrass) or *Uniola paniculata* (sea-oats) 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* (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

Assateague Island National Seashore

Stratum	Lifeform	Species
Herb (field)	Graminoid	*Schoenoplectus pungens* (common threesquare), *Spartina patens var. monogyna* (saltmeadow cordgrass)

Global

Stratum	Lifeform	Species
Herb (field)	Forb	*Solidago sempervirens* (seaside goldenrod)
Herb (field)	Graminoid	*Schoenoplectus pungens* (common threesquare), *Spartina patens* (saltmeadow cordgrass)

CHARACTERISTIC SPECIES

Assateague Island National Seashore: *Schoenoplectus pungens* (common threesquare), *Spartina patens* var. *monogyna* (saltmeadow cordgrass)

Global: *Schoenoplectus pungens* (common threesquare), *Solidago sempervirens* (seaside goldenrod), *Spartina patens* (saltmeadow cordgrass)

OTHER NOTEWORTHY SPECIES

Global: Invasive/Exotic: *Bassia hirsuta* (hairy smotherweed, invasive/exotic)

CONSERVATION STATUS RANK

Global Rank & Reasons: G2G3 (4-Nov-1998). 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

Status: Standard

Classification Confidence: 2 - Moderate

Global Comments: This community differs ecologically from dune grasslands dominated by *Ammophila breviligulata* (American beachgrass) or *Uniola paniculata* (sea-oats), 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.

Global Similar Associations:

- *Spartina patens - Eleocharis parvula* Herbaceous Vegetation (CEGL006342)
- *Spartina patens - Schizachyrium maritimum - Solidago sempervirens* Herbaceous Vegetation (CEGL008445)

Global Related Concepts:

- *Spartina patens - Schoenoplectus pungens - Solidago sempervirens* Herbaceous Vegetation (Harrison 2004) =
- *Spartina patens - Schoenoplectus pungens - Solidago sempervirens* Herbaceous Vegetation (Bowman 2000) =
- *Spartina patens - Schoenoplectus pungens - Solidago sempervirens* Herbaceous Vegetation (TNC 1997a) =
- Dry community of barrier flats (Travis and Godfrey 1976) >
- Dry maritime grassland (Lea 2002b) **?**
- Grassland community (Baumann 1978b) =
- Low dune community (Boule 1979) =
- Maritime Dry Grassland (Schafale and Weakley 1990) **?**
- Maritime Dry Grassland (Typic Subtype) (Schafale 2000) **?**
- Maritime Dune Grassland (Fleming et al. 2001) >
- Maritime Dune Grassland (Harrison 2004) >
- Secondary dunes (Klotz 1986) >
- Wash (Hill 1986) =
- Wash (Higgins et al. 1971) =

ELEMENT DISTRIBUTION

Assateague Island National Seashore Range: This vegetation is best developed in areas where no artificial dunes have been built. It occurs in flats behind the primary dune, and, on the northern end of the island, on the bayside where overwash has affected the full width of the island.

Global Range: This community is an upland dune grassland or overwash area of Atlantic barrier islands from Massachusetts to North Carolina.

Nations: US

States/Provinces: DE:S2S3, MA, MD, NC, NJ:S1S2, NY, VA:S2

TNC Ecoregions: 57:C, 58:C, 62:C

USFS Ecoregions (1994/95): 221Ab:CCC, 232Aa:CCC, 232Ab:CCC, 232Ac:CCC, 232Bz:CCC, 232Ch:CCC, 232Ci:CCC

Federal Lands: NPS (Assateague Island, Boston Harbor Islands, Cape Hatteras, Cape Lookout, Fire Island, Gateway, Sagamore Hill); USFWS (Back Bay?, Cape Romain, Cedar Island, E.B. Forsythe, Monomoy, Prime Hook)

ELEMENT SOURCES

Assateague Island National Seashore Plots and Observation Points: Plots: ASIS.55 (27RR01), ASIS.56 (TNC15), ASIS.57 (TNC17), ASIS.58 (22RR03), ASIS.113 (77AB06); **Observation Points:** AA030, AA037, AA045, AA065, AA072B, AA075, AA119, AA194, AA205, AA311, AA322, AA545, AA722, AA726.

Local Description Authors: L.A. Sneddon

Global Description Authors: L.A. Sneddon

References: Baumann 1978b, Berdine 1998, Boule 1979, Bowman 2000, Breden et al. 2001, Coxe 2009, Eastern Ecology Working Group n.d., Edinger et al. 2002, Edinger et al. 2008a, Edinger et al. 2008b, Fleming and Patterson 2011a, Fleming et al. 2001, Harrison 2004, Harrison 2011, Harrison and Stango 2003, Higgins et al. 1971, Hill 1986, Klopfer et al. 2002, Klotz 1986, Largay and Sneddon 2010, Lea 2002b, NRCS 2001b, NatureServe 2009, Reschke 1990, Schafale 2000, Schafale 2003b, Schafale 2011, Schafale and Weakley 1990, TNC 1995c, TNC 1997a, Travis and Godfrey 1976, Zaremba and Leatherman 1984



Overwash Dune Grassland, AA Point 545, October 3, 2009 (UTM X: 482996, UTM Y: 4216896)

2.B.6. Temperate & Boreal Freshwater Marsh, Wet Meadow & Shrubland

2.B.6.Na. Eastern North American Freshwater Wet Meadow, Riparian & Marsh

M067. Atlantic & Gulf Coastal Plain Pondshore & Wet Meadow

G111. Atlantic & Gulf Coastal Plain Pondshore & Wet Prairie

Interdunal Swale

***Schoenoplectus pungens - Fimbristylis (castanea, caroliniana)* Herbaceous Vegetation**
Common Threesquare - (Marsh Fimbry, Carolina Fimbry) Herbaceous Vegetation
Identifier: CEGL004117

USNVC CLASSIFICATION

Division	Eastern North American Freshwater Wet Meadow, Riparian & Marsh (2.B.6.Na)
Macrogroup	Atlantic & Gulf Coastal Plain Pondshore & Wet Meadow (M067)
Group	Atlantic & Gulf Coastal Plain Pondshore & Wet Prairie (G111)
Association	Interdunal Swale

ELEMENT CONCEPT

Global Summary: This interdunal swale community of the Atlantic coast (Chesapeake and Delaware drainages) is characterized by dense cover of *Schoenoplectus pungens* (common threesquare) in association with *Spartina patens* (saltmeadow cordgrass) and *Fimbristylis castanea* (marsh fimbry). There is usually standing water present in these swales in the spring, when *Schoenoplectus pungens* (common threesquare) is generally dominant with few other associates except species of *Eleocharis* (spikerush). By late summer a number of other species such as *Fimbristylis castanea* (marsh fimbry) and *Sabatia stellaris* (rose of Plymouth) contribute more substantial cover. Other herbs contribute very little to the overall vegetative cover. These associated species include *Andropogon virginicus* (broomsedge bluestem), *Eleocharis rostellata* (beaked spikerush), *Phragmites australis* (common reed), *Pluchea foetida* (stinking camphorweed), *Juncus scirpoides* (needlepod rush), *Hydrocotyle umbellata* (manyflower marshpennywort), *Eleocharis parvula* (dwarf spikerush), *Panicum amarum* (bitter panicgrass), *Fimbristylis autumnalis* (slender fimbry), *Sabatia stellaris* (rose of Plymouth), *Ptilimnium capillaceum* (herbwilliam), *Fuirena pumila* (dwarf umbrella-sedge), and *Juncus canadensis* (Canadian rush). Diagnostic species are *Schoenoplectus pungens* (common threesquare) and *Fimbristylis castanea* (marsh fimbry). Related vegetation of the Atlantic coast from North Carolina southward is accommodated under *Fimbristylis castanea - Schoenoplectus pungens* Seasonally Flooded Herbaceous Vegetation (CEGL003790).

ENVIRONMENTAL DESCRIPTION

Assateague Island National Seashore Environment: This association occurs in interdunal wet swales, as well as in artificial habitats such as ORV tracks that intersect the shallow water table. Vegetation is emergent in 0 to 15 cm of freshwater during the early- and mid-growing seasons. The unvegetated surface is generally water or bare soil in some cases. During the drier summer season, standing water disappears, but soils may remain somewhat saturated. Soils consist of shallow peat

averaging 5 cm in depth over dark mottled gray sand. Average elevation of this association is 1.23 m, as calculated from lidar-derived data of Brock et al. (2007).

Global Environment: This association is characterized by seasonally wet maritime interdunal depressions, commonly known as "interdunal swales." There is usually standing water present in these swales in the spring. The *Eleocharis* (spikerush) spp. - *Schoenoplectus pungens* (common threesquare) variant of this association occurs in similar habitat but tends to be flooded for a longer period of the year. Although this association occurs in swales, it occurs in association with the highest dunes on the island and so has a higher relative elevation than any other island wetlands. Average elevation of this association at Assateague Island National Seashore is 1.23 m, as calculated from lidar-derived data of Brock et al. (2007).

VEGETATION DESCRIPTION

Assateague Island National Seashore Vegetation: The general aspect and species composition of this community are variable, not only among occurrences, but also over the course of the growing season. At Assateague Island National Seashore, this community is typically characterized by dense *Schoenoplectus pungens* (common threesquare) (up to 80% cover). When *Schoenoplectus pungens* (common threesquare) is not as dense, it is most often associated with an even mixture of *Spartina patens* (saltmeadow cordgrass) or *Fimbristylis castanea* (marsh fimbry). In spring, *Schoenoplectus pungens* (common threesquare) is generally dominant with few other associates except *Eleocharis* (spikerush) spp., imparting a distinct aerial photo signature. By late summer a number of other species such as *Fimbristylis castanea* (marsh fimbry) and *Sabatia stellaris* (rose of Plymouth) contribute more substantial cover. Other herbs are sparse and provide very little to the overall vegetation cover. These associated species include *Eleocharis rostellata* (beaked spikerush), *Phragmites australis* (common reed), *Pluchea foetida* (stinking camphorweed), *Juncus scirpoides* (needlepod rush), *Hydrocotyle umbellata* (manyflower marshpennywort), *Eleocharis parvula* (dwarf spikerush), *Fimbristylis autumnalis* (slender fimbry), *Panicum amarum var. amarulum* (coastal panicgrass), *Fimbristylis autumnalis*, *Sabatia stellaris* (rose of Plymouth), *Ptilimnium capillaceum* (herbwilliam), and *Juncus canadensis* (Canadian rush). In some drier swales adjacent to the maintained dune on the central portion of Assateague Island National Seashore, *Ammophila breviligulata* (American beachgrass) is present in quantity.

Global Vegetation: This association is characterized by dense cover of *Schoenoplectus pungens* (common threesquare) in association with *Spartina patens* (saltmeadow cordgrass) and *Fimbristylis castanea* (marsh fimbry). In early spring, *Schoenoplectus pungens* (common threesquare) is usually dominant, with few other associates visible. By later summer as the water table drops, additional species emerge, including abundant *Fimbristylis castanea* (marsh fimbry) and *Sabatia stellaris* (rose of Plymouth). Cover and composition of associated species are variable but in aggregate include *Andropogon virginicus* (broomsedge bluestem), *Eleocharis rostellata* (beaked spikerush), *Phragmites australis* (common reed), *Pluchea foetida* (stinking camphorweed), *Juncus scirpoides* (needlepod rush), *Hydrocotyle umbellata* (manyflower marshpennywort), *Eleocharis parvula* (dwarf spikerush), *Panicum amarum* (bitter panicgrass), *Fimbristylis autumnalis* (slender fimbry), *Sabatia*

stellaris (rose of Plymouth), *Ptilimnium capillaceum* (herbwilliam), *Fuirena pumila* (dwarf umbrella-sedge), and *Juncus canadensis* (Canadian rush).

MOST ABUNDANT SPECIES

Assateague Island National Seashore

Stratum	Lifeform	Species
Herb (field)	Graminoid	*Eleocharis palustris* (common spikerush), *Fimbristylis autumnalis* (slender fimbry), *Fimbristylis castanea* (marsh fimbry), *Schoenoplectus pungens* (common threesquare)

Global

Stratum	Lifeform	Species
Herb (field)	Graminoid	*Andropogon virginicus* (broomsedge bluestem), *Fimbristylis castanea* (marsh fimbry), *Schoenoplectus pungens* (common threesquare), *Spartina patens* (saltmeadow cordgrass)

CHARACTERISTIC SPECIES

Assateague Island National Seashore: *Fimbristylis castanea* (marsh fimbry), *Schoenoplectus pungens* (common threesquare)

Global: *Fimbristylis castanea* (marsh fimbry), *Schoenoplectus pungens* (common threesquare)

CONSERVATION STATUS RANK

Global Rank & Reasons: G1G2 (19-Jan-2006). This small-patch community is limited to coastal dunes of Maryland and Virginia. There are likely fewer than 100 occurrences.

CLASSIFICATION

Status: Standard

Classification Confidence: 2 - Moderate

Assateague Island National Seashore Comments: The fresh marsh community described by Hill (1986) and Higgins et al. (1971) from Assateague Island are partially contained within this community.

Global Comments: This association is similar to *Juncus (dichotomus, scirpoides) - Drosera intermedia* Herbaceous Vegetation (CEGL004111) in environment, but lacks *Xyris* (yelloweyed grass) spp., *Pogonia* spp., and *Lycopodiella appressa* (southern bog clubmoss). It may represent a

successional phase or be slightly more brackish. Subsequent vegetation classification and mapping of adjoining Chincoteague National Wildlife Refuge noted the presence of a variant occurring in shallow interdunal ponds. This variant, referred to as the *Eleocharis* (spikerush) spp. - *Schoenoplectus pungens* (common threesquare) variant, differs from the typic association in its absence of *Fimbristylis* (fimbry) spp., lower diversity, and dominance of *Eleocharis albida* (white spikerush) and/or *Eleocharis quadrangulata* (squarestem spikerush) and *Schoenoplectus pungens* (common threesquare). Associated species include *Panicum rigidulum* (redtop panicgrass), *Panicum virgatum* (switchgrass), *Proserpinaca palustris* (marsh mermaidweed), and others.

Global Similar Associations:

- *Fimbristylis castanea - Schoenoplectus pungens* Seasonally Flooded Herbaceous Vegetation (CEGL003790) more southern type.
- *Juncus (dichotomus, scirpoides) - Drosera intermedia* Herbaceous Vegetation (CEGL004111)

Global Related Concepts:

- *Fimbristylis (castanea, caroliniana) - Scirpus pungens* Herbaceous Vegetation (Berdine 1998) =
- *Juncus scirpoides-Scirpus pungens* interdunal wetland association (McAvoy and Clancy 1994) **?**
- *Schoenoplectus pungens - Fimbristylis (castanea, caroliniana)* Herbaceous Vegetation (Harrison 2004) =
- *Scirpus-Hydrocotyle* community (Tyndall and Levy 1978) **?**
- *Spartina-Scirpus* community (Tyndall and Levy 1978) **?**
- Fresh marsh community (Higgins et al. 1971) >
- Fresh marsh community (Hill 1986) >
- Interdunal Swale (Harrison 2004) >
- Maritime Wet Grassland (Fleming et al. 2001) >
- Maritime Wet Grassland (Threesquare Subtype) (Schafale 2000) **?**
- Wet community of barrier flats (Travis and Godfrey 1976) **?**

ELEMENT DISTRIBUTION

Assateague Island National Seashore Range: Except for a few small patches, this association occurs discontinuously along the length of the island south of the Route 611 bridge.

Global Range: This association is currently described from Maryland and Virginia.

Nations: US

States/Provinces: MD:S1, VA:S1?

TNC Ecoregions: 57:?, 58:C

USFS Ecoregions (1994/95): 232Bz:CCC, 232Ci:CC?

Federal Lands: NPS (Assateague Island); USFWS (Back Bay?)

ELEMENT SOURCES

Assateague Island National Seashore Plots and Observation Points: Plots: ASIS.1 (47AB04), ASIS.2 (37RR04), ASIS.3 (TNC12), ASIS.4 (TNC18); **Observation Points:** AA061, AA448, AA555, AA583.

Local Description Authors: L.A. Sneddon and A. Berdine

Global Description Authors: L.A. Sneddon and A. Berdine

References: Berdine 1998, Brock et al. 2007, Eastern Ecology Working Group n.d., Fleming and Patterson 2011a, Fleming et al. 2001, Harrison 2004, Harrison 2011, Higgins et al. 1971, Hill 1986, McAvoy and Clancy 1994, Peet et al. unpubl. data, Schafale 2000, Sneddon et al. 1996, TNC 1995c, TNC 1997a, Travis and Godfrey 1976, Tyndall and Levy 1978



Interdunal Swale, AA Point 627, October 5, 2009 (UTM X: 481979, UTM Y: 4215102)

Phragmites Wetland

***Phragmites australis* Eastern North America Temperate Semi-natural Herbaceous Vegetation**
Common Reed Eastern North America Temperate Semi-natural Herbaceous Vegetation
Identifier: CEGL004141

USNVC CLASSIFICATION

Division	Eastern North American Freshwater Wet Meadow, Riparian & Marsh (2.B.6.Na)
Macrogroup	Eastern North American Semi-natural Wet Meadow & Marsh (M303)
Group	Northern & Central Semi-natural Wet Meadow & Marsh (G556)
Association	Eastern Reed Marsh

ELEMENT CONCEPT

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

ENVIRONMENTAL DESCRIPTION

Assateague Island National Seashore Environment: This community is a dense tall grassland indicative of disturbance. The soil profile is characterized by a shallow organic layer overlying sand. This association occurs almost exclusively in association with Wax-myrtle Shrub Swamp (CEGL003840). Average elevation of this association is 0.82 m as calculated from lidar-derived data of Brock et al. (2007).

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

VEGETATION DESCRIPTION

Assateague Island National Seashore Vegetation: Spreading in large colonies, *Phragmites australis* (common reed) eventually dominates disturbed areas at up to 100% cover. 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* (small-spike 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. Three accuracy assessment points were located in areas that had been treated by aerial spray or burning, resulting in unusual

expressions. One point was characterized by short (20 cm) dense culms of *Phragmites australis* (common reed).

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

MOST ABUNDANT SPECIES

Assateague Island National Seashore

Stratum	Lifeform	Species
Herb (field)	Vine/Liana	*Mikania scandens* (climbing hempvine)
Herb (field)	Graminoid	*Phragmites australis* (common reed)

Global

Stratum	Lifeform	Species
Herb (field)	Graminoid	*Phragmites australis* (common reed)

CHARACTERISTIC SPECIES

Assateague Island National Seashore: *Phragmites australis* (common reed)

Global: *Phragmites australis* (common reed)

CONSERVATION STATUS RANK

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

CLASSIFICATION

Status: Standard

Classification Confidence: 1 - Strong

Assateague Island National Seashore Comments: There are likely small portions of *Phragmites australis* (common reed)-dominated vegetation classified as this type that may be tidally influenced. However, due to their minor contribution, they have not been classified or mapped separately on Assateague Island National Seashore.

Global Comments: This is not a native community but is the result of the invasion of alien *Phragmites australis* (common reed) into natural or semi-natural vegetation. The vegetation has variable hydrology and, unless *Phragmites* (reed) is clearly dominant, is often treated as part of other

marsh and meadow types. The geographic distribution of the type is arbitrarily limited to Bailey's Humid Temperate Domain in eastern North America (Bailey 1997, 1998). Stands in northern Minnesota and farther north in Canada may represent native stands. If so, they should be tracked as a different type. Tidal vegetation of the Gulf Coast of Louisiana and Texas dominated by *Phragmites australis* (common reed) is classified in the *Phragmites australis* (common reed) Tidal Herbaceous Alliance (A.1477).

Global Similar Associations:

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

Global Related Concepts:

- *Phragmites australis* community (Metzler and Barrett 1992) **?**
- *Phragmites australis* temporarily flooded grasslands (Metzler and Barrett 2001) >
- *Phragmites australis* tidal marsh association (Clancy 1993b) **?**
- Inland Emergent Marsh (Chapman et al. 1989) >
- Semi-Natural (MNNHP 1993) >
- Semi-Natural (Faber-Langendoen 2001) >
- Southern New England nutrient-poor streamside/lakeside marsh (Rawinski 1984a) **?**
- Southern New England nutrient-rich streamside/lakeside marsh (Rawinski 1984a) **?**

OTHER COMMENTS

Other Comments: Two accuracy assessment points were classified as this type due to their history of dominance by *Phragmites australis* (common reed) and confirmation of control, but *Phragmites australis* (common reed) was absent or at very low cover, and *Mikania scandens* (climbing hempvine) was strongly dominant.

ELEMENT DISTRIBUTION

Assateague Island National Seashore Range: This association occurs most commonly on the central portion (east-west as well as north-south) of the island.

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

Nations: CA, US

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

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

USFS Ecoregions (1994/95): 212C:CP, 212Fc:CCC, 212Ho:CCC, 212Hw:CCC, 221Aa:CCP, 221Ab:CCC, 221Ae:CCC, 221Ai:CCC, 221Bc:CCC, 221Da:CCC, 222Ic:CCC, 222Jj:CCC, 231Fb:CCC, 232Ab:CCC, 232Ac:CCC, 232Ch:CCC, 232Dc:CCC, 232E:CC, 232G:CC, 234A:PP, 255Dc:CCC, M212:C, M221:P

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

ELEMENT SOURCES

Assateague Island National Seashore Plots and Observation Points: Plots: ASIS.91 (37AB03), ASIS.92 (37RR01), ASIS.93 (32RR04); **Observation Points:** AA160, AA164, AA248, AA252, AA421, AA441, AA777.

Local Description Authors: L.A. Sneddon and A. Berdine

Global Description Authors: D. Faber-Langendoen

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



Phragmites Wetland, AA Point 441, October 1, 2009 (UTM X: 483829, UTM Y: 4219896)

Switchgrass Swale

***(Morella cerifera) / Panicum virgatum - Spartina patens* Herbaceous Vegetation**

(Wax-myrtle) / Switchgrass - Saltmeadow Cordgrass Herbaceous Vegetation

Identifier: CEGL004129

USNVC CLASSIFICATION

Division	Eastern North American Freshwater Wet Meadow, Riparian & Marsh (2.B.6.Na)
Macrogroup	Eastern North American Wet Meadow & Marsh (M069)
Group	Northern & Mid-Atlantic Coastal Wetland (G752)
Association	Switchgrass Swale

ELEMENT CONCEPT

Global Summary: This medium-tall grassland association occurs in seasonally flooded basins, or interdunal swales, landward of maritime backdunes along the mid-Atlantic coast. The water table is at or close to the surface in the spring. Freshwater maintains these depressions as saturated or seasonally flooded and somewhat poorly drained. The community is generally strongly dominated by *Panicum virgatum* (switchgrass) but can be variable in its expression. Associated species include *Spartina patens* (saltmeadow cordgrass), *Juncus canadensis* (Canadian rush), *Solidago sempervirens* (seaside goldenrod), *Eleocharis palustris* (common spikerush), *Toxicodendron radicans* (eastern poison-ivy), *Linum medium* (stiff yellow flax), *Carex longii* (Long's sedge), and *Euthamia caroliniana* (slender goldentop). This community is typically dominated by 40-85% cover of *Panicum virgatum* (switchgrass) and occurs in larger interdunal depressions (up to one-half hectare). Variability occurs in the cover of *Panicum virgatum* (switchgrass) and the richness of associated species. When *Panicum virgatum* (switchgrass) is not as dense, it is most often associated with an even mixture of *Schoenoplectus pungens* (common threesquare) or *Spartina patens* (saltmeadow cordgrass). In some cases, *Morella cerifera* (wax-myrtle) or *Baccharis halimifolia* (eastern baccharis) will constitute less than 10% shrub cover, but shrub coverage is usually much less or none, and other herbs codominate. Soils are characterized by a shallow organic layer (usually a few centimeters in depth) overlying loamy sand or sand. The range of this vegetation is poorly known due to the low confidence of the classification. The vegetation is similar in total floristic composition to *Morella cerifera - Vaccinium corymbosum* Shrubland (CEGL003906), but shrubs are generally lacking or at very low cover, and grasses are much more abundant. The community apparently occurs in New Jersey, Delaware, Maryland, and may extend to North Carolina, but the full range will require further study.

ENVIRONMENTAL DESCRIPTION

Assateague Island National Seashore Environment: This vegetation is characterized by seasonally flooded basins landward of maritime backdunes. Soils are characterized by a shallow organic layer (usually a few centimeters in depth) overlying loamy sand or sand. The water table is at or close to

the surface in the spring. Freshwater maintains these depressions as saturated or seasonally flooded and somewhat poorly drained. Average elevation of this association is 0.47 m, as calculated from lidar-derived data of Brock et al. (2007).

Global Environment: This association occurs in interdunal swales, or seasonally flooded basins, landward of maritime backdunes. The water table is at or close to the surface in the spring. Freshwater maintains these depressions as saturated or seasonally flooded and somewhat poorly drained. Soils are characterized by a shallow organic layer (usually a few centimeters in depth) overlying loamy sand or sand.

VEGETATION DESCRIPTION

Assateague Island National Seashore Vegetation: This medium-tall grassland association is strongly dominated by *Panicum virgatum* (switchgrass). Associated species include *Spartina patens* (saltmeadow cordgrass), *Juncus canadensis* (Canadian rush), *Solidago sempervirens* (seaside goldenrod), *Festuca rubra* (red fescue), *Eleocharis* (spikerush) spp., *Toxicodendron radicans* (eastern poison-ivy), *Linum medium* (stiff yellow flax), *Carex albolutescens* (greenwhite sedge), *Euthamia caroliniana* (slender goldentop), *Scleria verticillata* (low nutrush), *Fuirena pumila* (dwarf umbrella-sedge), *Triadenum virginicum* (Virginia marsh St. Johnswort), *Osmunda regalis* (royal fern), *Pluchea odorata* (sweetscent), and others. This association is variable in its expression but is typically dominated by 40 to 85% cover of *Panicum virgatum* (switchgrass) and occurs in larger interdunal depressions (up to one-half hectare). Variability occurs in the cover of *Panicum virgatum* (switchgrass) and the richness of associated species. In some cases, *Morella cerifera* (wax-myrtle) or *Baccharis halimifolia* (eastern baccharis) will constitute less than 10% shrub cover. In most cases, shrub coverage is much less or none and other herbs codominate. When *Panicum virgatum* (switchgrass) is not as dense, it is most often associated with an even mixture of *Schoenoplectus pungens* or *Spartina patens* (saltmeadow cordgrass).

Global Vegetation: This community is generally strongly dominated by *Panicum virgatum* (switchgrass) but can be variable in its expression. Associated species include *Spartina patens* (saltmeadow cordgrass), *Juncus canadensis* (Canadian rush), *Solidago sempervirens* (seaside goldenrod), *Eleocharis palustris* (common spikerush), *Toxicodendron radicans* (eastern poison-ivy), *Linum medium* (stiff yellow flax), *Carex longii* (Long's sedge), and *Euthamia caroliniana* (slender goldentop). This community is typically dominated by 40-85% cover of *Panicum virgatum* (switchgrass) and occurs in larger interdunal depressions (up to one-half hectare). Variability occurs in the cover of *Panicum virgatum* (switchgrass) and the richness of associated species. When *Panicum virgatum* (switchgrass) is not as dense, it is most often associated with an even mixture of *Schoenoplectus pungens* (common threesquare) or *Spartina patens* (saltmeadow cordgrass). In some cases, *Morella cerifera* (wax-myrtle) or *Baccharis halimifolia* (eastern baccharis) will constitute less than 10% shrub cover, but shrub coverage is usually much less or none and other herbs codominate.

MOST ABUNDANT SPECIES

Assateague Island National Seashore

Stratum	Lifeform	Species
Herb (field)	Graminoid	*Panicum virgatum* (switchgrass), *Spartina patens* (saltmeadow cordgrass)

Global

Stratum	Lifeform	Species
Herb (field)	Graminoid	*Panicum virgatum* (switchgrass), *Spartina patens* (saltmeadow cordgrass)

CHARACTERISTIC SPECIES

Assateague Island National Seashore: *Spartina patens* (saltmeadow cordgrass)

Global: *Panicum virgatum* (switchgrass)

OTHER NOTEWORTHY SPECIES

Global: Other: *Schoenoplectus pungens* (common threesquare, G5)

CONSERVATION STATUS RANK

Global Rank & Reasons: G2G4 (19-Jan-2006). This small-patch wetland community is restricted to the Coastal Plain of the mid-Atlantic.

CLASSIFICATION

Status: Standard

Classification Confidence: 3 - Weak

Global Comments: In some cases, the vegetation is similar in total floristic composition to *Morella cerifera - Vaccinium corymbosum* Shrubland (CEGL003906), but shrubs are generally lacking or at very low cover and grasses are much more abundant. It is somewhat similar to *Panicum virgatum - Spartina patens - Carex silicea* Herbaceous Vegetation (CEGL006150), but that association is brackish, tidal, and occurs on the upper edges of salt marshes.

Global Similar Associations:

- *Morella cerifera - Vaccinium corymbosum* Shrubland (CEGL003906)
- *Morella cerifera / Spartina patens* Shrubland (CEGL003839)
- *Morella pensylvanica - Toxicodendron radicans / Typha latifolia* Shrubland (CEGL006444)
- *Panicum virgatum - Spartina patens - Carex silicea* Herbaceous Vegetation (CEGL006150) is tidal, brackish and occurs on salt marsh edges rather than interdunal depressions.

Global Related Concepts:

- *(Morella cerifera) - Panicum virgatum - Spartina patens* Herbaceous Vegetation (Harrison 2004) =
- *Panicum virgatum - Spartina patens* Herbaceous Vegetation (Bowman 2000) =
- *Panicum virgatum - Spartina patens* Herbaceous Vegetation (Harrison and Stango 2003) =
- *Panicum virgatum* Wetland Association (Heckscher et al. 1995) >
- Fresh marsh community (Hill 1986) >
- Freshwater marsh (Fender 1937) >
- Interdunal Swale (Harrison 2004) >
- Interdune Pond (Fleming et al. 2001) >
- Maritime Wet Grassland (Schafale and Weakley 1990) >
- Maritime Wet Grassland (Switchgrass Subtype) (Schafale 2000) **?**
- Mesic shrub community (Higgins et al. 1971) >

ELEMENT DISTRIBUTION

Assateague Island National Seashore Range: This association is not common on the island. It is absent from the northern portion of the island, and best developed on the southern end south of Fox Hills.

Global Range: The community apparently occurs in New Jersey, Delaware, Maryland, and may extend to North Carolina and north to Massachusetts, but the full range will require further study.

Nations: US

States/Provinces: DE, MA?, MD, NC, NJ, VA:S2?

TNC Ecoregions: 57:C, 58:C, 62:C

USFS Ecoregions (1994/95): 232Aa:CCC, 232Ac:CCC, 232Bt:CCC, 232Bz:CCC, 232Ci:CCC

Federal Lands: NPS (Assateague Island, Cape Lookout); USFWS (Back Bay?, Chincoteague, Currituck, Prime Hook)

ELEMENT SOURCES

Assateague Island National Seashore Plots and Observation Points: Plots: ASIS.94 (77AB08), ASIS.95 (47AB05), ASIS.96 (52AB04), ASIS.97 (77AB04); **Observation Points:** AA125, AA178, AA184, AA187, AA288, AA290, AA328, AA335, AA345, AA367, AA390, AA432, AA444, AA609, AA750A, AA763.

Local Description Authors: L.A. Sneddon and A. Berdine

Global Description Authors: Eastern Ecology Group

References: Berdine 1998, Bowman 2000, Breden et al. 2001, Brock et al. 2007, Coxe 2009, Eastern Ecology Working Group n.d., Fender 1937, Fleming 2001a, Fleming and Patterson 2011a, Fleming et al. 2001, Harrison 2004, Harrison 2011, Harrison and Stango 2003, Heckscher et al. 1995, Higgins et al. 1971, Hill 1986, Metzler and Barrett 2001, Schafale 2000, Schafale 2011, Schafale and Weakley 1990, TNC 1997a



Switchgrass Swale, AA Point 763, October 7, 2009 (UTM X: 479561, UTM Y: 4210811)

Forked Rush Dune Swale

***Juncus (dichotomus, scirpoides) - Drosera intermedia* Herbaceous Vegetation**
(Forked Rush, Needle-pod Rush) - Water Sundew Herbaceous Vegetation
Identifier: CEGL004111

USNVC CLASSIFICATION

Division	Eastern North American Freshwater Wet Meadow, Riparian & Marsh (2.B.6.Na)
Macrogroup	Eastern North American Wet Meadow & Marsh (M069)
Group	Northern & Mid-Atlantic Coastal Wetland (G752)
Association	Forked Rush Dune Swale

ELEMENT CONCEPT

Global Summary: This interdunal swale community of the Atlantic coast (Chesapeake Bay and Delaware Bay drainages) occurs in small, shallow, seasonally flooded depressions. Soils are characterized by a shallow organic layer overlying sands. Sedges and rushes are strongly dominant, including species such as *Juncus dichotomus* (forked rush), *Juncus canadensis* (Canadian rush), *Juncus biflorus* (bog rush), *Juncus scirpoides* (needlepod rush), *Juncus acuminatus* (tapertip rush), *Juncus megacephalus* (bighead rush), *Juncus canadensis* (Canadian rush), *Cyperus odoratus* (fragrant flatsedge), *Scleria verticillata* (low nutrush), *Rhynchospora colorata* (starrush whitetop), and *Fimbristylis castanea* (marsh fimbry). Common associates include *Drosera intermedia* (spoonleaf sundew), *Linum medium* (stiff yellow flax), *Lycopodiella appressa* (southern bog clubmoss), *Utricularia subulata* (zigzag bladderwort), *Utricularia juncea* (southern bladderwort), *Triadenum virginicum* (Virginia marsh St. Johnswort), *Fuirena pumila* (dwarf umbrella-sedge), *Xyris jupicai* (Richard's yelloweyed grass), *Xyris caroliniana* (Carolina yelloweyed grass), *Andropogon virginicus* (broomsedge bluestem), and *Solidago sempervirens* (seaside goldenrod).

ENVIRONMENTAL DESCRIPTION

Assateague Island National Seashore Environment: This uncommon interdunal wetland community occurs in small (4 square meters to one-eighth hectare), very shallow, freshwater depressions that remain saturated throughout the growing season. Soils are characterized by a very shallow organic layer (2 cm thick) over a gray-brown sand. The water table is generally high (from 10 to 50 cm from the surface). Average elevation of this association is 0.47 m, as calculated from lidar-derived data of Brock et al. (2007).

Global Environment: This community occupies freshwater interdunal swales with a shallow organic layer overlying sand.

VEGETATION DESCRIPTION

Assateague Island National Seashore Vegetation: This vegetation is variable in composition, and is often relatively species-rich in comparison to other vegetation types on the island. It is dominated by graminoids, usually *Juncus dichotomus* (forked rush), *Juncus canadensis* (Canadian rush), and *Andropogon virginicus* (broomsedge bluestem). Species typical of nutrient-poor bogs characterize

this vegetation, including *Utricularia subulata* (zigzag bladderwort), *Drosera intermedia* (spoonleaf sundew), and *Lycopodiella appressa* (southern bog clubmoss). Other associates include *Juncus biflorus* (bog rush), *Juncus scirpoides* (needlepod rush), *Fimbristylis autumnalis* (slender fimbry), *Linum medium* (stiff yellow flax), and *Solidago sempervirens* (seaside goldenrod). Scattered small-statured shrubs such as *Morella pensylvanica* (northern bayberry) and *Morella cerifera* (wax-myrtle) may occur, particularly on the periphery.

Global Vegetation: Sedges and rushes are strongly dominant, including species such as *Juncus dichotomus* (forked rush), *Juncus canadensis* (Canadian rush), *Juncus biflorus* (bog rush), *Juncus scirpoides* (needlepod rush), *Juncus acuminatus* (tapertip rush), *Juncus megacephalus* (bighead rush), *Juncus canadensis* (Canadian rush), *Cyperus odoratus* (fragrant flatsedge), *Scleria verticillata* (low nutrush), *Rhynchospora colorata* (starrush whitetop), and *Fimbristylis castanea* (marsh fimbry). Common associates include *Drosera intermedia* (spoonleaf sundew), *Linum medium* (stiff yellow flax), *Lycopodiella appressa* (southern bog clubmoss), *Utricularia subulata* (zigzag bladderwort), *Utricularia juncea* (southern bladderwort), *Triadenum virginicum* (Virginia marsh St. Johnswort), *Fuirena pumila* (dwarf umbrella-sedge), *Xyris jupicai* (Richard's yelloweyed grass), *Xyris caroliniana* (Carolina yelloweyed grass), *Andropogon virginicus* (broomsedge bluestem), and *Solidago sempervirens* (seaside goldenrod).

MOST ABUNDANT SPECIES

Assateague Island National Seashore

Stratum	Lifeform	Species
Herb (field)	Graminoid	*Andropogon virginicus* (broomsedge bluestem), *Juncus dichotomus* (forked rush)
Herb (field)	Succulent forb	*Drosera intermedia* (spoonleaf sundew)

Global

Stratum	Lifeform	Species
Herb (field)	Graminoid	*Andropogon virginicus* (broomsedge bluestem), *Juncus dichotomus* (forked rush)
Herb (field)	Succulent forb	*Drosera intermedia* (spoonleaf sundew)

CHARACTERISTIC SPECIES

Assateague Island National Seashore: *Drosera intermedia* (spoonleaf sundew), *Juncus dichotomus* (forked rush), *Lycopodiella appressa* (southern bog clubmoss), *Xyris torta* (slender yelloweyed grass)

Global: *Drosera intermedia* (spoonleaf sundew), *Juncus dichotomus* (forked rush), *Lycopodiella appressa* (southern bog clubmoss), *Xyris torta* (slender yelloweyed grass)

CONSERVATION STATUS RANK

Global Rank & Reasons: G2G3 (19-Jan-2006). This small-patch wetland community is limited to coastal sand dunes of four states. There may be more than 100 occurrences, but they are small patch and total well less than 1000 acres.

CLASSIFICATION

Status: Standard

Classification Confidence: 2 - Moderate

Assateague Island National Seashore Comments: This association is synonymous with the bog community described by Hill (1986) from Assateague Island. Higgins et al. (1971) did not describe this vegetation. It is similar to their Shrub Bog association in herbaceous composition, but differs in the absence of a shrub layer and occurs in smaller patches.

Global Comments: This community occurs in close association, and often as part of a finely textured mosaic, with *Morella cerifera - Vaccinium corymbosum* Shrubland (CEGL003906) and *Morella cerifera / Hydrocotyle verticillata* Shrubland (CEGL003840). It is similar to *Schoenoplectus pungens - Fimbristylis (castanea, caroliniana)* Herbaceous Vegetation (CEGL004117) and may represent a successional phase.

Global Similar Associations:

- *Morella cerifera - Vaccinium corymbosum* Shrubland (CEGL003906)
- *Schoenoplectus pungens - Fimbristylis (castanea, caroliniana)* Herbaceous Vegetation (CEGL004117)

Global Related Concepts:

- *Andropogon* community (Tyndall and Levy 1978) **?**
- *Juncus (dichotomus, scirpoides) - Drosera intermedia* Herbaceous Vegetation (Harrison 2004) =
- *Juncus scirpoides - Schoenoplectus pungens* Herbaceous Vegetation (Clancy 1996) =
- Bog community (Hill 1986) =
- Interdunal Swale (Harrison 2004) >
- Interdunal wetlands (Jones 1992a) **?**
- Maritime Wet Grassland (Fleming et al. 2001) >

ELEMENT DISTRIBUTION

Assateague Island National Seashore Range: This community has a limited extent on Assateague, primarily occurring in interdunal depressions in the central portion of the island, south to the Fox Hills area.

Global Range: This community occurs from New Jersey south to Virginia.

Nations: US

States/Provinces: DE:S2, MD:S1, NJ, VA:S1?

TNC Ecoregions: 57:P, 58:C, 62:C

USFS Ecoregions (1994/95): 232A:C?, 232Bz:CCC, 232Ci:CCC

Federal Lands: NPS (Assateague Island); USFWS (Back Bay)

ELEMENT SOURCES

Assateague Island National Seashore Plots and Observation Points: Plots: ASIS.10 (42CEF01), ASIS.11 (42CEF03); **Observation Points:** AA616.

Local Description Authors: L.A. Sneddon and A. Berdine

Global Description Authors: L.A. Sneddon and A. Berdine, mod. S.L. Neid

References: Berdine 1998, Bowman 2000, Breden et al. 2001, Brock et al. 2007, Clancy 1996, Coxe 2009, Eastern Ecology Working Group n.d., Fleming 2001a, Fleming and Patterson 2011a, Fleming et al. 2001, Harrison 2004, Harrison 2011, Higgins et al. 1971, Hill 1986, Jones 1992a, Sneddon et al. 1994, Sneddon et al. 1996, TNC 1995c, Tyndall and Levy 1978



Forked Rush Dune Swale, AA Point 616, October 5, 2009 (UTM X: 482191, UTM Y: 4215368)

Brackish Tidal Shrubland

***Morella cerifera - Baccharis halimifolia / Eleocharis fallax* Shrubland**
Wax-myrtle - Groundsel-tree / Creeping Spikerush Shrubland
Identifier: CEGL006846

USNVC CLASSIFICATION

Division	Eastern North American Freshwater Wet Meadow, Riparian & Marsh (2.B.6.Na)
Macrogroup	Eastern North American Wet Meadow & Marsh (M069)
Group	Northern & Mid-Atlantic Coastal Wetland (G752)
Association	Brackish Tidal Shrubland

ELEMENT CONCEPT

Global Summary: This is an oligohaline tidal shrubland of brackish tidal waters in Mid-Atlantic on firm, partially decomposed peat lacking pronounced hummock-and-hollow microtopography. This vegetation forms linear stands along tidal channels between freshwater tidal marshes and adjacent swamp forests. The shrub canopy is relatively open to moderately dense and is dominated by *Morella cerifera* (wax-myrtle). *Baccharis halimifolia* (eastern baccharis) is a common associate; others include *Acer rubrum* (red maple) and *Toxicodendron radicans* (eastern poison-ivy). The herbaceous layer is relatively diverse and characterized by *Eleocharis fallax* (creeping spikerush), *Eleocharis rostellata* (beaked spikerush), *Kosteletzkya virginica* (Virginia saltmarsh mallow), *Hibiscus moscheutos* (crimson-eyed rosemallow), *Typha angustifolia* (narrowleaf cattail), *Polygonum punctatum* (dotted smartweed), *Cyperus filicinus* (fern flatsedge), *Panicum virgatum* (switchgrass), *Schoenoplectus americanus* (chairmaker's bulrush), *Schoenoplectus pungens* (common threesquare), *Amaranthus cannabinus* (tidalmarsh amaranth), *Hydrocotyle verticillata* (whorled marshpennywort), *Pluchea odorata* (sweetscent), *Spartina alterniflora* (smooth cordgrass), *Spartina patens* (saltmeadow cordgrass), *Setaria parviflora* (marsh bristlegrass), *Lythrum lineare* (wand lythrum), *Asclepias* (milkweed) *incarnata*, *Ptilimnium capillaceum* (herbwilliam), and *Carex hormathodes* (marsh straw sedge).

ENVIRONMENTAL DESCRIPTION

Assateague Island National Seashore Environment: This tall wet shrubland occurs along tidal creeks on the bayside of the island, typically forming a narrow band between forest and salt marsh. The substrate is peat or muck, and standing water is often evident.

VEGETATION DESCRIPTION

Assateague Island National Seashore Vegetation: The aspect of this vegetation is a moderately open to closed tall-shrub canopy with a well-developed herbaceous layer. The dominant shrubs reach 3 m in height and include *Morella cerifera* (wax-myrtle), *Baccharis halimifolia* (eastern baccharis), and *Iva frutescens* (Jesuit's bark). The herbaceous layer is characterized by *Spartina patens* (saltmeadow cordgrass), *Distichlis spicata* (saltgrass), *Schoenoplectus pungens* (common threesquare), *Eleocharis rostellata* (beaked spikerush), *Pluchea odorata* (sweetscent), and *Panicum*

virgatum (switchgrass). *Setaria parviflora* (marsh bristlegrass) is characteristic of this vegetation and is usually present in quantity.

MOST ABUNDANT SPECIES

Assateague Island National Seashore

Stratum	Lifeform	Species
Tall shrub/sapling	Broad leaved deciduous shrub	*Iva frutescens* (Jesuit's bark)
Tall shrub/sapling	Broad leaved evergreen shrub	*Baccharis halimifolia* (eastern baccharis), *Morella cerifera* (wax myrtle)
Herb (field)	Vine/Liana	*Smilax rotundifolia* (roundleaf greenbrier)
Herb (field)	Forb	*Pluchea odorata* (sweetscent)
Herb (field)	Graminoid	*Schoenoplectus pungens* (common threesquare), *Setaria parviflora* (marsh bristlegrass), *Spartina patens* (saltmeadow cordgrass)

CHARACTERISTIC SPECIES

Assateague Island National Seashore: *Setaria parviflora* (marsh bristlegrass)

CONSERVATION STATUS RANK

Global Rank & Reasons: GNR (21-Apr-2004).

CLASSIFICATION

Status: Standard

Classification Confidence: 3 - Weak

Assateague Island National Seashore Comments: This vegetation can be distinguished from the freshwater shrubland dominated by *Morella cerifera* (wax-myrtle), Wax-myrtle Shrub Swamp (CEGL003840), by the presence of *Iva frutescens* (Jesuit's bark) and *Setaria parviflora* (marsh bristlegrass), and by its location at the edges of tidal marshes and creeks.

- Global Related Concepts:
- *Morella cerifera - (Baccharis halimifolia) / Eleocharis fallax* (Coulling unpubl. data 2007) =
- *Morella cerifera - Baccharis halimifolia / Eleocharis fallax* Tidal Shrubland (Harrison 2004) =
- *Morella cerifera - Baccharis halimifolia / Eleocharis fallax* Tidal Shrubland (Harrison and Stango 2003) =
- *Morella cerifera / Typha angustifolia* (Coulling unpubl. data 2007) <
- Tidal Oligohaline Shrubland (Harrison 2004) >

OTHER COMMENTS

Other Comments: This association was not classified in the USNVC until 2003 and so was not included in the original map.

ELEMENT DISTRIBUTION

Assateague Island National Seashore Range: This association occurs adjacent to tidal marshes on the larger peninsulas of the central portion of the island. It also occurs at the edges of salt marshes in the more interior portion of the island.

Global Range: This vegetation occurs on tidal rivers of the central Atlantic coast.

Nations: US

States/Provinces: DE, MD:S3, NJ, VA?

TNC Ecoregions: 58:C, 62:C

USFS Ecoregions (1994/95): 232Ab:CCC, 232Ac:CCC, 232Bx:CCC

Federal Lands: NPS (Assateague Island); USFWS (Cape May, Chesapeake Marshlands, Prime Hook)

ELEMENT SOURCES

Assateague Island National Seashore Plots and Observation Points: Plots: None; **Observation Points:** AA137, AA182, AA188, AA190, AA193, AA210, AA331, AA332, AA353, AA381, AA385, AA453, AA462, AA486, AA518, AA520, AA522, AA529, AA711.

Local Description Authors: L.A. Sneddon

Global Description Authors: J. Harrison and L.A. Sneddon

References: Coulling unpubl. data 2007, Coxe 2009, Eastern Ecology Working Group n.d., Harrison 2004, Harrison 2011, Harrison and Stango 2003



Brackish Tidal Shrubland, AA Point 518, October 3, 2009 (UTM X: 482789, UTM Y: 4217584)

Shrub Bog

***Morella cerifera* - *Vaccinium corymbosum* Shrubland**
Wax-myrtle - Highbush Blueberry Shrubland
Identifier: CEGL003906

USNVC CLASSIFICATION

Division	Eastern North American Freshwater Wet Meadow, Riparian & Marsh (2.B.6.Na)
Macrogroup	Eastern North American Wet Meadow & Marsh (M069)
Group	Northern & Mid-Atlantic Coastal Wetland (G752)
Association	Barrier Island Bog

ELEMENT CONCEPT

Global Summary: This shrub bog community of Maryland, Delaware, and New Jersey occurs in interdunal depressions of barrier island dunes. This community is a relatively open, short-statured shrub wetland with a thin veneer of peat. The two most characteristic shrubs are *Morella cerifera* (wax-myrtle) and *Vaccinium corymbosum* (highbush blueberry). *Rosa palustris* (swamp rose) and *Ilex glabra* (inkberry) also frequently occur. *Panicum virgatum* (switchgrass), *Andropogon glomeratus* (bushy bluestem), and other grasses are common. Other herbs include *Juncus canadensis* (Canadian rush), *Juncus scirpoides* (needlepod rush), *Juncus dichotomus* (forked rush), *Pluchea foetida* (stinking camphorweed), *Triadenum virginicum* (Virginia marsh St. Johnswort), *Drosera intermedia* (spoonleaf sundew), *Lycopodiella appressa* (southern bog clubmoss), *Xyris torta* (slender yelloweyed grass), and *Osmunda regalis* (royal fern).

ENVIRONMENTAL DESCRIPTION

Assateague Island National Seashore Environment: This association occurs in seasonally flooded interdunal depressions that remain saturated and hold standing water (to a depth of less than 0.15 m) early in the growing season. Standing water disappears later in the summer, but soils remain somewhat moist throughout the season. A shallow organic layer (1-5 cm) overlies sand. Occurrences range in size from an eighth to a quarter hectare and are generally located in the interdunal areas of the inner island. Average elevation of this association is 0.71 m as calculated from lidar-derived data of Brock et al. (2007).

Global Environment: This community occurs in interdunal depressions of barrier island dunes with a thin veneer of peat.

VEGETATION DESCRIPTION

Assateague Island National Seashore Vegetation: This association is a relatively open, short-statured shrub wetland. The two most characteristic shrubs are *Morella cerifera* (wax-myrtle) and *Vaccinium corymbosum* (highbush blueberry). This association is distinct in that *Morella cerifera* (wax-myrtle) grows in standing water forming a 20-50% cover with *Vaccinium corymbosum* (highbush blueberry) characteristically scattered around the perimeter of the wet depressions. It is characterized by patchy, open *Morella cerifera* (wax-myrtle) 1-2 m tall, with lesser amounts of

Vaccinium corymbosum (highbush blueberry). *Pinus taeda* (loblolly pine) seedlings and saplings may also be found scattered throughout. Characteristic of this association are high cover of grasses and rushes such as *Panicum virgatum* (switchgrass), *Schoenoplectus pungens* (common threesquare), *Juncus dichotomus* (forked rush), *Juncus canadensis* (Canadian rush), and to a lesser degree *Andropogon glomeratus* (bushy bluestem) and *Andropogon virginicus* (broomsedge bluestem). Other associated herbaceous species include *Pluchea foetida* (stinking camphorweed), *Rhexia mariana* (Maryland meadowbeauty), *Euthamia caroliniana* (slender goldentop), *Triadenum virginicum* (Virginia marsh St. Johnswort), and occasionally *Osmunda regalis* (royal fern). The presence of *Lycopodiella appressa* (southern bog clubmoss), *Drosera intermedia* (spoonleaf sundew), *Fuirena pumila* (dwarf umbrella-sedge), *Scleria verticillata* (low nutrush) and *Xyris torta* (slender yelloweyed grass) suggest the presence of acidic, nutrient-poor conditions, hence the local name "shrub bog."

Global Vegetation: This community is a relatively open, short-statured shrub wetland with *Morella cerifera* (wax-myrtle) and *Vaccinium corymbosum* (highbush blueberry). *Rosa palustris* (swamp rose) and *Ilex glabra* (inkberry) also frequently occur. *Panicum virgatum* (switchgrass), *Andropogon glomeratus* (bushy bluestem), and other grasses are common. Other herbs include *Juncus canadensis* (Canadian rush), *Juncus scirpoides* (needlepod rush), *Juncus dichotomus* (forked rush), *Pluchea foetida* (stinking camphorweed), *Triadenum virginicum* (Virginia marsh St. Johnswort), *Drosera intermedia* (spoonleaf sundew), *Lycopodiella appressa* (southern bog clubmoss), *Xyris torta* (slender yelloweyed grass), and *Osmunda regalis* (royal fern).

MOST ABUNDANT SPECIES

Assateague Island National Seashore

Stratum	Lifeform	Species
Short shrub/sapling	Broad leaved deciduous shrub	*Vaccinium corymbosum* (highbush blueberry)
Short shrub/sapling	Broad leaved evergreen shrub	*Morella cerifera* (wax myrtle)
Herb (field)	Graminoid	*Panicum virgatum* (switchgrass), *Schoenoplectus pungens* (common threesquare)
Herb (field)	Succulent forb	*Drosera intermedia* (spoonleaf sundew)

Global

Stratum	Lifeform	Species
Short shrub/sapling	Broad leaved deciduous shrub	*Vaccinium corymbosum* (highbush blueberry)
Short shrub/sapling	Broad leaved evergreen shrub	*Morella cerifera* (wax myrtle)
Herb (field)	Graminoid	*Panicum virgatum* (switchgrass), *Schoenoplectus pungens* (common threesquare)
Herb (field)	Succulent forb	*Drosera intermedia* (spoonleaf sundew)

CHARACTERISTIC SPECIES

Assateague Island National Seashore: *Drosera intermedia* (spoonleaf sundew), *Fuirena pumila* (dwarf umbrella-sedge), *Lycopodiella appressa* (southern bog clubmoss), *Morella cerifera* (wax-myrtle), *Osmunda regalis* (royal fern), *Rhexia mariana* (Maryland meadowbeauty), *Vaccinium corymbosum* (highbush blueberry), *Xyris torta* (slender yelloweyed grass)

Global: *Drosera intermedia* (spoonleaf sundew), *Fuirena pumila* (dwarf umbrella-sedge), *Morella cerifera* (wax-myrtle), *Osmunda regalis* (royal fern), *Vaccinium corymbosum* (highbush blueberry), *Xyris torta* (slender yelloweyed grass)

OTHER NOTEWORTHY SPECIES

Global: Other: *Scleria verticillata* (low nutrush, G5)

CONSERVATION STATUS RANK

Global Rank & Reasons: G2G4 (18-Jan-2006). This small-patch wetland type is restricted to the coastal sand dunes of four states.

CLASSIFICATION

Status: Standard

Classification Confidence: 2 - Moderate

Assateague Island National Seashore Comments: The mesic shrub zone (Higgins et al. 1971) is partially contained within this association, and the shrub bog (Hill 1986) is synonymous with the community. The scrub-shrub/mixed herbaceous interdunal wetland association of McAvoy and Clancy (1994) and the mesic shrub thicket described from New Jersey by Martin (1959b) are closely related floristically and ecologically, and may also be synonymous with this association.

Global Similar Associations:

- *(Morella cerifera) / Panicum virgatum - Spartina patens* Herbaceous Vegetation (CEGL004129)
- *Juncus (dichotomus, scirpoides) - Drosera intermedia* Herbaceous Vegetation (CEGL004111)
- *Morella cerifera / Hydrocotyle verticillata* Shrubland (CEGL003840)
- *Morella cerifera / Spartina patens* Shrubland (CEGL003839)

Global Related Concepts:

- *Morella cerifera - Vaccinium corymbosum* Shrubland (Harrison 2004) **=**
- Interdunal Swale (Harrison 2004) **>**
- Mesic shrub thicket (Martin 1959b) **?**
- Mesic shrub zone (Higgins et al. 1971) **>**
- Scrub-shrub/mixed herbaceous interdunal wetland association (McAvoy and Clancy 1994) **?**

- Shrub bog (Hill 1986) =

ELEMENT DISTRIBUTION

Assateague Island National Seashore Range: This association is not common, but occurs most frequently south of the Tingles Campground and Fox Hills.

Global Range: This shrub bog community occurs in Maryland, Delaware, and New Jersey.

Nations: US

States/Provinces: DE, MD, NJ:S1S2

TNC Ecoregions: 58:C, 62:C

USFS Ecoregions (1994/95): 232A:CC, 232Bz:CCC, 232Ci:CCC

Federal Lands: NPS (Assateague Island); USFWS (Back Bay, Monomoy)

ELEMENT SOURCES

Assateague Island National Seashore Plots and Observation Points: Plots: ASIS.79 (57AB04), ASIS.80 (57AB01), ASIS.81 (52AB01), ASIS.82 (42CEF02); **Observation Points:** AA181, AA287, AA359, AA361, AA370, AA731, AA780.

Local Description Authors: L.A. Sneddon and A. Berdine

Global Description Authors: S.L. Neid

References: Breden et al. 2001, Brock et al. 2007, Clancy 1993b, Coxe 2009, Eastern Ecology Working Group n.d., Harrison 2004, Harrison 2011, Higgins et al. 1971, Hill 1986, Martin 1959b, McAvoy and Clancy 1994, TNC 1995c



Shrub Bog, AA Point 4111, October 8, 2009 (UTM X: 480866, UTM Y: 4213267)

Wet Maritime Shrubland

***Morella cerifera / Hydrocotyle verticillata* Shrubland**
Wax-myrtle / Whorled Marsh-pennywort Shrubland
Identifier: CEGL003840

USNVC CLASSIFICATION

Division	Eastern North American Freshwater Wet Meadow, Riparian & Marsh (2.B.6.Na)
Macrogroup	Eastern North American Wet Meadow & Marsh (M069)
Group	Northern & Mid-Atlantic Coastal Wetland (G752)
Association	Wax-myrtle Shrub Swamp

ELEMENT CONCEPT

Global Summary: This tall wet shrubland of sheltered maritime backdunes is restricted to the mid-Atlantic states. Although the hydrologic regime of this shrubland is somewhat variable, it is influenced by a shallow water table and surface water may be present in pools. A shallow to moderately deep layer of muck usually characterizes the soil profile. This community can form dense wet thickets, particularly in more protected areas. The vegetation is strongly dominated by tall, tree-like shrub growth of *Morella cerifera* (wax-myrtle), with associates including *Baccharis halimifolia* (eastern baccharis), *Rosa palustris* (swamp rose), and *Acer rubrum* (red maple) saplings occurring at very low cover. Shrubs may reach heights of 6 m and appear tree-like in their growth form. Herbaceous vegetation can be quite lush and diverse. Common herbs include *Hydrocotyle verticillata* (whorled marshpennywort), *Hydrocotyle umbellata* (manyflower marshpennywort), *Chasmanthium laxum* (slender woodoats), *Woodwardia areolata* (netted chainfern), *Osmunda regalis var. spectabilis* (royal fern), *Carex longii* (Long's sedge), *Leersia virginica* (whitegrass), *Polygonum pensylvanicum* (Pennsylvania smartweed), *Boehmeria cylindrica* (small-spike false nettle), *Calystegia sepium* (hedge false bindweed), *Ludwigia palustris* (marsh seedbox), *Juncus canadensis* (Canadian rush), *Ptilimnium capillaceum* (herbwilliam), *Lycopus americanus* (American water horehound), *Galium obtusum* (bluntleaf bedstraw), *Samolus valerandi ssp. parviflorus* (seaside brookweed), *Pluchea odorata* (sweetscent), *Mikania scandens* (climbing hempvine), and *Polygonum pensylvanicum* (Pennsylvania smartweed). *Toxicodendron radicans* (eastern poison-ivy) can be very common and constitutes a large portion of the 'understory' cover. This community can be prone to invasion by *Phragmites australis* (common reed).

ENVIRONMENTAL DESCRIPTION

Assateague Island National Seashore Environment: This tall wetland shrubland of backdunes is influenced by a shallow water table, as evidenced by the presence of obligate and facultative wetland species in the herbaceous layer. Surface water may be evident in pools, and a shallow to moderately deep layer of muck usually characterizes the substrate, although the hydrologic regime of this alliance is somewhat variable. Moderately deep, wet, mucky soils are characteristic. Average elevation of this type was calculated to be 0.57 m from analysis of lidar-derived data of Brock et al. (2007).

Global Environment: This association occurs on sheltered maritime backdunes where there is a shallow water table or surface water. Soils are shallow to moderately deep muck.

VEGETATION DESCRIPTION

Assateague Island National Seashore Vegetation: This wet shrubland typically forms a dense (greater than 80%) cover dominated by *Morella cerifera* (wax-myrtle). Large individuals of *Baccharis halimifolia* (eastern baccharis) are also scattered throughout. Scattered trees, usually *Pinus taeda* (loblolly pine) and *Acer rubrum* (red maple), may also be present in the canopy. Shrubs are tall, reaching heights of 6 m, and appear treelike in their growth form. This association is prevalent at Assateague Island National Seashore, forming vast thickets, particularly in more protected areas behind the artificial dune, most typically located between the bayside high marsh herbaceous vegetation and the inner-island forests. Commonly associated species include *Rosa palustris* (swamp rose), *Baccharis halimifolia* (eastern baccharis), and *Morella pensylvanica* (northern bayberry) in the shrub layer. *Smilax rotundifolia* (roundleaf greenbrier) is often very dense in the understory; other vines include *Vitis rotundifolia* (muscadine), *Mikania scandens* (climbing hempvine), and *Parthenocissus quinquefolia* (Virginia creeper). Herbaceous vegetation is quite lush and diverse. Common herbs include *Calystegia sepium* (hedge false bindweed), *Galium obtusum* (bluntleaf bedstraw), *Chasmanthium laxum* (slender woodoats), *Panicum* (panicgrass) spp., and *Festuca rubra* (red fescue). *Toxicodendron radicans* (eastern poison-ivy) is very common and constitutes a large portion of the "understory" cover. The well-shaded, yet lush nature promotes many additional facultative and obligate wetland species such as *Ludwigia palustris* (marsh seedbox), *Juncus canadensis* (Canadian rush), *Eleocharis* (spikerush) sp., *Eleocharis rostellata* (beaked spikerush), *Ranunculus sceleratus* (cursed buttercup), *Ptilimnium capillaceum* (herbwilliam), *Lycopus americanus* (American water horehound), *Ludwigia palustris* (marsh seedbox), *Pluchea odorata* (sweetscent), *Echinochloa walteri* (coast cockspur grass), *Thelypteris palustris* (marsh fern), *Bidens* (beggarticks) spp., *Carex albolutescens* (greenwhite sedge), *Carex hormathodes* (marsh straw sedge), *Samolus valerandi ssp. parviflorus* (seaside brookweed), *Hydrocotyle americana* (American marshpennywort), *Hydrocotyle verticillata* (whorled marshpennywort), and *Polygonum pensylvanicum* (Pennsylvania smartweed).

Global Vegetation: This community is a dense wet thicket, particularly in more protected areas. The vegetation is strongly dominated by tall, tree-like shrub growth of *Morella cerifera* (wax-myrtle), with associates including *Baccharis halimifolia* (eastern baccharis), *Rosa palustris* (swamp rose), and *Acer rubrum* (red maple) saplings occurring at very low cover. Shrubs may reach heights of 6 m and appear tree-like in their growth form. Herbaceous vegetation can be quite lush and diverse. Common herbs include *Hydrocotyle verticillata* (whorled marshpennywort), *Hydrocotyle umbellata* (manyflower marshpennywort), *Chasmanthium laxum* (slender woodoats), *Woodwardia areolata* (netted chainfern), *Osmunda regalis var. spectabilis* (royal fern), *Carex longii* (Long's sedge), *Leersia virginica* (whitegrass), *Polygonum pensylvanicum* (Pennsylvania smartweed), *Boehmeria cylindrica* (small-spike false nettle), *Calystegia sepium* (hedge false bindweed), *Ludwigia palustris* (marsh seedbox), *Juncus canadensis* (Canadian rush), *Ptilimnium capillaceum* (herbwilliam), *Lycopus americanus* (American water horehound), *Galium obtusum* (bluntleaf bedstraw), *Samolus valerandi ssp. parviflorus* (seaside brookweed), *Pluchea odorata* (sweetscent), *Mikania scandens*

(climbing hempvine), and *Polygonum pensylvanicum* (Pennsylvania smartweed). *Toxicodendron radicans* (eastern poison-ivy) can be very common and constitutes a large portion of the 'understory' cover. This community can be prone to invasion by *Phragmites australis* (common reed).

MOST ABUNDANT SPECIES

Assateague Island National Seashore

Stratum	Lifeform	Species
Tall shrub/sapling	Broad leaved evergreen shrub	*Baccharis halimifolia* (eastern baccharis), *Morella cerifera* (wax myrtle)
Herb (field)	Vine/Liana	*Toxicodendron radicans* (eastern poison ivy)
Herb (field)	Forb	*Polygonum pensylvanicum* (Pennsylvania smartweed)
Herb (field)	Graminoid	*Chasmanthium laxum* (slender woodoats)

Global

Stratum	Lifeform	Species
Shrub/sapling (tall & short)	Vine/Liana	*Parthenocissus quinquefolia* (Virginia creeper), *Toxicodendron radicans* (eastern poison ivy)
Tall shrub/sapling	Broad leaved evergreen shrub	*Baccharis halimifolia* (eastern baccharis), *Morella cerifera* (wax myrtle)

CHARACTERISTIC SPECIES

Assateague Island National Seashore: *Hydrocotyle verticillata* (whorled marshpennywort), *Morella cerifera* (wax-myrtle)

Global: *Hydrocotyle verticillata* (whorled marshpennywort), *Morella cerifera* (wax-myrtle)

CONSERVATION STATUS RANK

Global Rank & Reasons: G2G3 (18-Jan-2006). This vegetation is limited to the coastal dunes of barrier islands in only two states. It is threatened by coastal development.

CLASSIFICATION

Status: Standard

Classification Confidence: 3 - Weak

Assateague Island National Seashore Comments: The mesic shrub zone of Higgins et al. (1986) and the shrub succession community of Hill (1971) described from Assateague Island, as well as the thicket community of Boule (1979) and the swamp thicket of Klotz (1986) described from Virginia, are partially contained within this community. Maritime shrub vegetation occurring on sites having a

high water table, described for North Carolina by Schafale and Weakley (1990) is also likely contained in part within this community.

Global Comments: The classification of maritime shrublands dominated by *Morella cerifera* (wax-myrtle) is murky and requires further data for clarification.

Global Similar Associations:

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

Global Related Concepts:

- *Morella cerifera / Hydrocotyle verticillata* Shrubland (Harrison 2004) **=**
- *Myrica cerifera / Hydrocotyle* spp. Shrubland (Bartgis 1986) **?**
- Maritime Shrub Swamp (Fleming et al. 2001) **?**
- Maritime Shrubland (Harrison 2004) **>**
- Mesic shrub zone (Higgins et al. 1971) **>**
- Shrub succession community (Hill 1986) **>**
- Swamp thicket (Klotz 1986) **>**
- Thicket community (Boule 1979) **>**

OTHER COMMENTS

Other Comments: This vegetation is prone to invasion by *Phragmites australis* (common reed), so this species can found in various densities throughout, but generally not prevalent over large areas.

ELEMENT DISTRIBUTION

Global Range: Currently this association is described from Maryland and Virginia.

Nations: US

States/Provinces: DE:S1, MD, VA:S2?

TNC Ecoregions: 58:C

USFS Ecoregions (1994/95): 232A:CP, 232Bz:CCC, 232C:CC

Federal Lands: NPS (Assateague Island); USFWS (Chincoteague)

ELEMENT SOURCES

Assateague Island National Seashore Plots and Observation Points: Plots: ASIS.8 (67AB05), ASIS.9 (37AB06); **Observation Points:** AA009B, AA083, AA114, AA122, AA128, AA135A,

AA135B, AA169, AA173, AA214, AA230, AA232, AA245, AA274, AA278, AA294, AA436, AA470, AA607, AA631, AA647, AA717, AA721, AA727, AA729, AA746.

Local Description Authors: L.A. Sneddon and A. Berdine

Global Description Authors: A. Berdine and L.A. Sneddon, mod S.L. Neid

References: Bartgis 1986, Berdine 1998, Boule 1979, Brock et al. 2007, Coxe 2009, Eastern Ecology Working Group n.d., Fleming 2001a, Fleming and Patterson 2011a, Fleming et al. 2001, Harrison 2004, Harrison 2011, Higgins et al. 1971, Hill 1986, Klotz 1986, Schafale and Weakley 1990, TNC 1995c, TNC 1997a



Wet Maritime Shrubland, AA Point 214, September 16, 2009 (UTM X: 485257, 4225339)

Maritime Shrubland

Morella cerifera / Spartina patens Shrubland
Wax-myrtle / Saltmeadow Cordgrass Shrubland
Identifier: CEGL003839

USNVC CLASSIFICATION

Division	Eastern North American Freshwater Wet Meadow, Riparian & Marsh (2.B.6.Na)
Macrogroup	Eastern North American Wet Meadow & Marsh (M069)
Group	Northern & Mid-Atlantic Coastal Wetland (G752)
Association	Wax-myrtle Shrub Flats

ELEMENT CONCEPT

Global Summary: This association occurs in wetland flats, backdunes and interdune swales along the Atlantic Coast from New Jersey to Florida. The substrate may be sand or loamy sand, sometimes with a thin layer of organic matter. It occurs beyond the reach of most storm tides but may be impacted by salt spray. The water table may often be less than half a meter below the surface. Canopy closure varies from densely closed to moderately open. This vegetation is dominated by *Morella cerifera* (wax-myrtle), sometimes intermixed with *Juniperus virginiana var. silicicola* (southern red-cedar) (from North Carolina and possibly southern Virginia southward), *Morella pensylvanica* (northern bayberry) (from northern North Carolina northward), *Rhus copallinum* (winged sumac), *Baccharis halimifolia* (eastern baccharis), or *Ilex vomitoria* (yaupon). The shrub layer can vary from 2-8 m in height. Occasionally, a sparse emergent canopy of trees (such as *Juniperus virginiana var. silicicola* (southern red-cedar) or *Sabal palmetto* (cabbage palmetto) in the southern parts of the range) may be present. The herbaceous layer is characterized by *Spartina patens* (saltmeadow cordgrass). Other ground flora associates include *Toxicodendron radicans* (eastern poison-ivy), *Panicum virgatum* (switchgrass), *Andropogon virginicus* (broomsedge bluestem), *Juncus dichotomus* (forked rush), *Solidago sempervirens* (seaside goldenrod), *Smilax* (greenbrier) spp., *Parthenocissus quinquefolia* (Virginia creeper), *Vitis* (grape) spp., and *Schoenoplectus pungens* (common threesquare). Small openings may have wetland graminoids, such as *Juncus roemerianus* (needlegrass rush), *Spartina patens* (saltmeadow cordgrass), *Fimbristylis castanea* (marsh fimbry), *Andropogon glomeratus var. pumilus* (bushy bluestem), *Muhlenbergia filipes* (gulf hairawn muhly), etc., and forbs, such as *Hydrocotyle bonariensis* (largeleaf pennywort), *Sabatia stellaris* (rose of Plymouth), *Polygonum hydropiperoides* (swamp smartweed), *Eleocharis* (spikerush) spp., etc. In other cases, few herbs are present, because of the dense, thicket-like shrub layer.

ENVIRONMENTAL DESCRIPTION

Assateague Island National Seashore Environment: This mesic shrub community occurs on dunes, usually on more protected backdunes not directly influenced by storm tides. It is not tidally flooded, although is impacted by salt spray. The substrate is sand with little or no organic layer. Soils have a shallow loamy component, from the accumulation of organic matter under graminoid vegetation, but in less vegetated examples, exposed sands persist. The water table is often less than half a meter below the surface, so mottled sands lie directly below the loam and loamy sands,

overtopped by a shallow layer of duff. The average elevation of this association is variable, ranging from <1.0 to 2 m, calculated from lidar-derived data of Brock et al. (2007).

Global Environment: This association occurs on maritime barrier islands and spits, usually on more protected backdunes, barrier flats, islands within salt marshes, and interdunal swales. It is not tidally flooded and occurs beyond the reach of most storm tides, but it is impacted by salt spray. The substrate may be sand or loamy sand, sometimes with a thin layer of organic matter. The water table is often less than half a meter below the surface.

VEGETATION DESCRIPTION

Assateague Island National Seashore Vegetation: Examples of this association on Assateague Island National Seashore are characterized by more-or-less evenly distributed shrubs, with *Morella cerifera* (wax-myrtle) and *Baccharis halimifolia* (eastern baccharis) cover ranging from 10 to 60%. More often, *Baccharis halimifolia* (eastern baccharis) is much more prevalent than *Morella cerifera* (wax-myrtle) in this layer. *Morella pensylvanica* (northern bayberry) may occur at low cover. *Toxicodendron radicans* (eastern poison-ivy) characteristically covers up to 10%. The herbaceous cover is predominantly *Spartina patens* (saltmeadow cordgrass) (from 50-100%) and *Schoenoplectus pungens* (common threesquare); *Panicum virgatum* (switchgrass) may also be evenly mixed as a secondary component of the herbaceous cover (generally less than 30%). Other herbs are frequent but provide little overall cover. Characteristic species include *Eupatorium hyssopifolium* (hyssopleaf thoroughwort), *Solidago sempervirens* (seaside goldenrod), *Juncus dichotomus* (forked rush), *Fimbristylis castanea* (marsh fimbry), and *Panicum amarum var. amarulum* (coastal panicgrass). Other associates may include *Linum medium* (stiff yellow flax), *Dichanthelium acuminatum* (tapered rosette grass), *Chasmanthium laxum* (slender woodoats), *Schizachyrium scoparium* (little bluestem), and *Euthamia caroliniana* (slender goldentop).

Global Vegetation: This vegetation is characterized by a moderately open to densely closed canopy of *Morella cerifera* (wax-myrtle). Other canopy associates include *Baccharis halimifolia* (eastern baccharis), *Morella pensylvanica* (northern bayberry) (from northern NC northward), *Juniperus virginiana var. silicicola* (southern red-cedar) (from NC and possibly southern VA southward), *Sabal palmetto* (cabbage palmetto), and *Rhus copallinum* (winged sumac). The herbaceous layer is characterized by *Spartina patens* (saltmeadow cordgrass). Other ground flora associates include *Toxicodendron radicans* (eastern poison-ivy), *Panicum virgatum* (switchgrass), *Andropogon virginicus* (broomsedge bluestem), *Juncus dichotomus* (forked rush), *Solidago sempervirens* (seaside goldenrod), *Smilax* (greenbrier) spp., *Parthenocissus quinquefolia* (Virginia creeper), *Vitis* (grape) spp., and *Schoenoplectus pungens* (common threesquare). Small openings may have wetland graminoids, such as *Juncus roemerianus* (needlegrass rush), *Spartina patens* (saltmeadow cordgrass), *Fimbristylis castanea* (marsh fimbry), *Andropogon glomeratus var. pumilus* (bushy bluestem), *Muhlenbergia filipes* (gulf hairawn muhly), etc., and forbs, such as *Hydrocotyle bonariensis* (largeleaf pennywort), *Sabatia stellaris* (rose of Plymouth), *Polygonum hydropiperoides* (swamp smartweed), *Phyla nodiflora* (turkey tangle fogfruit), *Eleocharis* (spikerush) spp., etc. In other cases, few herbs are present, because of the dense, thicket-like shrub layer.

MOST ABUNDANT SPECIES

Assateague Island National Seashore

Stratum	Lifeform	Species
Short shrub/sapling	Broad leaved evergreen shrub	*Baccharis halimifolia* (eastern baccharis), *Morella cerifera* (wax myrtle)
Herb (field)	Vine/Liana	*Toxicodendron radicans* (eastern poison ivy)
Herb (field)	Forb	*Solidago sempervirens* (seaside goldenrod)
Herb (field)	Graminoid	*Panicum virgatum* (switchgrass), *Spartina patens* (saltmeadow cordgrass)

Global

Stratum	Lifeform	Species
Short shrub/sapling	Broad leaved evergreen shrub	*Morella cerifera* (wax myrtle)
Herb (field)	Graminoid	*Spartina patens* (saltmeadow cordgrass)

CHARACTERISTIC SPECIES

Assateague Island National Seashore: *Baccharis halimifolia* (eastern baccharis), *Morella cerifera* (wax-myrtle), *Panicum virgatum* (switchgrass), *Spartina patens* (saltmeadow cordgrass)

Global: *Morella cerifera* (wax-myrtle), *Spartina patens* (saltmeadow cordgrass)

OTHER NOTEWORTHY SPECIES

Global: Vulnerable: *Parietaria praetermissa* (clustered pellitory, G3G4)

CONSERVATION STATUS RANK

Global Rank & Reasons: G3G4 (1-Feb-2005). This association occurs in interdune flats on barrier islands and barrier spits from New Jersey south to Florida. Many occurrences have been destroyed by coastal development, as these soils are sandy enough and dry enough that they are often not considered "jurisdictional wetlands" and are therefore destroyed for development. Other occurrences have been left undeveloped but now occur as isolated areas fragmented by development. Fairly extensive occurrences are protected on Cape Hatteras National Seashore and Cape Lookout National Seashore, North Carolina.

CLASSIFICATION

Status: Standard

Classification Confidence: 2 - Moderate

Assateague Island National Seashore Comments: This association may be differentiated from Wax-myrtle Shrub Swamp (CEGL003840) by the absence of wetland species and muck soils, and

from Tidal Salt Shrubland (CEGL006848) by the influence of the freshwater table rather than tidal flooding and by the absence of halophytes such as *Iva frutescens* (Jesuit's bark). This community is differentiated from Barrier Island Bog (CEGL003906) by the absence of *Drosera intermedia* (spoonleaf sundew), *Xyris torta* (slender yelloweyed grass), and *Lycopodiella appressa* (southern bog clubmoss).

Global Similar Associations:

- (*Morella cerifera*) / *Panicum virgatum* - *Spartina patens* Herbaceous Vegetation (CEGL004129)
- *Morella cerifera* - *Vaccinium corymbosum* Shrubland (CEGL003906)
- *Morella cerifera / Hydrocotyle verticillata* Shrubland (CEGL003840)

Global Related Concepts:

- Maritime Interdune Shrub Vegetation (Ambrose 1990a) **?**
- Maritime Shrub (Schafale and Weakley 1990) >
- Maritime Shrub Swamp (Ambrose 1990a) **?**
- Mesic shrub community (Higgins et al. 1971) >
- Salt grass sea myrtle red cedar savanna (Martin 1959b) **?**
- Salt grass sea myrtle savanna (Martin 1959b) **?**
- Shrub savannah (Godfrey and Godfrey 1976) **?**
- Shrub succession community (Hill 1986) >
- Thicket community (Boule 1979) **=**
- Tidal Mesohaline Shrubland (Harrison 2004) >
- Upland thicket (Klotz 1986) **=**

OTHER COMMENTS

Other Comments: Portions of the mesic shrub community (Higgins et al. 1971) and the shrub succession community (Hill 1986) described from Assateague Island are contained within this community. The thicket community (Boule 1979) and the upland thicket (Klotz 1986) described from Virginia are suspected to by synonymous with this community. Portions of the maritime shrub community described from North Carolina by Schafale and Weakley (1990), particularly occurrences lacking *Ilex vomitoria* (yaupon) and *Quercus virginiana* (live oak) may be included within this community. The salt grass sea myrtle red cedar savanna and the salt grass sea myrtle savanna described from New Jersey (Martin 1959b) may also be synonymous with this community.

ELEMENT DISTRIBUTION

Assateague Island National Seashore Range: This vegetation occurs from the Route 611 bridge south to the southern end of the park. It is situated behind the primary dunes, largely on the eastern portion of the island.

Global Range: This type occurs along the Atlantic Coast from New Jersey south to Florida.

Nations: US

States/Provinces: DE, FL, GA, MD, NC, NJ, SC, VA:S2S3

TNC Ecoregions: 56:C, 57:C, 58:C, 62:C

USFS Ecoregions (1994/95): 232Ab:CCP, 232Ac:CCC, 232Bz:CCC, 232Cb:CCP, 232Ce:CCC, 232Ch:CCP, 232Ci:CCC, 232Gb:CCC

Federal Lands: DOD (Cape Canaveral); NPS (Assateague Island, Canaveral?, Cape Hatteras, Cape Lookout, Cumberland Island, Fort Pulaski, Timucuan?); USFWS (Back Bay?, Cape Romain?, Chincoteague, Merritt Island?, Pea Island, Prime Hook, Mackay Island)

ELEMENT SOURCES

Assateague Island National Seashore Plots and Observation Points: Plots: ASIS.107 (37AB05), ASIS.108 (TNC9), ASIS.109 (TNC2), ASIS.110 (TNC7), ASIS.111 (TNC3,) ASIS.112 (TNC1), ASIS.114 (57AB03); **Observation Points:** AA007, AA027, AA058, AA060, AA069, AA138, AA141, AA183A, AA212, AA261, AA314, AA319, AA320, AA325, AA351, AA459, AA472, AA480, AA561, AA563, AA701, AA704, AA718, AA732, AA733, AA760.

Local Description Authors: L.A. Sneddon and A. Berdine

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

References: Ambrose 1990a, Berdine 1998, Boule 1979, Bowman 2000, Breden et al. 2001, Brock et al. 2007, Coxe 2009, FNAI 1992a, FNAI 2010a, Fleming 2001a, Fleming and Patterson 2012, Godfrey and Godfrey 1976, Govus 1998, Harrison 2004, Harrison 2011, Higgins et al. 1971, Hill 1986, Klotz 1986, Martin 1959b, Schafale 2011, Schafale and Weakley 1990, Southeastern Ecology Working Group n.d., TNC 1995c



Maritime Shrubland, AA Point 7, August 11, 2009 (UTM X: 491014, UTM Y: 4240964)

Brackish Interdunal Swale

***Spartina patens - Eleocharis parvula* Herbaceous Vegetation**
Saltmeadow Cordgrass - Dwarf Spikerush Herbaceous Vegetation
Identifier: CEGL006342

USNVC CLASSIFICATION

Division	Eastern North American Freshwater Wet Meadow, Riparian & Marsh (2.B.6.Na)
Macrogroup	Eastern North American Wet Meadow & Marsh (M069)
Group	Northern & Mid-Atlantic Coastal Wetland (G752)
Association	Brackish Interdunal Swale

ELEMENT CONCEPT

Global 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* (crimson-eyed 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

Assateague Island National Seashore Environment: This association occurs as small to relatively large patches in low flats on the central portion of the island. It is often in close proximity to high salt marsh, and is no longer tidally flooded but influenced by freshwater, originating from the shallow water table or from overland flow. Several centimeters of standing water may be present. The substrate is characterized by a shallow layer of peat overlying sand.

Global Environment: 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

Assateague Island National Seashore Vegetation: This graminoid vegetation is characterized by low species diversity and dominance by *Spartina patens* (saltmeadow cordgrass) and *Schoenoplectus pungens* (common threesquare). Scattered low-statured shrubs may occur, including *Morella cerifera* (wax-myrtle) and *Baccharis halimifolia* (eastern baccharis). Other herbaceous associates occurring at low cover may include *Sabatia stellaris* (rose of Plymouth), *Setaria parviflora* (marsh bristlegrass), *Lythrum lineare* (wand lythrum), *Pluchea odorata* (sweetscent), and *Kosteletzkya virginica* (Virginia saltmarsh mallow).

Global Vegetation: 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* (crimson-eyed 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

Assateague Island National Seashore

Stratum	Lifeform	Species
Herb (field)	Graminoid	*Schoenoplectus pungens* (common threesquare), *Spartina patens* (saltmeadow cordgrass)

Global

Stratum	Lifeform	Species
Herb (field)	Graminoid	*Eleocharis parvula* (dwarf spikerush), *Schoenoplectus pungens* (common threesquare), *Spartina patens* (saltmeadow cordgrass)

CHARACTERISTIC SPECIES

Assateague Island National Seashore: *Spartina patens* (saltmeadow cordgrass)

Global: *Eleocharis parvula* (dwarf spikerush), *Spartina patens* (saltmeadow cordgrass)

CONSERVATION STATUS RANK

Global Rank & Reasons: GNR (1-Dec-1997).

CLASSIFICATION

Status: Standard

Classification Confidence: 2 - Moderate

Assateague Island National Seashore Comments: This vegetation often grades into High Salt Marsh (CEGL004197), and although the transition from one type to the other is often fairly gradual and difficult to discern. The absence or unimportance of other species typical of the high salt marsh, such as *Distichlis spicata* (saltgrass) and *Limonium carolinianum* (lavender thrift), and importance of freshwater species, particularly *Schoenoplectus pungens* (common threesquare), are characteristic. The nominal species *Eleocharis parvula* (dwarf spikerush) is not common in this vegetation at Assateague Island National Seashore.

Global Comments: This association is similar to coastal salt pond vegetation, *Schoenoplectus pungens - Eleocharis parvula* Herbaceous Vegetation (CEGL006398).

Global Similar Associations:

- *Schoenoplectus pungens - Eleocharis parvula* Herbaceous Vegetation (CEGL006398)
- *Spartina patens - Schoenoplectus pungens - Solidago sempervirens* Herbaceous Vegetation (CEGL004097)

Global Related Concepts:

- *Spartina patens - Eleocharis parvula* Herbaceous Vegetation (TNC 1997a) =
- *Spartina patens - Eleocharis parvula* Herbaceous Vegetation (Harrison 2004) =
- Coastal interdunal marsh/swale (Rawinski 1984a) **?**
- Maritime Wet Grassland (Fleming et al. 2001) >
- Overwash Community (Lea 2002b) **?**

ELEMENT DISTRIBUTION

Assateague Island National Seashore Range: This vegetation occurs on the wider regions of the island, inland from salt marsh on the bayside up to the secondary dunes and often distributed in patches within Loblolly Pine Forest (CEGL006040). It occurs sparingly in the vicinity of Little Levels, and is best developed on the widest portions of the park in the Green Run and Pope Bay section.

Global Range: This association is currently described from Maryland, New Jersey, New York, Massachusetts, and New Hampshire. It likely occurs in other states.

Nations: CA, US

States/Provinces: DE, MA, MD, NH, NJ:S1S2, NY:S1S2, QC, VA:S2?

TNC Ecoregions: 57:?, 58:C, 62:C

USFS Ecoregions (1994/95): 221Ab:CCC, 221Ac:CCC, 221Ak:CCC, 232Aa:CCC, 232Ac:CCC, 232Bz:CCC

Federal Lands: NPS (Assateague Island, Fire Island, Gateway); USFWS (Monomoy?)

ELEMENT SOURCES

Assateague Island National Seashore Plots and Observation Points: Plots: ASIS.53 (77AB07); **Observation Points:** AA005, AA006, AA104, AA238, AA246, AA309, AA339, AA627, AA653.

Local Description Authors: L.A. Sneddon

Global Description Authors: D. Hunt, mod. S.L. Neid

References: Breden et al. 2001, CDPNQ unpubl. data, Dowhan and Rozsa 1989, Eastern Ecology Working Group n.d., Edinger et al. 2002, Edinger et al. 2008a, Fleming and Patterson 2011a, Fleming et al. 2001, Harrison 2004, Harrison 2011, Hunt 1997b, Klopfer et al. 2002, Lea 2002b, Lundgren 1998, NRCS 2001b, Rawinski 1984a, Reschke 1990, Sneddon and Lundgren 2001, Sperduto 2000b, Swain and Kearsley 2001, TNC 1997a



Brackish Interdunal Swale, AA Point 5, August 11, 2009 (UTM X: 491126, UTM Y: 4241052)

2.B.7. Salt Marsh

2.B.7.Nb. Temperate & Boreal Atlantic Coastal Salt Marsh

M079. Eastern North American Atlantic Salt Marsh

G120. North American Atlantic Brackish Tidal Marsh

Eastern Reed Tidal Marsh

***Phragmites australis* Tidal Herbaceous Vegetation**
Common Reed Tidal Herbaceous Vegetation
Identifier: CEGL004187

USNVC CLASSIFICATION

Division	Temperate & Boreal Atlantic Coastal Salt Marsh (2.B.7.Nb)
Macrogroup	Eastern North American Atlantic Salt Marsh (M079)
Group	North American Atlantic Brackish Tidal Marsh (G120)
Association	Reed Tidal Marsh

ELEMENT CONCEPT

Global 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* (small-spike 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

Assateague Island National Seashore Environment: This vegetation occurs in tidal marshes influenced by disturbance.

Global Environment: 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

Assateague Island National Seashore Vegetation: *Phragmites australis* (common reed) is the dominant species, and examples may include scattered individuals of the marsh that had been

invaded, such as *Spartina patens* (saltmeadow cordgrass) or *Spartina alterniflora* (smooth cordgrass).

Global Vegetation: 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* (small-spike 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

Assateague Island National Seashore

Stratum	Lifeform	Species
Herb (field)	Graminoid	Phragmites australis (common reed)

Global

Stratum	Lifeform	Species
Herb (field)	Graminoid	Phragmites australis (common reed)

CHARACTERISTIC SPECIES

Assateague Island National Seashore: *Phragmites australis* (common reed)

Global: *Phragmites australis* (common reed)

CONSERVATION STATUS RANK

Global Rank & Reasons: GNA (invasive) (22-Nov-1997).

CLASSIFICATION

Status: Standard

Classification Confidence: 1 - Strong

Assateague Island National Seashore Comments: This vegetation can be differentiated from its freshwater analog, Eastern Reed Marsh (CEGL004141), by the presence of associated salt marsh species and tidal flooding.

Global 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, non-native 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).

Global Similar Associations:

- *Phragmites australis - (Sagittaria platyphylla, Vigna luteola)* Tidal Herbaceous Vegetation (CEGL007891)
- *Phragmites australis* Eastern North America Temperate Semi-natural Herbaceous Vegetation (CEGL004141)

Global Related Concepts:

- *Phragmites australis* Association (Fleming 1998) ?
- *Phragmites australis* Herbaceous Wetland (Fleming and Moorhead 1998) =
- *Phragmites australis* Tidal Herbaceous Vegetation (Bowman 2000) =
- *Phragmites australis* community (Metzler and Barrett 1992) ?
- *Phragmites australis* temporarily flooded grasslands (Metzler and Barrett 2001) >
- *Phragmites australis* tidal marsh association (Clancy 1993b) =
- Brackish Tidal Marsh (Rawinski 1984a) ?
- Salt Marsh Complex (Breden 1989) >
- Successional / Modified Estuarine Herbaceous Vegetation (Fleming et al. 2006) ?

ELEMENT DISTRIBUTION

Assateague Island National Seashore Range: This vegetation occurs in a few scattered locations on the bayside of the central portion of the park. It is known from the Bayside Campground, as well as

other areas close to the transition between salt marsh and Wax-myrtle Shrub Swamp (CEGL003840) or Tidal Salt Shrubland (CEGL006848).

Global Range: This community has a broad geographic range, including coastal areas of the eastern and southeastern United States and Canada.

Nations: CA?, US

States/Provinces: AL, CT, DC?, DE, FL, GA, LA, LB?, MA, MD:S5, ME, MS, NC, NF?, NH, NJ:S5, NS?, NY, PA, PE?, QC, RI, SC, TX, VA

TNC Ecoregions: 53:C, 56:C, 57:C, 58:C, 62:C

USFS Ecoregions (1994/95): 221Ab:CCC, 232Aa:CCC, 232Ab:CCC, 232Ac:CCC, 232Ad:CCC, 232Bz:CCC, 232Ch:CCC, 232Ci:CCC, 232Dc:CCC

Federal Lands: NPS (Assateague Island, Boston Harbor Islands, Cape Cod, Cape Hatteras, Cape Lookout, Colonial, Fire Island, Gateway, George Washington Birthplace, George Washington Parkway, National Capital-East, Saugus Iron Works); USFWS (Back Bay, Bon Secour, Cape May, Chesapeake Marshlands, E.B. Forsythe, Monomoy, Supawna Meadows)

ELEMENT SOURCES

Assateague Island National Seashore Plots and Observation Points: Plots: None; **Observation Points:** AA140, AA159, AA236.

Local Description Authors: L.A. Sneddon

Global Description Authors: R.E. Zaremba

References: Bell et al. 2002, Bowman 2000, Breden 1989, CDPNQ unpubl. data, Clancy 1993b, Coulling 2002, Coxe 2009, Edinger et al. 2002, Edinger et al. 2008a, Enser and Lundgren 2006, Fleming 1998, Fleming and Moorhead 1998, Fleming and Patterson 2011a, Fleming et al. 2006, Harrison 2001, Harrison 2011, Klopfer et al. 2002, Largay and Sneddon 2008, Largay and Sneddon 2010, Metzler and Barrett 1992, Metzler and Barrett 1996, Metzler and Barrett 2001, Metzler and Barrett 2006, NRCS 2001b, NatureServe 2009, Nelson 1986, Niering and Warren 1977, Odum et al. 1984, Patterson 2008c, Patterson 2008d, Rawinski 1984a, Saltonstall 2002, Schafale and Weakley 1990, Schotz pers. comm., Sneddon et al. 2010, Southeastern Ecology Working Group n.d., Swain and Kearsley 2001, TNC 1995c, Walz et al. 2008



Eastern Reed Tidal Marsh, AA Point 159, September 14, 2009 (UTM X: 486172, UTM Y: 4228051)

Giant Cordgrass Marsh

***Spartina cynosuroides* Herbaceous Vegetation**
Big Cordgrass Herbaceous Vegetation
Identifier: CEGL004195

USNVC CLASSIFICATION

Division	Temperate & Boreal Atlantic Coastal Salt Marsh (2.B.7.Nb)
Macrogroup	Eastern North American Atlantic Salt Marsh (M079)
Group	North American Atlantic Brackish Tidal Marsh (G120)
Association	Giant Cordgrass Marsh

ELEMENT CONCEPT

Global Summary: This community includes narrow, almost pure stands of *Spartina cynosuroides* (big cordgrass) along tidal creeks and sloughs or on levees of oligohaline tidal marshes along the central Atlantic Coast. Some occurrences are nearly monospecific, while others have a diverse component of other graminoids and forbs. Where mixed, associated plants include *Schoenoplectus pungens* (common threesquare), *Schoenoplectus robustus* (sturdy bulrush), *Schoenoplectus americanus* (chairmaker's bulrush), *Kosteletzkya virginica* (Virginia saltmarsh mallow), *Hibiscus moscheutos* (crimson-eyed rosemallow), *Amaranthus cannabinus* (tidalmarsh amaranth), *Panicum virgatum* (switchgrass), *Peltandra virginica* (green arrow-arum), and *Polygonum punctatum* (dotted smartweed). Where more saline, *Spartina alterniflora* (smooth cordgrass) and *Iva frutescens* (Jesuit's bark) can become more frequent. Where less saline, associates can include *Schoenoplectus tabernaemontani* (softstem bulrush), *Pontederia cordata* (pickerelweed), *Peltandra virginica* (green arrow-arum), *Leersia oryzoides* (rice cutgrass), *Mikania scandens* (climbing hempvine), *Rumex verticillatus* (swamp dock), *Echinochloa walteri* (coast cockspur grass), *Polygonum hydropiperoides* (swamp smartweed), and *Typha angustifolia* (narrowleaf cattail) (or *Typha domingensis* (southern cattail) in the south), among others. In more disturbed areas, this association can be displaced by *Phragmites australis* (common reed).

ENVIRONMENTAL DESCRIPTION

Assateague Island National Seashore Environment: This association is documented with a single accuracy assessment point; it occurs adjacent to the bay shore and grades into a large freshwater wetland.

Global Environment: This association occurs along tidal creeks, guts, and levees of oligohaline to mesohaline marshes in irregularly flooded high marsh situations, but in areas that are well-drained.

VEGETATION DESCRIPTION

Assateague Island National Seashore Vegetation: *Spartina cynosuroides* (big cordgrass) is strongly dominant, with few other associates. *Distichlis spicata* (saltgrass) occurs sparingly, and *Morella cerifera* (wax-myrtle) occurs on the edge of the stand.

Global Vegetation: *Spartina cynosuroides* (big cordgrass) is strongly dominant in this community, often occurring in pure stands. Where stands are mixed, common associates can include *Schoenoplectus robustus* (sturdy bulrush), *Schoenoplectus pungens* (common threesquare), *Schoenoplectus americanus* (chairmaker's bulrush), *Peltandra virginica* (green arrow-arum), *Kosteletzkya virginica* (Virginia saltmarsh mallow), *Amaranthus cannabinus* (tidalmarsh amaranth), *Panicum virgatum* (switchgrass), *Peltandra virginica* (green arrow-arum), and *Polygonum punctatum* (dotted smartweed). Where more saline, *Spartina alterniflora* (smooth cordgrass) and *Iva frutescens* (Jesuit's bark) can become more frequent. Where less saline, *Schoenoplectus tabernaemontani* (softstem bulrush), *Polygonum hydropiperoides* (swamp smartweed), *Pontederia cordata* (pickerelweed), *Peltandra virginica* (green arrow-arum), *Leersia oryzoides* (rice cutgrass), *Mikania scandens* (climbing hempvine), *Rumex verticillatus* (swamp dock), *Echinochloa walteri* (coast cockspur grass), and *Typha angustifolia* (narrowleaf cattail) are also common associates. In more disturbed areas, this association can be displaced by *Phragmites australis* (common reed).

MOST ABUNDANT SPECIES

Assateague Island National Seashore

Stratum	Lifeform	Species
Herb (field)	Graminoid	Spartina cynosuroides (big cordgrass)

Global

Stratum	Lifeform	Species
Herb (field)	Graminoid	Spartina cynosuroides (big cordgrass)

CHARACTERISTIC SPECIES

Assateague Island National Seashore: *Spartina cynosuroides* (big cordgrass)

Global: *Spartina cynosuroides* (big cordgrass)

CONSERVATION STATUS RANK

Global Rank & Reasons: G4 (13-Aug-1997).

CLASSIFICATION

Status: Standard

Classification Confidence: 2 - Moderate

Assateague Island National Seashore Comments: No plot data were collected.

Global Comments: *Spartina cynosuroides - Panicum virgatum - Phyla lanceolata* Herbaceous Vegetation (CEGL007741) is similar in terms of dominant and codominant species, however, associated species differ somewhat and CEGL007741 occurs in wind-tidal situations in North

Carolina and Virginia. North of New Jersey, *Spartina cynosuroides* (big cordgrass) is a component of brackish high marsh associations, but does not tend to dominate.

Global Similar Associations:

- *Spartina cynosuroides - Panicum virgatum - Phyla lanceolata* Herbaceous Vegetation (CEGL007741)

Global Related Concepts:

- *Spartina cynosuroides* Herbaceous Vegetation (Coulling 2002) =
- *Spartina cynosuroides* Herbaceous Vegetation (Harrison 2004) =
- *Spartina cynosuroides* Tidal Herbaceous Vegetation (Clancy 1996) =
- Big Cordgrass Community Type (Odum et al. 1984) **?**
- Brackish Marsh (Wharton 1978) >
- Brackish Marsh (Schafale and Weakley 1990) ><
- Brackish tidal marsh complex (Breden 1989) **?**
- Tidal Freshwater Marsh (Schafale and Weakley 1990) ><
- Tidal Freshwater Marsh (Giant Cordgrass Subtype) (Schafale 2000) **?**
- Tidal Oligohaline Marsh (Harrison 2004) >
- Tidal Oligohaline Marsh (Fleming et al. 2001) >

ELEMENT DISTRIBUTION

Assateague Island National Seashore Range: The single documented stand occurs on the western edge of the large peninsula to the north of Green Run.

Global Range: This association occurs along the Atlantic coast from New Jersey to Georgia.

Nations: US

States/Provinces: DE:S3, GA, MA, MD:S4?, NC, NJ:S3, SC, VA:S4

TNC Ecoregions: 56:C, 57:C, 58:C, 62:C

USFS Ecoregions (1994/95): 221Ab:CCC, 232Ab:CCC, 232Ac:CCC, 232Ad:CCC, 232Br:CCC, 232Bt:CCC, 232Bx:CCC, 232Bz:CCC, 232Cb:CCC, 232Ce:CCC, 232Ch:CCC, 232Ci:CCC

Federal Lands: NPS (Assateague Island, Cape Cod, Colonial, Fort Pulaski, George Washington Birthplace); USFS (Croatan); USFWS (Back Bay, Cape May, Chesapeake Marshlands, Supawna Meadows)

ELEMENT SOURCES

Assateague Island National Seashore Plots and Observation Points: Plots: None; **Observation Points:** AA628.

Local Description Authors: L.A. Sneddon

Global Description Authors: S.L. Neid

References: Bowman 2000, Breden 1989, Breden et al. 2001, Clancy 1996, Coulling 2002, Coxe 2009, Fleming 2001a, Fleming and Moorhead 1998, Fleming and Patterson 2011a, Fleming et al. 2001, Fleming et al. 2007b, Govus 1998, Harrison 2001, Harrison 2004, Harrison 2011, Nelson 1986, Odum 1988, Odum and Smith 1981, Odum et al. 1984, Patterson 2008c, Patterson 2008d, Schafale 2000, Schafale 2003b, Schafale 2011, Schafale and Weakley 1990, Sneddon et al. 2010, Southeastern Ecology Working Group n.d., Wharton 1978



Giant Cordgrass Marsh, AA Point 628, October 6, 2009 (UTM X: 481007, UTM Y: 4215158)

Brackish Tidal Marsh

***Typha angustifolia - Hibiscus moscheutos* Herbaceous Vegetation**
Narrowleaf Cattail - Crimson-eyed Rosemallow Herbaceous Vegetation
Identifier: CEGL004201

USNVC CLASSIFICATION

Division	Temperate & Boreal Atlantic Coastal Salt Marsh (2.B.7.Nb)
Macrogroup	Eastern North American Atlantic Salt Marsh (M079)
Group	North American Atlantic Brackish Tidal Marsh (G120)
Association	Cattail Brackish Tidal Marsh

ELEMENT CONCEPT

Global Summary: This community is a brackish tidal marsh of the northern to central Atlantic coast, occurring along the margin of tidal rivers and at the upper margins of some high salt marshes and coastal salt ponds where water salinity ranges from 0.5-18.0 ppt. Brackish marshes are most extensive on large tidal rivers, but smaller marshes of this alliance also occur at the upper limits of larger tidal creeks. The vegetation of this tall grassland is a mixture of freshwater and saltmarsh species dominated by *Typha angustifolia* (narrowleaf cattail). *Phragmites australis* (common reed) and/or *Typha latifolia* (broadleaf cattail) can be codominant. The *Phragmites australis* (common reed) component is the native strain. Common associates include *Hibiscus moscheutos* (crimson-eyed rosemallow), *Schoenoplectus pungens* (common threesquare), *Impatiens capensis* (jewelweed), *Amaranthus cannabinus* (tidalmarsh amaranth), *Peltandra virginica* (green arrow-arum), *Pontederia cordata* (pickerelweed), and *Bidens* (beggarticks) spp., plus *Spartina cynosuroides* (big cordgrass) in the south. Other infrequent associates include *Mikania scandens* (climbing hempvine), *Polygonum punctatum* (dotted smartweed), *Pluchea odorata* (sweetscent), *Eleocharis* (spikerush) spp., and *Schoenoplectus robustus* (sturdy bulrush), plus *Schoenoplectus americanus* (chairmaker's bulrush) farther south. Species from adjacent high salt marsh may also be present. Substrate is muck or peat, and there is often an accumulation of *Typha* (cattail) litter.

ENVIRONMENTAL DESCRIPTION

Assateague Island National Seashore Environment: This small-patch association occurs sparingly on Assateague Island National Seashore, and with the exception of one stand, occurs at the head of tidal inlets adjacent to the road where freshwater affects the hydrology. An additional stand occurs to the interior of a brackish marsh, and grades into a large freshwater wetland. Soils are comprised of a shallow organic layer (5-20 cm peaty muck) overlying sand. The soil substrate is either bare muck or peat, standing water, or an accumulation of dead cattail litter.

Global Environment: This association occurs in oligohaline to mesohaline areas of tidal marshes (0.5-18 ppt). In estuarine systems, it can occur in the uppermost zone of brackish marshes where there is freshwater influence; it receives diurnal tidal flooding of brackish water. In salt marshes behind barrier beaches it can occur in the upper reaches of larger tidal creeks within brackish areas and also at the upland border where there is significant freshwater input from the adjacent upland;

here it receives irregular tidal flooding only during high spring tides. Substrate is muck or peat, and there is often an accumulation of *Typha* (cattail) litter.

VEGETATION DESCRIPTION

Assateague Island National Seashore Vegetation: *Typha angustifolia* (narrowleaf cattail) dominates the vegetation cover (30-90% cover). *Phragmites australis* (common reed) is present in roadside examples. Other herbaceous species are present but sparsely distributed and with low cover values; characteristic species include *Hibiscus moscheutos* (crimson-eyed rosemallow), *Spartina patens* (saltmeadow cordgrass), *Distichlis spicata* (saltgrass), *Schoenoplectus pungens* (common threesquare), *Lycopus americanus* (American water horehound), *Eleocharis palustris* (common spikerush), *Hydrocotyle umbellata* (manyflower marshpennywort), *Eupatorium capillifolium* (dogfennel), *Ptilimnium capillaceum* (herbwilliam), *Bidens* (beggarticks) spp., and *Spartina alterniflora* (smooth cordgrass).

Global Vegetation: The vegetation of this tall grassland is a mixture of freshwater and saltmarsh species dominated by *Typha angustifolia* (narrowleaf cattail). *Phragmites australis* (common reed), *Typha latifolia* (broadleaf cattail), *Spartina cynosuroides* (big cordgrass), or *Schoenoplectus pungens* (common threesquare) can codominate. The *Phragmites australis* (common reed) component is the native strain (Saltonstall 2002). Common associates include *Hibiscus moscheutos* (crimson-eyed rosemallow), *Schoenoplectus pungens* (common threesquare), *Impatiens capensis* (jewelweed), *Amaranthus cannabinus* (tidalmarsh amaranth), *Peltandra virginica* (green arrow-arum), *Pontederia cordata* (pickerelweed), and *Bidens* (beggarticks) spp., plus *Spartina cynosuroides* (big cordgrass) in the south. Other infrequent associates include *Mikania scandens* (climbing hempvine), *Pluchea odorata* (sweetscent), *Polygonum punctatum* (dotted smartweed), *Eleocharis* (spikerush) spp., and *Schoenoplectus robustus* (sturdy bulrush), plus *Schoenoplectus americanus* (chairmaker's bulrush) farther south. Species from adjacent high salt marsh may also be present.

MOST ABUNDANT SPECIES

Assateague Island National Seashore

Stratum	Lifeform	Species
Herb (field)	Graminoid	*Typha angustifolia* (narrowleaf cattail)

Global

Stratum	Lifeform	Species
Herb (field)	Forb	*Hibiscus moscheutos* (crimson eyed rosemallow), *Pontederia cordata* (pickerelweed)
Herb (field)	Graminoid	*Schoenoplectus pungens* (common threesquare), *Typha angustifolia* (narrowleaf cattail)

CHARACTERISTIC SPECIES

Assateague Island National Seashore: *Typha angustifolia* (narrowleaf cattail)

Global: *Hibiscus moscheutos* (crimson-eyed rosemallow), *Typha angustifolia* (narrowleaf cattail)

CONSERVATION STATUS RANK

Global Rank & Reasons: G4G5 (19-Jan-2006). This common small-patch community occurs in the estuarine areas of up to 13 northeastern states, several of which rank this vegetation as S4. It is threatened by pollution and by encroachment of *Phragmites australis* (common reed).

CLASSIFICATION

Status: Standard

Classification Confidence: 2 - Moderate

Assateague Island National Seashore Comments: All but one documented example occur in disturbed settings that receive freshwater drainage from the road.

Global Comments: A non-tidal barrier wetland documented at the Cove Point Wetland, Calvert County, Maryland (Steury 1999), appears to fit this concept.

Global Similar Associations:

- *Typha domingensis* Tidal Herbaceous Vegetation (CEGL008456)

Global Related Concepts:

- *Hibiscus* marsh (Cahoon and Stevenson 1986) **?**
- *Typha (angustifolia, latifolia) - Hibiscus moscheutos* Herbaceous Vegetation (Harrison 2001) =
- *Typha angustifolia - Hibiscus moscheutos* Herbaceous Vegetation (Harrison 2004) =
- *Typha angustifolia - Hibiscus moscheutos* Herbaceous Vegetation (Bowman 2000) =
- *Typha angustifolia - Hibiscus moscheutos* community (Metzler and Barrett 2001) =
- *Typha angustifolia - Hibiscus palustris* community (Metzler and Barrett 1992) **?**
- *Typha angustifolia* Tidal Herbaceous Vegetation (Coulling 2002) =
- *Typha angustifolia* community (Good and Good 1975b) **?**
- *Typha angustifolia* type (Ferren et al. 1981) **?**
- *Typha* association (Shreve et al. 1910) =
- Brackish Tidal Marsh (Rawinski 1984a) **?**
- Brackish Tidal Marsh (Enser 1999) >
- Brackish Tidal Marsh (Gawler 2002) >
- Brackish marsh (Sperduto 1994) **?**

- Brackish tidal marsh (Reschke 1990) **?**
- Brackish tidal marsh community (MENHP 1991) **?**
- Brackish tidal marsh complex (Breden 1989) **?**
- Cattail Community Type (Odum et al. 1984) **?**
- Fresh-brackish marsh (Klotz 1986) **?**
- Narrowleaf cattail type (McCormick and Ashbaugh 1972) **?**
- Tidal Freshwater Marsh (Schafale and Weakley 1990) **>**
- Tidal Freshwater Marsh (Narrowleaf Cattail Subtype) (Schafale 2000) **?**
- Tidal Oligohaline Marsh (Harrison 2004) **>**
- Tidal Oligohaline Marsh (Fleming et al. 2001) **>**
- Transitional fresh marsh (Hill 1986) **>**

OTHER COMMENTS

Other Comments: The transitional fresh marsh (Hill 1986) described from Assateague Island is partially contained in this community. Higgins et al. (1971) did not describe this vegetation.

ELEMENT DISTRIBUTION

Assateague Island National Seashore Range: This vegetation is not widespread on Assateague Island, and is largely confined to the head of tidal creeks on the bayside adjacent to the road. It can be found from just south of the bridge to the peninsula north of Green Run.

Global Range: This association occurs along the Atlantic coast from Maine to Virginia and possibly to South Carolina.

Nations: US

States/Provinces: CT, DE:S1, MA, MD:S4, ME, NC, NH, NJ:S4, NY, RI, SC?, VA:S3?

TNC Ecoregions: 56:?, 57:C, 58:C, 61:C, 62:C, 63:C

USFS Ecoregions (1994/95): 212Cb:CCC, 221Aa:CCC, 221Ab:CCC, 221Ac:CCC, 221Ad:CCC, 221Ak:CCC, 232Aa:CCC, 232Ab:CCC, 232Ac:CCC, 232Ad:CCC, 232Br:CCC, 232Bt:CCC, 232Bx:CCC, 232Bz:CCC, 232Cb:CCC, 232Ch:CCC, 232Ci:CCC

Federal Lands: DOD (Camp Lejeune); NPS (Acadia, Assateague Island, Boston Harbor Islands, Cape Cod, Fire Island, Saugus Iron Works); USFWS (Alligator River, Back Bay?, Cape May, Chesapeake Marshlands, Chincoteague, E.B. Forsythe, Monomoy?, Parker River?, Prime Hook, Supawna Meadows, Mackay Island)

ELEMENT SOURCES

Assateague Island National Seashore Plots and Observation Points: Plots: ASIS.83 (37AB04), ASIS.84 (37RR02), ASIS.85 (42RR03); **Observation Points:** AA131, AA171, AA624A.

Local Description Authors: L.A. Sneddon

Global Description Authors: S.L. Neid

References: Bowman 2000, Breden 1989, Breden et al. 2001, Cahoon and Stevenson 1986, Coulling 2002, Coxe 2009, Dowhan and Rozsa 1989, Eastern Ecology Working Group n.d., Edinger et al. 2002, Enser 1999, Ferren et al. 1981, Fleming 2001a, Fleming and Moorhead 1998, Fleming and Patterson 2011a, Fleming et al. 2001, Fleming et al. 2007b, Gawler 2002, Gawler and Cutko 2010, Good and Good 1975b, Harrison 2001, Harrison 2004, Harrison 2011, Higgins et al. 1971, Hill 1986, Klopfer et al. 2002, Klotz 1986, Largay and Sneddon 2008, Largay and Sneddon 2010, Lubinski et al. 2003, MENHP 1991, McCormick and Ashbaugh 1972, Metzler and Barrett 1992, Metzler and Barrett 2001, Metzler and Barrett 2006, NatureServe 2009, Odum et al. 1984, Rawinski 1984a, Reschke 1990, Saltonstall 2002, Schafale 2000, Schafale 2003b, Schafale 2011, Schafale and Weakley 1990, Shreve et al. 1910, Sneddon et al. 2010, Sperduto 1994, Sperduto 1997a, Sperduto 2000b, Sperduto and Nichols 2004, Steury 1999, Swain and Kearsley 2001, TNC 1995c, TNC 1997a



Brackish Tidal Marsh, AA Point 171, September 15, 2009 (UTM X: 486113, UTM Y: 4227512)

Spikerush Lawn Tidal Marsh

***Eleocharis rostellata - Spartina patens* Herbaceous Vegetation**

Beaked Spikerush - Saltmeadow Cordgrass Herbaceous Vegetation

Identifier: CEGL006611

USNVC CLASSIFICATION

Division	Temperate & Boreal Atlantic Coastal Salt Marsh (2.B.7.Nb)
Macrogroup	Eastern North American Atlantic Salt Marsh (M079)
Group	North American Atlantic High Salt Marsh (G121)
Association	Spikerush Lawn Tidal Marsh

ELEMENT CONCEPT

Global Summary: This association is an irregularly flooded oligohaline marsh ranging discontinuously along the coast from Massachusetts to Virginia. It occurs as a narrow band in the transition zone between high salt marsh and salt shrub vegetation. Groundwater seepage dilutes tidal floodwaters. It occurs on peat or muck of variable depth over sand. It is heavily dominated by *Eleocharis rostellata* (beaked spikerush), growing in association with *Spartina patens* (saltmeadow cordgrass), *Schoenoplectus pungens* (common threesquare), *Typha angustifolia* (narrowleaf cattail), *Distichlis spicata* (saltgrass), *Juncus gerardii* (saltmeadow rush), *Cladium mariscoides* (smooth sawgrass), *Eleocharis fallax* (creeping spikerush), *Lythrum lineare* (wand lythrum), *Samolus valerandi ssp. parviflorus* (seaside brookweed), and *Galium tinctorium* (stiff marsh bedstraw), and *Centella erecta* (erect centella) and *Fimbristylis castanea* (marsh fimbry) in the southern extent of the range. *Glaux maritima* (sea milkwort) occurs in this association on Cape Cod, Massachusetts. *Baccharis halimifolia* (eastern baccharis) and *Iva frutescens* (Jesuit's bark) can occur sporadically. It is currently described from barrier islands along the Mid- and North Atlantic Coast.

ENVIRONMENTAL DESCRIPTION

Assateague Island National Seashore Environment: This association occurs on the landward border of high salt marsh in association with High Salt Marsh (CEGL004197). A thin organic layer (10 cm) overlies 10-20 cm of blue-grey sand. The water table is less than 0.3 m from the surface and likely influences the hydrology, but this vegetation apparently receives input of freshwater seepage from adjacent Wax-myrtle Shrub Swamp (CEGL003840).

Global Environment: This association is an irregularly flooded high marsh. Substrate is peat or muck of variable depth over sand.

VEGETATION DESCRIPTION

Assateague Island National Seashore Vegetation: This vegetation is dominated by *Eleocharis rostellata* (beaked spikerush), exhibiting tall, arching stems taking root at the tips. *Spartina patens* (saltmeadow cordgrass) is abundant. Other associates include *Toxicodendron radicans* (eastern poison-ivy), *Solidago sempervirens* (seaside goldenrod), *Iva frutescens* (Jesuit's bark) seedlings,

Schoenoplectus pungens (common threesquare), *Carex hormathodes* (marsh straw sedge), and *Festuca rubra* (red fescue). *Morella cerifera* (wax-myrtle) forms a sparse shrub canopy, generally overtopping from adjacent shrublands.

Global Vegetation: This type represents "spikerush lawn" dominated or codominated by *Eleocharis rostellata* (beaked spikerush), growing in association with *Spartina patens* (saltmeadow cordgrass), *Schoenoplectus pungens* (common threesquare), *Typha angustifolia* (narrowleaf cattail), *Distichlis spicata* (saltgrass), *Juncus gerardii* (saltmeadow rush), *Cladium mariscoides* (smooth sawgrass), *Eleocharis fallax* (creeping spikerush), *Lythrum lineare* (wand lythrum), *Samolus valerandi ssp. parviflorus* (seaside brookweed), and *Galium tinctorium* (stiff marsh bedstraw), and *Centella erecta* (erect centella) and *Fimbristylis castanea* (marsh fimbry) in the southern extent of the range. *Baccharis halimifolia* (eastern baccharis) and *Iva frutescens* (Jesuit's bark) can occur sporadically.

MOST ABUNDANT SPECIES

Assateague Island National Seashore

Stratum	Lifeform	Species
Herb (field)	Graminoid	*Eleocharis rostellata* (beaked spikerush)

Global

Stratum	Lifeform	Species
Herb (field)	Graminoid	*Eleocharis rostellata* (beaked spikerush)

CHARACTERISTIC SPECIES

Assateague Island National Seashore: *Eleocharis rostellata* (beaked spikerush)

Global: *Eleocharis rostellata* (beaked spikerush)

OTHER NOTEWORTHY SPECIES

Global: Other: *Spartina patens* (saltmeadow cordgrass, G5)

CONSERVATION STATUS RANK

Global Rank & Reasons: GNR (17-Apr-2000).

CLASSIFICATION

Status: Standard

Classification Confidence: 2 - Moderate

Assateague Island National Seashore Comments: The plot describing this vegetation was originally included as a portion of Tidal Salt Shrubland (CEGL006848), but regional classification

work conducted since the mapping effort began supports the recognition of this vegetation as a distinct type (Coulling 2002).

Global Similar Associations:

- *Baccharis halimifolia - Iva frutescens / Panicum virgatum* Shrubland (CEGL003921)
- *Iva frutescens / Spartina patens* Shrubland (CEGL006848)

Global Related Concepts:

- *Eleocharis rostellata - Spartina patens* Herbaceous Vegetation (Harrison 2004) =
- *Eleocharis rostellata - Spartina patens* Herbaceous Vegetation [Provisional] (VDNH 2003) =
- Beaked Spikerush Brackish Tidal Marsh (Bowman 2000) =
- Tidal Oligohaline Marsh (Fleming et al. 2001) >

ELEMENT DISTRIBUTION

Assateague Island National Seashore Range: This association occurs very rarely on the island.

Global Range: This association occurs along the Atlantic Coast from Virginia and Maryland, and northward to New York and Massachusetts.

Nations: US

States/Provinces: DE, MA, MD, NY, VA:S1?

TNC Ecoregions: 58:C, 62:C

USFS Ecoregions (1994/95): 221Ab:CCC, 232Aa:CCC, 232Br:CCC, 232Bx:CCP, 232Bz:CCC, 232C:CC

Federal Lands: NPS (Assateague Island, Cape Cod, Fire Island); USFWS (Chincoteague)

ELEMENT SOURCES

Assateague Island National Seashore Plots and Observation Points: Plots: ASIS.46 (32RR10), ASIS.52 (32RR07); **Observation Points:** AA132.

Local Description Authors: L.A. Sneddon

Global Description Authors: S.L. Neid

References: Bowman 2000, Coulling 2002, Dowhan and Rozsa 1989, Eastern Ecology Working Group n.d., Edinger et al. 2002, Fleming and Patterson 2011a, Fleming et al. 2001, Fleming et al. 2007b, Harrison 2004, Harrison 2011, Klopfer et al. 2002, Sneddon and Lundgren 2001, Sneddon et al. 2010, VDNH 2003



Spikerush Lawn Tidal Marsh, AA Point 132, August 14, 2009 (UTM X: 486449, UTM Y: 4229015)

Tidal Salt Scrub

***Iva frutescens / Spartina patens* Shrubland**

Maritime Marsh-elder / Saltmeadow Cordgrass Shrubland

Identifier: CEGL006848

USNVC CLASSIFICATION

Division	Temperate & Boreal Atlantic Coastal Salt Marsh (2.B.7.Nb)
Macrogroup	Eastern North American Atlantic Salt Marsh (M079)
Group	North American Atlantic High Salt Marsh (G121)
Association	Tidal Salt Shrubland

ELEMENT CONCEPT

Global 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* (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* (lavender thrift), *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

Assateague Island National Seashore Environment: This association is characterized by a shallow (5-20 cm) organic layer comprised of peat or peaty muck overlying sand or sandy loam. It occurs on the upper border of salt marshes and is subject to irregular tidal flooding.

Global Environment: 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

Assateague Island National Seashore Vegetation: *Iva frutescens* (Jesuit's bark) is the dominant shrub of this community, with cover values ranging from 30 to 85%. *Baccharis halimifolia* (eastern baccharis) is sometimes present at very low cover. Ground cover is complete and most commonly

Spartina patens (saltmeadow cordgrass) but can be mixed with *Eleocharis palustris* (common spikerush), *Eleocharis rostellata* (beaked spikerush), *Schoenoplectus pungens* (common threesquare), *Carex hormathodes* (marsh straw sedge), *Setaria parviflora* (marsh bristlegrass), and *Distichlis spicata* (saltgrass). Seedlings of *Baccharis* (baccharis) and *Iva* (marsh elder) are frequent. Other associates that may occur include *Lythrum lineare* (wand lythrum), *Kosteletzkya virginica* (Virginia saltmarsh mallow), *Limonium carolinianum* (lavender thrift), and *Solidago sempervirens* (seaside goldenrod).

Global Vegetation: *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* (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* (lavender thrift), *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

Assateague Island National Seashore

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

Global

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

CHARACTERISTIC SPECIES

Assateague Island National Seashore: *Iva frutescens* (Jesuit's bark)

Global: *Iva frutescens* (Jesuit's bark)

CONSERVATION STATUS RANK

Global Rank & Reasons: G5 (1-Dec-1997). This vegetation occurs commonly in salt marshes of the eastern seaboard.

CLASSIFICATION

Status: Standard

Classification Confidence: 2 - Moderate

Assateague Island National Seashore Comments: Portions of the shrub succession community (Higgins et al. 1971) and the salt marsh community (Hill 1986) described from Assateague Island, and the swamp thicket (Klotz 1986) described from Virginia are contained within this association.

Global 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 / Spartina patens* Shrubland (CEGL003839) by the presence of *Iva frutescens* (Jesuit's bark) and by the influence of tidal flooding. It is differentiated from *Baccharis halimifolia / Panicum virgatum* Shrubland (CEGL003921) 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).

Global Similar Associations:

- *Baccharis halimifolia - Iva frutescens - Morella cerifera - (Ilex vomitoria)* Shrubland (CEGL003920)
- *Baccharis halimifolia - Iva frutescens / Panicum virgatum* Shrubland (CEGL003921)
- *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 - Carex silicea* Herbaceous Vegetation (CEGL006150)

Global Related Concepts:

- *Baccharis halimifolia - Iva frutescens* Shrubland (Clancy 1996) **>**
- *Baccharis halimifolia - Iva frutescens* ssp. *oraria / Spartina patens* Shrubland (Bartgis 1986) **>**
- *Iva frutescens - Baccharis halimifolia / Spartina patens - Distichlis spicata* Tidal Shrubland (VDNH 2003) **=**
- *Iva frutescens - Baccharis halimifolia* (Good 1965) **?**
- *Iva frutescens / Panicum virgatum* community (Metzler and Barrett 2001) **>**

- *Iva frutescens / Spartina patens* Shrubland (Fleming et al. 2007b) =
- *Iva frutescens / Spartina patens* Shrubland (Coulling 2002) =
- *Iva frutescens / Spartina patens* Tidal Shrubland (Harrison and Stango 2003) =
- *Iva frutescens* and *Baccharis halimifolia* (Klemas et al. 1973) >
- Estuarine scrub-shrub wetland (Tiner 1985b) **?**
- Estuarine scrub-shrub wetland (Tiner 1985a) **?**
- Salt Marsh (Rawinski 1984a) **?**
- Salt Marsh Complex, marsh-upland border (Breden 1989) >
- Salt Shrub (Schafale and Weakley 1990) >
- 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) >
- Salt shrub (Reschke 1990) >
- Saltbush zone (Boule 1979) >
- Shrub succession community (Higgins et al. 1971) >
- Swamp thicket (Klotz 1986) >
- Tidal Mesohaline Shrubland (Harrison 2004) >
- Tidal Shrub Swamp (Fleming et al. 2001) >

ELEMENT DISTRIBUTION

Assateague Island National Seashore Range: This association occurs adjacent to high salt marsh along the length of the park.

Global Range: This association ranges from Massachusetts to South Carolina.

Nations: US

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

TNC Ecoregions: 56:P, 57:C, 58:C, 62:C

USFS Ecoregions (1994/95): 221Aa:CCC, 221Ab:CCC, 221Ac:CCC, 221Ad:CCC, 221Ak:CC?, 232Aa:CCC, 232Ab:CCC, 232Ac:CCC, 232Ad:CC?, 232Br:CCC, 232Bt:CCC, 232Bx:CCC, 232Bz:CCC, 232Ch:CCC, 232Ci:CC?

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

ELEMENT SOURCES

Assateague Island National Seashore Plots and Observation Points: Plots: ASIS.41 (32RR06), ASIS.42 (47AB03), ASIS.43 (32RR11), ASIS.44 (37AB02), ASIS.45 (67AB08); **Observation Points:** AA009, AA010, AA117, AA196, AA200, AA393, AA413, AA546, AA548, AA570, AA735, AA740.

Local Description Authors: L.A. Sneddon and A. Berdine

Global Description Authors: S.L. Sneid, 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, Edinger et al. 2008a, Enser 1999, Enser and Lundgren 2006, Fleming 2001a, Fleming and Patterson 2011a, Fleming et al. 2001, Fleming et al. 2007b, Fleming pers. comm., Good 1965, Harrison 2004, Harrison 2011, Harrison and Stango 2003, Higgins et al. 1971, Hill 1986, J. Harrison pers. comm., Klemas et al. 1973, Klopfer et al. 2002, Klotz 1986, Largay and Sneddon 2010, Martin 1959b, Mercer 1978, Metzler and Barrett 2001, Metzler and Barrett 2006, NRCS 2001b, NatureServe 2009, Patterson 2008d, Rawinski 1984a, 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



Tidal Salt Scrub, AA point 117, August 11, 2009 (UTM X: 486609, UTM Y: 4229885)

Needlerush Marsh

***Juncus roemerianus* Herbaceous Vegetation**
Black Needlerush Herbaceous Vegetation
Identifier: CEGL004186

USNVC CLASSIFICATION

Division	Temperate & Boreal Atlantic Coastal Salt Marsh (2.B.7.Nb)
Macrogroup	Eastern North American Atlantic Salt Marsh (M079)
Group	North American Atlantic High Salt Marsh (G121)
Association	Needlerush High Marsh

ELEMENT CONCEPT

Global Summary: This broad-ranging *Juncus roemerianus* (needlegrass rush) salt marsh community is characterized by discrete, dense patches usually strongly dominated by *Juncus roemerianus* (needlegrass rush), often with few other associates, or with low cover of *Distichlis spicata* (saltgrass), *Spartina alterniflora* (smooth cordgrass), *Spartina patens* (saltmeadow cordgrass), and *Limonium carolinianum* (lavender thrift). As currently defined, this community occurs in a variety of settings in different marsh regions including both "high" and "low" marshes. For example, large expanses of this type are found in northwest Florida at or below the mean high water line. In other regions it may be found as isolated patches within high salt marsh, or may dominate vast areas at the heads of tidal creeks. In general, the prevalence of *Juncus roemerianus* (needlegrass rush) in Florida indicates the prevalence of high marshes (above mean high water). Its hydrology is generally irregularly tidally flooded.

ENVIRONMENTAL DESCRIPTION

Assateague Island National Seashore Environment: This association occurs within the low and high salt marshes of the bayside, and therefore is usually surrounded by Low Salt Marsh(CEGL006586) or High Salt Marsh (CEGL004197). Soils are generally poorly to very poorly drained, often with standing water atop peat accumulations (averaging 15 cm in depth) which in turn overlie gleyed sands. Average elevation of this association is 0.06 m as calculated from lidar-derived data of Brock et al. (2007). It occurs on the bayside of the island, seaward of Wax-myrtle Shrub Swamp (CEGL003840), and in tight association with the other salt marsh associations.

Global Environment: Large expanses of this type are found in northwest Florida, where approximately 60% of the salt marshes consist of monospecific stands of this type. These stands extend nearly to the water's edge and may be considered low marsh (Montague and Wiegert 1990). In other regions of Florida, including northeast Florida, Indian River (central Atlantic coast), and south Florida, *Juncus roemerianus* (needlegrass rush) occurs in smaller discrete patches of high marsh (Montague and Wiegert 1990). Presumably, this type also occurs primarily as high salt marsh along the Atlantic coast as well (Hackney and de la Cruz 1982). In Mississippi *Juncus roemerianus* (needlegrass rush) marsh was inundated less than 5.4% of the time that any portion of the marsh was flooded (Eleuterius and Eleuterius 1979). Due to longer and more frequent periods of exposure and

resulting evaporation, interstitial water salinity may be higher than more frequently inundated zones. In addition, the interstitial water salinity was generally higher and more stable than flood water (Hackney and de la Cruz 1982). A range of soil conditions may be present in this broadly defined association, but soils are generally poorly to very poorly drained. In some areas, including tall-growth zones, soils were highly organic and peaty (averaging 15 cm in depth?), while shorter zones occurred on sandy soils underlain by clay (Eleuterius and Caldwell 1984). In general, *Juncus roemerianus* (needlegrass rush) occurs on sandy substrates (Penfound 1952). pH at the Mississippi site was 6.2 (Hackney and de la Cruz 1982).

VEGETATION DESCRIPTION

Assateague Island National Seashore Vegetation: *Juncus roemerianus* (needlegrass rush) forms large clones or clonelike patches effectively excluding other species. Vegetation generally covers 98 to 100% of the ground with a small percentage of other herbs associated, which may include scattered individuals of *Spartina alterniflora* (smooth cordgrass), *Spartina patens* (saltmeadow cordgrass), *Distichlis spicata* (saltgrass), *Limonium carolinianum* (lavender thrift), or *Iva frutescens* (Jesuit's bark).

Global Vegetation: The very dense vegetation is typically exclusively codominated by *Juncus roemerianus* (needlegrass rush) and *Spartina alterniflora* (smooth cordgrass). Tall and short growth-form zones have been noted in several areas (Kruczynski et al. 1978, Hackney and de la Cruz 1982, Stout 1984, Montague and Wiegert 1990). Associates that may occur at low cover include *Borrichia frutescens* (bushy seaside-tansy), *Baccharis halimifolia* (eastern baccharis), *Spartina alterniflora* (smooth cordgrass), *Distichlis spicata* (saltgrass), *Schoenoplectus robustus* (sturdy bulrush), *Limonium carolinianum* (lavender thrift), *Symphyotrichum tenuifolium* (perennial saltmarsh aster), *Symphyotrichum subulatum* (eastern annual saltmarsh aster), and (in more southern occurrences) *Ipomoea sagittata* (saltmarsh morning-glory).

MOST ABUNDANT SPECIES

Assateague Island National Seashore

Stratum	Lifeform	Species
Herb (field)	Graminoid	*Juncus roemerianus* (needlegrass rush)

Global

Stratum	Lifeform	Species
Herb (field)	Graminoid	*Juncus roemerianus* (needlegrass rush)

CHARACTERISTIC SPECIES

Assateague Island National Seashore: *Juncus roemerianus* (needlegrass rush)

Global: *Juncus roemerianus* (needlegrass rush)

OTHER NOTEWORTHY SPECIES

Global: Vulnerable: *Ptilimnium nodosum* (piedmont mock bishopweed, G2); **Invasive/Exotic**: *Schinus terebinthifolius* (Brazilian peppertree, invasive/exotic, High)

CONSERVATION STATUS RANK

Global Rank & Reasons: G5 (4-Feb-2009). This is a common coastal marsh of the Gulf and southern-central Atlantic coasts of the United States.

CLASSIFICATION

Status: Standard

Classification Confidence: 1 - Strong

Assateague Island National Seashore Comments: The salt marsh community (Hill 1986) and the salt marsh (Higgins et al. 1971) described from Assateague Island are partially contained within this association.

Global Comments: This community is common on the southeastern seaboard, but large undisturbed areas are of high conservation concern. Although this community exhibits little floristic variation across its range, the associated animal species may vary to a greater extent. This community may not occur west of Texas. *Juncus roemerianus* (needlegrass rush) was found to be lower in elevation than the associated *Spartina patens* (saltmeadow cordgrass) type and mixed type (Cooper and Waits 1973).

Global Similar Associations:

- *Spartina alterniflora - Juncus roemerianus - Distichlis spicata* Louisianian Zone Salt Tidal Herbaceous Vegetation (CEGL004190)
- *Spartina patens - Distichlis spicata - (Juncus roemerianus)* Herbaceous Vegetation (CEGL004197)

Global Related Concepts:

- *Juncus roemerianus* Tidal Herbaceous Vegetation (Harrison 2001) =
- *Juncus roemerianus* Herbaceous Vegetation (Bowman 2000) =
- *Juncus roemerianus* Herbaceous Vegetation (Harrison 2004) =
- *Juncus roemerianus* Tidal Herbaceous Vegetation (VDNH 2003) =
- *Juncus roemerianus* Tidal Herbaceous Vegetation (Coulling 2002) =
- *Juncus roemerianus* association of the low marsh (Adams 1963) =
- *Juncus* type (Cooper and Waits 1973) =
- *Spartina - Distichlis - Juncus* associes (Penfound 1952) >
- Brackish Marsh (Schafale and Weakley 1990) >

- Brackish Marsh (Smith 1996a) >
- Brackish Marsh (Wieland 1994a) >
- Brackish Marsh (Needlerush Subtype) (Schafale 2000) **?**
- Irregularly flooded salt marsh (Jenkins 1974) =
- Lower high marsh (Stalter 1973a) =
- Needlerush - saltmeadow type (Nicholson and Van Deusen 1954) =
- Saline Marsh (Wieland 1994a) >
- Salt marsh (Higgins et al. 1971) >
- Salt marsh community (Hill 1986) >
- Smooth Cordgrass Series (Diamond 1993) >
- Tidal Mesohaline / Polyhaline Marsh (Fleming et al. 2001) >
- Tidal Mesohaline Marsh (Harrison 2004) >

ELEMENT DISTRIBUTION

Assateague Island National Seashore Range: This association is not present of the northern end of the island. It is best developed north and south of the old ferry landing.

Global Range: This community is widespread along the Atlantic and Gulf coasts of North America ranging from Delaware south to Florida, and west to Texas.

Nations: US

States/Provinces: AL:S2S3, DE:S1, FL, GA, LA?, MD:S5, MS, NC, SC, TX:S4, VA:S4

TNC Ecoregions: 31:C, 53:C, 54:C, 55:C, 56:C, 57:C, 58:C

USFS Ecoregions (1994/95): 231Fb:CCC, 232Ad:CCC, 232Br:CCC, 232Bx:CCC, 232Bz:CCC, 232Cb:CCC, 232Ce:CCC, 232Ch:CCC, 232Ci:CCC, 232Cj:CCC, 232Db:CCP, 232Dc:CCC, 232Dd:CCC, 232De:CCP, 232Eb:CCC, 232Ec:CC?, 232Ed:CCC, 232Gb:CCC, 255Da:CCP, 255Dc:CCC

Federal Lands: NPS (Assateague Island, Canaveral, Cape Hatteras, Cape Lookout, Cumberland Island, Fort Frederica?, Fort Pulaski, Timucuan); USFS (Croatan); USFWS (Anahuac, Big Boggy, Bon Secour, Brazoria, Cedar Island, Chesapeake Marshlands, Chincoteague, McFaddin, San Bernard, Swanquarter, Texas Point)

ELEMENT SOURCES

Assateague Island National Seashore Plots and Observation Points: Plots: ASIS.86 (27RR02), ASIS.87 (32RR09), ASIS.88 (32RR14), ASIS.89 (37AB01), ASIS.90 (42RR01); **Observation Points:** AA062, AA078, AA080, AA084, AA088, AA098, AA108, AA112, AA113, AA116, AA121, AA134, AA143, AA156, AA158, AA166, AA167, AA185.

Local Description Authors: L.A. Sneddon and A. Berdine

Global Description Authors: R.E. Evans, mod. L.A. Sneddon and M. Pyne

References: Adams 1963, Bowman 2000, Cooper and Waits 1973, Coulling 2002, Coxe 2009, Diamond 1993, Eleuterius 1976, Eleuterius and Caldwell 1984, Eleuterius and Eleuterius 1979, Fleming and Patterson 2011a, Fleming et al. 2001, Fleming et al. 2007b, Govus 1998, Hackney and de la Cruz 1981, Hackney and de la Cruz 1982, Harrison 2001, Harrison 2004, Harrison 2011, Higgins et al. 1971, Hill 1986, Jenkins 1974, Kruczynski et al. 1978, LNHP 2009, Lynch 1941, Montague and Wiegert 1990, Nelson 1986, Nicholson and Van Deusen 1954, Peet et al. unpubl. data, Penfound 1952, Schafale 2000, Schafale 2003b, Schafale 2011, Schafale and Weakley 1990, Schotz pers. comm., Smith 1996a, Southeastern Ecology Working Group n.d., Stalter 1973a, Stalter 1973b, Stout 1984, TNC 1995c, VDNH 2003, Wieland 1994a, Wieland 1994b, Wieland 2000b



Needlerush Marsh, AA Point 112, August 13, 2009 (UTM X: 486834, UTM Y: 4230055)

Brackish Meadow

***Panicum virgatum* - *Spartina patens* - *Carex silicea* Herbaceous Vegetation**
Switchgrass - Saltmeadow Cordgrass - Beach Sedge Herbaceous Vegetation
Identifier: CEGL006150

USNVC CLASSIFICATION

Division	Temperate & Boreal Atlantic Coastal Salt Marsh (2.B.7.Nb)
Macrogroup	Eastern North American Atlantic Salt Marsh (M079)
Group	North American Atlantic High Salt Marsh (G121)
Association	Brackish Meadow

ELEMENT CONCEPT

Global Summary: This brackish meadow of the Atlantic Coast from New Hampshire to North Carolina 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* (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* (crimson-eyed 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

Assateague Island National Seashore Environment: This association occurs sparingly on Assateague Island National Seashore as small patches in the transition zone between High Salt Marsh (CEGL004197) and adjacent shrublands, and occurs at a slightly higher elevation relative to the high salt marsh. Substrate is sand with a shallow organic layer or algal crust.

Global Environment: 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

Assateague Island National Seashore Vegetation: The vegetation is herbaceous and usually dominated by a mix of graminoids and some forbs. *Panicum virgatum* (switchgrass) is dominant, or codominant with *Setaria parviflora* (marsh bristlegrass) or *Schoenoplectus pungens* (common threesquare). Forbs and other graminoids include *Sabatia stellaris* (rose of Plymouth), *Linum medium* (stiff yellow flax), *Fimbristylis castanea* (marsh fimbry), *Spartina patens* (saltmeadow cordgrass), and *Symphyotrichum subulatum* (eastern annual saltmarsh aster). Scattered shrubs may include *Iva frutescens* (Jesuit's bark), *Morella cerifera* (wax-myrtle), and *Baccharis halimifolia* (eastern baccharis).

Global Vegetation: 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* (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

Assateague Island National Seashore

Stratum	Lifeform	Species
Herb (field)	Graminoid	*Panicum virgatum* (switchgrass), *Schoenoplectus pungens* (common threesquare)

Global

Stratum	Lifeform	Species
Herb (field)	Graminoid	*Panicum virgatum* (switchgrass), *Spartina patens* (saltmeadow cordgrass)

CHARACTERISTIC SPECIES

Assateague Island National Seashore: *Panicum virgatum* (switchgrass), *Sabatia stellaris* (rose of Plymouth)

Global: *Panicum virgatum* (switchgrass), *Spartina patens* (saltmeadow cordgrass)

CONSERVATION STATUS RANK

Global Rank & Reasons: GNR (1-Dec-1997).

CLASSIFICATION

Status: Standard

Classification Confidence: 2 - Moderate

Assateague Island National Seashore Comments: This vegetation can be distinguished from High Salt Marsh (CEGL004197) by the unimportance or absence of *Spartina patens* (saltmeadow cordgrass) and the importance of *Panicum virgatum* (switchgrass), as well as other forbs, including *Sabatia stellaris* (rose of Plymouth) and *Linum medium* (stiff yellow flax).

Global Comments: This association is similar in species composition to the herbaceous component of *Baccharis halimifolia - Iva frutescens / Panicum virgatum* Shrubland (CEGL003921). This association is less developed in the northern edge of its range (New Hampshire).

Global Similar Associations:

- (*Morella cerifera*) / *Panicum virgatum - Spartina patens* Herbaceous Vegetation (CEGL004129) is not tidal or brackish; occurs in swales rather than on salt marshes.
- *Baccharis halimifolia - Iva frutescens / Panicum virgatum* Shrubland (CEGL003921)
- *Iva frutescens / Spartina patens* Shrubland (CEGL006848)
- *Schoenoplectus pungens - Eleocharis parvula* Herbaceous Vegetation (CEGL006398)
- *Spartina patens - Festuca rubra - (Spartina pectinata)* Herbaceous Vegetation (CEGL006368)

Global Related Concepts:

- *Panicum virgatum - Spartina patens* Herbaceous Vegetation (Harrison 2004) =
- *Panicum virgatum* Tidal Herbaceous Vegetation (Clancy 1996) =
- *Panicum virgatum* Tidal Herbaceous Vegetation (Harrison 2001) =
- *Panicum virgatum* Wetland Association (Heckscher et al. 1995) >
- *Panicum virgatum* medium-tall grasslands (Metzler and Barrett 2001) =
- *Panicum virgatum* upland border (Nixon 1982) **?**
- *Panicum virgatum* upper border (Miller and Egler 1950) =

- Brackish Tidal Marsh (Enser 1999) >
- Brackish Tidal Marsh (Rawinski 1984a) **?**
- Fresh marsh (Hill 1986) >
- Freshwater marsh (Fender 1937) >
- Mesic shrub community (Higgins et al. 1971) >
- Salt Marsh (Rawinski 1984a) **?**
- Salt marsh complex, upland border (Breden 1989) **?**
- Tidal Oligohaline Marsh (Harrison 2004) >

ELEMENT DISTRIBUTION

Assateague Island National Seashore Range: Only two small patches of this vegetation have been confirmed with accuracy assessment points, one just south of the Assateague State Park, and the other in the Fox Hill vicinity.

Global Range: This association occurs from New Hampshire to North Carolina.

Nations: US

States/Provinces: CT, DE:S3?, MA, MD:S4, ME?, NC, NJ:S2, NY:S1S2, RI, VA?

TNC Ecoregions: 57:C, 58:C, 61:C, 62:C

USFS Ecoregions (1994/95): 221Ab:CCC, 221Ac:CCC, 221Ad:CCC, 221Ak:CCC, 232Aa:CCC, 232Ab:CCC, 232Ac:CCC, 232Ad:CCC, 232Bx:CCC, 232Bz:CCC

Federal Lands: NPS (Assateague Island, Cape Cod, Fire Island, Gateway); USFWS (E.B. Forsythe, Muskeget Island?, Parker River, Prime Hook, Supawna Meadows)

ELEMENT SOURCES

Assateague Island National Seashore Plots and Observation Points: Plots: None; **Observation Points:** AA100, AA485, AA553, AA622, AA623, AA625.

Local Description Authors: L.A. Sneddon

Global Description Authors: S.L. Neid after D. Hunt

References: Bowman 2000, Breden 1989, Breden et al. 2001, Clancy 1996, Coxe 2009, Dowhan and Rozsa 1989, Eastern Ecology Working Group n.d., Edinger et al. 2002, Edinger et al. 2008a, Enser 1999, Fender 1937, Harrison 2001, Harrison 2004, Harrison 2011, Heckscher et al. 1995, Higgins et al. 1971, Hill 1986, Hunt 2000, Johnson 1985b, Klopfer et al. 2002, Lundgren et al. 2000, Metzler and Barrett 2001, Metzler and Barrett 2006, Miller and Egler 1950, NRCS 2001b, NatureServe 2009, Nixon 1982, Rawinski 1984a, Schafale 2011, Schafale pers. comm., Sneddon et al. 2010, Sperduto 2000b, Swain and Kearsley 2001, TNC 1995c



Brackish Meadow, AA Point 1553, October 3, 2009 (UTM X: 482647, UTM Y: 4216684)

Transitional Tidal Marsh

***Schoenoplectus americanus* - *Spartina patens* Herbaceous Vegetation**
Chairmaker's Bulrush - Saltmeadow Cordgrass Herbaceous Vegetation
Identifier: CEGL006612

USNVC CLASSIFICATION

Division	Temperate & Boreal Atlantic Coastal Salt Marsh (2.B.7.Nb)
Macrogroup	Eastern North American Atlantic Salt Marsh (M079)
Group	North American Atlantic High Salt Marsh (G121)
Association	Transitional Tidal Marsh

ELEMENT CONCEPT

Global Summary: This brackish marsh occurs in wet depressions at the upper reaches of irregularly flooded tidal marshes of the mid-Atlantic coast. It occurs at the ecotone between low and high salt marsh zones. It is irregularly flooded, occurring just above the zone of regular tidal flooding, but is more frequently flooded than *Spartina patens* (saltmeadow cordgrass)-dominated high marsh. This community is dominated by colonies of *Schoenoplectus americanus* (chairmaker's bulrush), which often accounts for 40-75% of the total vegetation cover or codominant with *Spartina patens* (saltmeadow cordgrass) at some sites. Associated species can include *Pluchea odorata* (sweetscent), *Juncus roemerianus* (needlegrass rush), *Spartina alterniflora* (smooth cordgrass), *Spartina cynosuroides* (big cordgrass), *Distichlis spicata* (saltgrass), and *Limonium carolinianum* (lavender thrift) plus *Typha* (cattail) spp. and *Phragmites australis* (common reed). This community often grades into *Spartina patens* (saltmeadow cordgrass)- or *Juncus roemerianus* (needlegrass rush)-dominated high marsh landward or *Spartina alterniflora* (smooth cordgrass)- or *Spartina cynosuroides* (big cordgrass)-dominated low marsh seaward. This association is best developed where the elevation gradient across the marsh is more gradual, allowing for greater diversity of physical conditions of duration and frequency of flooding.

ENVIRONMENTAL DESCRIPTION

Assateague Island National Seashore Environment: A single small patch of this vegetation was discovered on the island during accuracy assessment. It occurs adjacent to high salt marsh in the proximity of the large pond at Tingles Campground, and forms a small inlet into the surrounding salt shrub vegetation.

Global Environment: This association occurs in wet depressions of high salt marshes and in the ecotone between low and high salt marsh zones. It is irregularly flooded, occurring just above the zone of regular tidal flooding, but is more frequently flooded than *Spartina patens* (saltmeadow cordgrass)-dominated high marsh. This association is best developed where the elevation gradient across the marsh is more gradual, allowing for greater diversity of physical conditions of duration and frequency of flooding.

VEGETATION DESCRIPTION

Assateague Island National Seashore Vegetation: Incomplete vegetation data taken during accuracy assessment note that *Schoenoplectus americanus* (chairmaker's bulrush) is strongly dominant, overtopping scattered *Iva frutescens* (Jesuit's bark). Other associates include *Pluchea odorata* (sweetscent), *Phragmites australis* (common reed), and standing dead *Spartina patens* (saltmeadow cordgrass).

Global Vegetation: This community is dominated by colonies of *Schoenoplectus americanus* (chairmaker's bulrush), which often accounts for 40-75% of the total vegetation cover or codominant with *Spartina patens* (saltmeadow cordgrass) at some sites. Associated species can include *Pluchea odorata* (sweetscent), *Juncus roemerianus* (needlegrass rush), *Hibiscus moscheutos* (crimson-eyed rosemallow), *Spartina alterniflora* (smooth cordgrass), *Spartina cynosuroides* (big cordgrass), *Distichlis spicata* (saltgrass), *Limonium carolinianum* (lavender thrift), and *Typha* (cattail) spp. *Phragmites australis* (common reed) also occurs in this vegetation. This community often grades into vegetation dominated by *Spartina patens* (saltmeadow cordgrass) or *Juncus roemerianus* (needlegrass rush) in high marsh landward and by vegetation dominated by *Spartina alterniflora* (smooth cordgrass) or *Spartina cynosuroides* (big cordgrass) in low marsh seaward. This vegetation does not typically occur along the edge of tidal channels.

MOST ABUNDANT SPECIES

Assateague Island National Seashore

Stratum	Lifeform	Species
Herb (field)	Graminoid	*Schoenoplectus americanus* (chairmaker's bulrush)

Global

Stratum	Lifeform	Species
Herb (field)	Graminoid	*Schoenoplectus americanus* (chairmaker's bulrush)

CHARACTERISTIC SPECIES

Assateague Island National Seashore: *Schoenoplectus americanus* (chairmaker's bulrush)

Global: *Schoenoplectus americanus* (chairmaker's bulrush), *Spartina patens* (saltmeadow cordgrass)

CONSERVATION STATUS RANK

Global Rank & Reasons: GNR (17-Apr-2000).

CLASSIFICATION

Status: Standard

Classification Confidence: 2 - Moderate

Global Comments: The halinity range of this vegetation is uncertain, but the relatively higher species diversity suggests lower halinity than that characteristic of *Spartina patens - Distichlis spicata - (Juncus gerardii)* Herbaceous Vegetation (CEGL006006). It is unclear whether stands attributed to this type at North Landing River and Back Bay National Wildlife Refuge represent the same vegetation. The prevailing tidal influence in these areas is generally wind-generated rather than strictly lunar (Coulling 2002).

Global Similar Associations:

- *Schoenoplectus americanus - (Spartina patens) - Typha* spp. Herbaceous Vegetation (CEGL008476)
- *Schoenoplectus pungens* Tidal Herbaceous Vegetation (CEGL004188)

Global Related Concepts:

- *Schoenoplectus americanus - Spartina patens* Herbaceous Vegetation (Harrison 2004) =
- *Schoenoplectus americanus - Spartina patens* Herbaceous Vegetation (Fleming et al. 2007b) =
- *Schoenoplectus americanus - Spartina patens* Tidal Herbaceous Vegetation (Bartgis 1986) =
- *Schoenoplectus americanus* Tidal Herbaceous Vegetation (Clancy 1996) **?**
- *Spartina patens - Schoenoplectus americanus* Tidal Herbaceous Vegetation (VDNH 2003) =
- *Spartina patens - Schoenoplectus americanus* Tidal Herbaceous Vegetation (Coulling 2002) =
- Tidal Oligohaline Marsh (Fleming et al. 2001) >
- Tidal Oligohaline Marsh (Harrison 2004) >

OTHER COMMENTS

Other Comments: It is likely that the setting is brackish and nontidal; the role of disturbance in the origin of this patch is not clear.

ELEMENT DISTRIBUTION

Assateague Island National Seashore Range: This vegetation was noted in only one location, east of the large pond in the Tingles Campground vicinity.

Global Range: This association is currently described from mid-Atlantic states of Delaware, Maryland and Virginia. It possibly extends south to Georgia.

Nations: US

States/Provinces: DE?, GA?, MA, MD:S4, NC?, NJ:S2, SC?, VA:S3?

TNC Ecoregions: 56:?, 57:C, 58:C, 62:C

USFS Ecoregions (1994/95): 232Ab:CCC, 232Ac:CCC, 232Br:CCC, 232Bx:CCC, 232Bz:CCC, 232Ch:CCC, 232Ci:CCC

Federal Lands: NPS (Assateague Island, Cape Cod, Colonial); USFWS (Back Bay, Cape May, Chesapeake Marshlands, E.B. Forsythe)

ELEMENT SOURCES

Assateague Island National Seashore Plots and Observation Points: Plots: None; **Observation Points:** AA233.

Local Description Authors: L.A. Sneddon

Global Description Authors: S.L. Neid, mod. L.A. Sneddon

References: Bartgis 1986, Bowman 2000, Clancy 1996, Coulling 2002, Coxe 2009, Eastern Ecology Working Group n.d., Fleming 2001a, Fleming and Patterson 2011a, Fleming et al. 2001, Fleming et al. 2007b, Harrison 2001, Harrison 2004, Harrison 2011, NatureServe 2009, Patterson 2008c, Sneddon et al. 2010, VDNH 2003



Transitional Tidal Marsh, AA Point 233, September 16, 2009 (UTM X: 484865, UTM Y: 4224575)

High Salt Marsh

***Spartina patens - Distichlis spicata - (Juncus roemerianus)* Herbaceous Vegetation**
Saltmeadow Cordgrass - Saltgrass - (Black Needlerush) Herbaceous Vegetation
Identifier: CEGL004197

USNVC CLASSIFICATION

Division	Temperate & Boreal Atlantic Coastal Salt Marsh (2.B.7.Nb)
Macrogroup	Eastern North American Atlantic Salt Marsh (M079)
Group	North American Atlantic High Salt Marsh (G121)
Association	High Salt Marsh

ELEMENT CONCEPT

Global Summary: This coastal community is an irregularly tidally flooded high salt marsh of the mid- and southern Atlantic Coast from Delaware south to Florida. It is dominated by *Spartina patens* (saltmeadow cordgrass), which forms meadows with a distinct "cowlicked" appearance. These meadows occur at slightly higher elevations than adjacent, regularly flooded low salt marsh occupying the zone extending from mean high tide landward approximately to the limit of high spring tides. The substrate is peat of variable depths overlying sand. *Distichlis spicata* (saltgrass) can be codominant. Additional associated species that generally occur in low abundance can include *Limonium carolinianum* (lavender thrift), *Agalinis maritima* (saltmarsh false foxglove), *Salicornia virginica* (Virginia glasswort), *Juncus roemerianus* (needlegrass rush), *Sabatia stellaris* (rose of Plymouth), *Borrichia frutescens* (bushy seaside-tansy), *Lythrum lineare* (wand lythrum), *Solidago sempervirens* (seaside goldenrod), *Pluchea odorata* (sweetscent), *Hibiscus moscheutos ssp. moscheutos* (crimson-eyed rosemallow), or *Atriplex prostrata* (triangle orache). Shrub seedlings of *Baccharis halimifolia* (eastern baccharis), *Iva frutescens* (Jesuit's bark), and/or *Morella cerifera* (wax-myrtle) may occur sporadically. Diagnostic species are *Spartina patens* (saltmeadow cordgrass), *Distichlis spicata*, *Borrichia frutescens* (bushy seaside-tansy), *Kosteletzkya virginica* (Virginia saltmarsh mallow), and *Pluchea odorata* (sweetscent). One unusual Virginia occurrence is dominated by *Plantago maritima var. juncoides* (goose tongue).

ENVIRONMENTAL DESCRIPTION

Assateague Island National Seashore Environment: This high salt marsh vegetation is irregularly to regularly flooded by the brackish waters from the bay or nearby water channels and its water table is at or near the surface. Soils are generally 10 to 30 cm of very poorly drained peaty organics overtopping gray or mottled sand. A variant of the association dominated by *Schoenoplectus robustus* (sturdy bulrush) is characterized by shallow peaty soils (up to 20 cm) that are very poorly drained and appear to be influenced by freshwater, amidst infrequent brackish overwash.

Global Environment: 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 high 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

Assateague Island National Seashore Vegetation: This association covers extensive areas of bayside marsh. It is almost solely vegetated by *Spartina patens* (saltmeadow cordgrass) (from 75-100% cover) with few associated species except for small amounts of *Distichlis spicata* (saltgrass) (up to 10% cover). Associates may include *Symphyotrichum subulatum* (eastern annual saltmarsh aster), *Schoenoplectus robustus* (sturdy bulrush), and low cover of *Spartina alterniflora* (smooth cordgrass). Other more uncommon associates found at low cover include *Fimbristylis castanea* (marsh fimbry), *Lythrum lineare* (wand lythrum), *Pluchea odorata* (sweetscent), and *Sabatia stellaris* (rose of Plymouth). A variant of this community has *Schoenoplectus robustus* (sturdy bulrush) as a substantial component. It is comprised of *Schoenoplectus robustus* (sturdy bulrush) forming large discrete patches up to a half hectare in size, with *Spartina patens* (saltmeadow cordgrass) and *Distichlis spicata* (saltgrass) forming a continuous and dense "understory." This variant is limited to the bayside high marsh on Assateague Island National Seashore. Combined, these three species completely cover the ground except for a small percentage of leaf and stem litter that persists from past growing seasons. *Baccharis halimifolia* (eastern baccharis), occurring primarily as seedlings, is also an associate.

Global Vegetation: This high salt marsh is dominated by *Spartina patens* (saltmeadow cordgrass) with *Distichlis spicata* (saltgrass) occurring as a common associate or a codominant species. Associated species that generally occur in low abundance can include *Limonium carolinianum* (lavender thrift), *Agalinis maritima* (saltmarsh false foxglove), *Salicornia virginica* (Virginia glasswort), *Sabatia stellaris* (rose of Plymouth), *Borrichia frutescens* (bushy seaside-tansy), *Lythrum lineare* (wand lythrum), *Juncus roemerianus* (needlegrass rush), *Solidago sempervirens* (seaside goldenrod), *Pluchea odorata* (sweetscent), *Hibiscus moscheutos ssp. moscheutos* (crimson-eyed rosemallow), and/or *Atriplex prostrata* (triangle orache). Shrub seedlings of *Baccharis halimifolia* (eastern baccharis), *Iva frutescens* (Jesuit's bark), and/or *Morella cerifera* (wax-myrtle) may occur sporadically.

MOST ABUNDANT SPECIES

Assateague Island National Seashore

Stratum	Lifeform	Species
Herb (field)	Graminoid	*Distichlis spicata* (saltgrass), *Spartina patens* (saltmeadow cordgrass)

Global

Stratum	Lifeform	Species
Herb (field)	Graminoid	*Distichlis spicata* (saltgrass), *Spartina patens* (saltmeadow cordgrass)

CHARACTERISTIC SPECIES

Assateague Island National Seashore: *Distichlis spicata* (saltgrass), *Spartina patens* (saltmeadow cordgrass)

Global: *Distichlis spicata* (saltgrass), *Kosteletzkya virginica* (Virginia saltmarsh mallow), *Pluchea odorata* (sweetscent), *Spartina patens* (saltmeadow cordgrass)

CONSERVATION STATUS RANK

Global Rank & Reasons: G4G5 (13-May-2002). Although widespread on the eastern seaboard, examples of this community that have not been impacted by ditching, dredging and filling, mosquito spraying, and other activities are relatively uncommon.

CLASSIFICATION

Status: Standard

Classification Confidence: 2 - Moderate

Assateague Island National Seashore Comments: This vegetation grades into Brackish Interdunal Swale (CEGL006342) on the interior portions of Assateague Island National Seashore. Here, *Spartina patens* (saltmeadow cordgrass) may be dominant, but is influenced by groundwater rather than tidal flooding.

The salt marsh community described from Assateague Island by Hill (1986) and Higgins et al. (1971) are partially contained within this community. Hill (1986) notes the "infrequent but widespread" presence of *Juncus gerardii* (saltmeadow rush) in salt marshes of Assateague, and denotes *Borrichia frutescens* (bushy seaside-tansy) as "rare" and confined to the Virginia portion of the island.

Global Comments: Although *Juncus roemerianus* (needlegrass rush) may not be present or have minor cover in some stands, it is a differential species and was chosen as a nominal of this association to distinguish it from *Spartina patens - Distichlis spicata - (Juncus gerardii)* Herbaceous Vegetation (CEGL006006), which occurs to the north. *Spartina patens - Distichlis spicata - (Juncus roemerianus)* Herbaceous Vegetation (CEGL004197) is differentiated by the absence or relative infrequent occurrence of *Juncus gerardii* (saltmeadow rush), *Plantago maritima* (goose tongue), and *Triglochin maritima* (seaside arrowgrass) (in pannes), and by the importance 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). If discrete patches of *Juncus roemerianus* (needlegrass rush) occur in substantial size (several acres), the community is considered to be *Juncus roemerianus* (needlegrass rush) Herbaceous Vegetation (CEGL004186). Currently, some unusually diverse variants exist in Virginia that may warrant recognition as a separate association.

Global Similar Associations:

- *Juncus roemerianus* Herbaceous Vegetation (CEGL004186)
- *Spartina alterniflora - Distichlis spicata* Tidal Herbaceous Vegetation (CEGL006586)

- *Spartina patens - Distichlis spicata - (Juncus gerardii)* Herbaceous Vegetation (CEGL006006)

Global Related Concepts:

- *Aster tenuifolius - Distichlis spicata - Fimbristylis castanea - Borrichia frutescens - Spartina patens* association (Adams 1963) =
- *Spartina - Distichlis - Juncus* associes (Penfound 1952) =
- *Spartina patens - Distichlis spicata - (Juncus roemerianus)* Herbaceous Vegetation (Fleming et al. 2007b) =
- *Spartina patens - Distichlis spicata - Juncus roemerianus* Herbaceous Vegetation (Harrison 2004) =
- *Spartina patens - Distichlis spicata - Sarcocornia perennis - Limonium carolinianum* Herbaceous Vegetation (Coulling 2002) <
- *Spartina patens - Distichlis spicata* Herbaceous Vegetation (Clancy 1996) =
- *Spartina patens - Distichlis spicata* Herbaceous Vegetation (Harrison 2001) ><
- *Spartina patens - Distichlis spicata* Herbaceous Vegetation (Coulling 2002) <
- *Spartina patens - Distichlis spicata* high marsh (Clancy 1993b) =
- *Spartina patens* type (Cooper and Waits 1973) =
- Brackish Marsh (Salt Meadow Cordgrass Subtype) (Schafale 2000) **?**
- High marsh (Cooper 1974) =
- Salt Marsh (Schafale and Weakley 1990) >
- Salt marsh (Higgins et al. 1971) >
- Salt marsh community (Hill 1986) >
- Tidal Mesohaline / Polyhaline Marsh (Fleming et al. 2001) >
- Tidal Mesohaline Marsh (Harrison 2004) >

ELEMENT DISTRIBUTION

Assateague Island National Seashore Range: This association is widespread on the bayside of Assateague Island National Seashore.

Global Range: This association occurs along the Atlantic Coast from Delaware to Florida.

Nations: US

States/Provinces: DE:S4, FL, GA, MD, NC, NJ, SC, VA

TNC Ecoregions: 56:C, 57:C, 58:C, 62:C

USFS Ecoregions (1994/95): 232Ab:CCC, 232Br:CCC, 232Bx:CCC, 232Bz:CCC, 232Ce:CCC, 232Ch:CCC, 232Ci:CCC

Federal Lands: NPS (Assateague Island, Cape Hatteras, Cape Lookout, Cumberland Island, Fort Pulaski); USFWS (Back Bay?, Cape May, Chesapeake Marshlands, Chincoteague, Pea Island, Prime Hook, Swanquarter)

ELEMENT SOURCES

Assateague Island National Seashore Plots and Observation Points: Plots: ASIS.47 (47AB02), ASIS.48 (32RR05), ASIS.49 (77AB02), ASIS.50 (TNC11), ASIS.51 (47RR01), ASIS.54 (67AB02); **Observation Points:** AA081, AA189, AA235, AA237, AA297, AA323, AA347, AA489, AA496, AA540, AA562, AA582, AA610, AA624, AA636, AA778.

Local Description Authors: L.A. Sneddon

Global Description Authors: L.A. Sneddon, mod. S.L. Neid

References: Adams 1963, Bowman 2000, Clancy 1993b, Clancy 1996, Cooper 1974, Cooper and Waits 1973, Coulling 2002, Coxe 2009, Eastern Ecology Working Group n.d., Fleming 2001a, Fleming and Patterson 2003, Fleming and Patterson 2011a, Fleming et al. 2001, Fleming et al. 2007b, Govus 1998, Harrison 2001, Harrison 2004, Harrison 2011, Higgins et al. 1971, Hill 1986, Nelson 1986, Peet et al. unpubl. data, Penfound 1952, Schafale 2000, Schafale 2003b, Schafale 2011, Schafale and Weakley 1990, TNC 1995c



High Salt Marsh, AA Point 297, September 17, 2009 (UTM X: 484469, UTM Y: 4223506)

Low Salt Marsh
***Spartina alterniflora - Distichlis spicata* Tidal Herbaceous Vegetation**
Smooth Cordgrass - Saltgrass Tidal Herbaceous Vegetation
Identifier: CEGL006586

USNVC CLASSIFICATION

Division	Temperate & Boreal Atlantic Coastal Salt Marsh (2.B.7.Nb)
Macrogroup	Eastern North American Atlantic Salt Marsh (M079)
Group	North American Atlantic Low Salt Marsh (G122)
Association	Low Salt Marsh

ELEMENT CONCEPT

Global Summary: This community represents low salt marsh vegetation dominated by the "short form" of *Spartina alterniflora* (smooth cordgrass) and *Distichlis spicata* (saltgrass), although the latter species may be somewhat less abundant. Diversity is exceedingly low. Some stands may be codominated by *Spartina patens* (saltmeadow cordgrass). Most occurrences of this community type are located in nonriverine, mesohaline marshes subject to regular, diurnal tides.

ENVIRONMENTAL DESCRIPTION

Assateague Island National Seashore Environment: This association is irregularly to regularly flooded by the brackish waters from the bay and has standing water at or near the soil surface. The substrate is a shallow layer of peat, approximately 5-20 cm, overlying gleyed sand.

Global Environment: Stands of this vegetation are located in mesohaline (5-18 ppt salinity), chiefly non-riverine marshes subject to regular, diurnal tides. The substrate typically consists of extremely dense, often firm, fibric peat rich in fine roots and rhizomes. This vegetation is documented from large estuaries that are somewhat more sheltered from storm overwash than similar vegetation of barrier island marshes.

VEGETATION DESCRIPTION

Assateague Island National Seashore Vegetation: This association is characterized by *Spartina alterniflora* (smooth cordgrass) and *Distichlis spicata* (saltgrass), occurring at variable cover, with the latter often more abundant. Total vegetation cover is usually high, near 90%, achieving a height of 0.5 m or less. Other associates are few, but when present may include *Limonium carolinianum* (lavender thrift), *Salicornia virginica* (Virginia glasswort), *Salicornia bigelovii* (dwarf saltwort), or *Sarcocornia perennis* (chickenclaws).

Global Vegetation: This community is dominated by short-statured *Spartina alterniflora* (smooth cordgrass), generally much less than 1 m in height; *Distichlis spicata* (saltgrass) is a constant and typically codominant associate. *Spartina patens* (saltmeadow cordgrass) may attain moderate to high cover in some stands. Infrequent components of this vegetation include *Limonium carolinianum*

(lavender thrift), *Schoenoplectus pungens* (common threesquare), *Iva frutescens* (Jesuit's bark), *Juncus roemerianus* (needlegrass rush), *Kosteletzkya virginica* (Virginia saltmarsh mallow), *Pluchea odorata* (sweetscent) and *Salicornia virginica* (Virginia glasswort). Species richness is very low, with an average of five species per 100 square meters.

MOST ABUNDANT SPECIES

Assateague Island National Seashore

Stratum	Lifeform	Species
Herb (field)	Graminoid	*Distichlis spicata* (saltgrass), *Spartina alterniflora* (smooth cordgrass)

Global

Stratum	Lifeform	Species
Herb (field)	Graminoid	*Distichlis spicata* (saltgrass), *Spartina alterniflora* (smooth cordgrass)

CHARACTERISTIC SPECIES

Assateague Island National Seashore: *Spartina alterniflora* (smooth cordgrass)

Global: *Distichlis spicata* (saltgrass), *Spartina alterniflora* (smooth cordgrass)

CONSERVATION STATUS RANK

Global Rank & Reasons: GNR (2-Jun-2007).

CLASSIFICATION

Status: Standard

Classification Confidence: 3 - Weak

Global Comments: Stands of this vegetation generally occupy lower landscape positions than the typically adjacent high marsh represented by *Spartina patens - Distichlis spicata - (Juncus roemerianus)* Herbaceous Vegetation (CEGL004197) and are usually flooded daily. Salt pannes dominated by *Salicornia (virginica, bigelovii, maritima) - Spartina alterniflora* Herbaceous Vegetation (CEGL004308) may form at intermediate landscape positions, where salt concentrations are higher due to evaporation between less regular episodes of inundation, and hence halophytic forbs attain greater importance. This type is documented by 11 vegetation plots and numerous National Park Service Accuracy Assessment points from Virginia and Maryland.

Global Similar Associations:

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

- *Spartina alterniflora / (Ascophyllum nodosum)* Acadian/Virginian Zone Herbaceous Vegetation (CEGL004192)
- *Spartina patens - Distichlis spicata - (Juncus roemerianus)* Herbaceous Vegetation (CEGL004197)

Global Related Concepts:

- *Spartina alterniflora - Distichlis spicata* Tidal Herbaceous Vegetation (Fleming et al. 2007b) =
- Salt marsh (Higgins et al. 1971) >
- Salt marsh community (Hill 1986) >
- Tidal Mesohaline / Polyhaline Marsh (Fleming et al. 2001) >

OTHER COMMENTS

Other Comments: Grazing has a high impact on this vegetation; an exclosure plot in this marsh is clearly visible on aerial photos.

ELEMENT DISTRIBUTION

Assateague Island National Seashore Range: This association is abundant and occurs on the bayside the length of the park.

Global Range: This association has been documented from several, chiefly non-riverine sites on the eastern and western shores of the Chesapeake Bay in Maryland and Virginia.

Nations: US

States/Provinces: DE, MD, NJ:S5, VA:S4?

TNC Ecoregions: 58:C, 62:C

USFS Ecoregions (1994/95): 232Ab:CCC, 232Ad:CCP, 232Br:CCP, 232Bx:CCC, 232Bz:CCC, 232Ch:CCC

Federal Lands: NPS (Assateague Island, Colonial, George Washington Birthplace); USFWS (Cape May, Chincoteague, E.B. Forsythe)

ELEMENT SOURCES

Assateague Island National Seashore Plots and Observation Points: Plots: ASIS.21 (32RR12), ASIS.22 (47RR02), ASIS.23 (22RR02), ASIS.24 (32RR15), ASIS.25 (72AB02), ASIS.26 (17RR01), ASIS.27 (67AB07), ASIS.31 (32RR13); **Observation Points:** AA017, AA046, AA063, AA071, AA074, AA076, AA097, AA105, AA106, AA123, AA124, AA126, AA139, AA153, AA161, AA165, AA186, AA203, AA281, AA317, AA362, AA375, AA383, AA516, AA531, AA543, AA549, AA599, AA703, AA765.

Local Description Authors: L.A. Sneddon

Global Description Authors: P.P. Coulling, mod. S.C. Gawler

References: Coulling 2002, Eastern Ecology Working Group n.d., Fleming and Patterson 2003, Fleming and Patterson 2011a, Fleming et al. 2001, Fleming et al. 2007b, Higgins et al. 1971, Hill 1986, NatureServe 2009, Patterson 2008c, Patterson 2008d, TNC 1995c



Low Salt Marsh, AA Point 105, August 13, 2009 (UTM X: 486900, UTM Y: 4230585)

Salt Panne

***Salicornia (virginica, bigelovii, maritima)* - *Spartina alterniflora* Herbaceous Vegetation (Virginia Glasswort, Dwarf Saltwort, Slender Grasswort) - Smooth Cordgrass Herbaceous Vegetation**

Identifier: CEGL004308

USNVC CLASSIFICATION

Division	Temperate & Boreal Atlantic Coastal Salt Marsh (2.B.7.Nb)
Macrogroup	Eastern North American Atlantic Salt Marsh (M079)
Group	North American Atlantic Tidal Flat & Panne (G123)
Association	Salicornia Salt Panne

ELEMENT CONCEPT

Global 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 pacifica* (Pacific swampfire), or *Spartina alterniflora* (smooth cordgrass) (short form). Common associates include *Limonium carolinianum* (lavender thrift), *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

Assateague Island National Seashore Environment: This vegetation occurs sparingly on Assateague Island National Seashore, on small flats within low salt marsh. The substrate is peat. Throughout the seasons, large areas of slight depression in the low marsh hold (presumably) brackish to hypersaline water up to 10 cm in depth.

Global Environment: 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

Assateague Island National Seashore Vegetation: Vegetation is sparse in these mudflats except for a dense algal mat that develops later in the summer. Occasional *Spartina alterniflora* (smooth cordgrass) persist in the flats, but the pannes mostly remain unvegetated until late summer and fall when *Salicornia virginica* (Virginia glasswort) and *Salicornia bigelovii* (dwarf saltwort) emerge. Other associates may include *Limonium carolinianum* (lavender thrift) and *Distichlis spicata* (saltgrass). Hill (1986) includes the following additional species as components of pannes on Assateague Island: *Bassia hirsuta* (hairy smotherweed), *Spergularia salina* (salt sandspurry), *Atriplex prostrata* (triangle orache), *Suaeda linearis* (annual seepweed), *Suaeda maritima* (herbaceous seepweed), and *Agalinis maritima* (saltmarsh false foxglove).

Global Vegetation: 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 pacifica* (Pacific swampfire), or *Spartina alterniflora* (smooth cordgrass) (short form). Common associates include *Limonium carolinianum* (lavender thrift), *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

Assateague Island National Seashore

Stratum	Lifeform	Species
Herb (field)	Forb	*Salicornia bigelovii* (dwarf saltwort)
Herb (field)	Graminoid	*Spartina alterniflora* (smooth cordgrass)

Global

Stratum	Lifeform	Species
Herb (field)	Graminoid	*Spartina alterniflora* (smooth cordgrass)
Herb (field)	Succulent forb	*Salicornia bigelovii* (dwarf saltwort), *Salicornia virginica* (Virginia glasswort), *Sarcocornia perennis* (chickenclaws)

CHARACTERISTIC SPECIES

Assateague Island National Seashore: *Salicornia bigelovii* (dwarf saltwort), *Salicornia virginica* (Virginia glasswort), *Spartina alterniflora* (smooth cordgrass)

Global: *Salicornia bigelovii* (dwarf saltwort), *Salicornia virginica* (Virginia glasswort), *Sarcocornia perennis* (chickenclaws)

CONSERVATION STATUS RANK

Global Rank & Reasons: G5 (1-Dec-1997).

CLASSIFICATION

Status: Standard

Classification Confidence: 2 - Moderate

Assateague Island National Seashore Comments: The pannes described from Assateague Island by Hill (1986) and Higgins et al. (1971) are synonymous with this community.

Global 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.

Global Similar Associations:

- *Batis maritima - Sarcocornia pacifica* Dwarf-shrubland (CEGL003956)
- *Sarcocornia pacifica* - (*Batis maritima, Distichlis spicata*) Dwarf-shrubland (CEGL002278)
- *Spartina alterniflora - Distichlis spicata* Tidal Herbaceous Vegetation (CEGL006586)

Global Related Concepts:

- *Salicornia (virginica, bigelovii, maritima) - Spartina alterniflora* Herbaceous Vegetation (Harrison 2004) =
- *Salicornia (virginica, bigelovii, maritima) - Spartina alterniflora* Herbaceous Vegetation (Fleming et al. 2007b) =

- *Salicornia - Bassia* salt flat (Harvill 1965) =
- *Salicornia europaea - Spartina alterniflora* community (Metzler and Barrett 2001) =
- *Salicornia europaea - Spartina alterniflora* community (Metzler and Barrett 1992) =
- *Salicornia virginica* Tidal Dwarf Shrubland (VDNH 2003) =
- *Salicornia virginica* Tidal Dwarf-Shrubland (Coulling 2002) =
- *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 and Weakley 1990) =
- Salt Flat (Schafale 2000) =
- Salt Flat (Fleming et al. 2001) >
- Salt Marsh (Rawinski 1984a) **?**
- Salt Panne (Clancy 1996) =
- Salt Panne (Harrison 2004) >
- Salt marsh complex, pannes (Breden 1989) =
- Salt pan (Klotz 1986) =
- Salt panne (Clancy 1993b) =
- Salt panne (Miller and Egler 1950) =
- Salt panne (Reschke 1990) =
- Spartina Saltmarsh (Gawler 2002) >
- Stunted *Spartina alterniflora* community (Miller and Egler 1950) =
- Tidal Mesohaline / Polyhaline Marsh (Fleming et al. 2001) >

ELEMENT DISTRIBUTION

Assateague Island National Seashore Range: Vegetated pannes occur sparingly on Assateague Island National Seashore. Plots sampled in 1994 documented this vegetation in three locations from the vicinity of the bridge to Tingles Campground. Two accuracy assessment points classified to this

type were documented in 2009, one near the northern tip of the island, and two within three km south of the bridge.

Global Range: This association occurs along the Mid- and North Atlantic Coast from the Canadian maritime provinces south to North Carolina and possibly South Carolina and Georgia.

Nations: CA, US

States/Provinces: CT, DE:S3, GA?, MA, MD, ME, NB, NC, NH, NJ:S3S4, NS, NY, QC:S5?, RI, SC?, VA:S3

TNC Ecoregions: 56:P, 57:C, 58:C, 62:C, 63:C

USFS Ecoregions (1994/95): 212C:PP, 212D:PP, 221Aa:CCC, 221Ab:CCC, 221Ac:CCC, 221Ad:CCC, 221Ak:CCC, 232Aa:CCC, 232Ab:CCC, 232Ac:CCC, 232Ad:CC?, 232Bx:CCC, 232Bz:CCC, 232Ce:CCP, 232Ci:CCC

Federal Lands: NPS (Assateague Island, Boston Harbor Islands, Cape Cod, Cape Lookout, Fire Island, Fort Frederica?, Gateway); USFWS (Cape May, E.B. Forsythe, Monomoy, Parker River, Pea Island, Prime Hook)

ELEMENT SOURCES

Assateague Island National Seashore Plots and Observation Points: Plots: ASIS.28 (72AB03), ASIS.29 (62AB03), ASIS.30 (32RR08); **Observation Points:** AA008, AA101, AA129.

Local Description Authors: L.A. Sneddon

Global 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, CDPNQ unpubl. data, Clancy 1993b, Clancy 1996, Clovis 1968, Conard 1935, Coulling 2002, Coxe 2009, Dowhan and Rozsa 1989, Eastern Ecology Working Group n.d., Edinger et al. 2002, Edinger et al. 2008a, Enser 1999, Enser and Lundgren 2006, Fleming 2001a, Fleming and Patterson 2011a, Fleming et al. 2001, Fleming et al. 2007b, Gawler 2001, Gawler 2002, Gawler and Cutko 2010, Godfrey et al. 1978, Good 1965, Harrison 2004, Harrison 2011, Harvill 1965, Higgins et al. 1971, Hill 1986, Klopfer et al. 2002, Klotz 1986, Largay and Sneddon 2010, Metzler and Barrett 1992, Metzler and Barrett 2001, Metzler and Barrett 2006, Miller and Egler 1950, NRCS 2001b, NatureServe 2009, Nichols 1920, Niering and Warren 1980, Peet et al. unpubl. data, Rawinski 1984a, Redfield 1972, Reschke 1990, Schafale 2000, Schafale 2011, Schafale and Weakley 1990, Sneddon et al. 2010, Sperduto 2000b, Sperduto and Nichols 2004, Swain and Kearsley 2001, TNC 1995c, VDNH 2003, Webber 1967



Salt Panne, AA Point 129, August 11, 2009 (UTM X: 486070, UTM Y: 4229280)

Common name	Association Name	Association Code	Global Rank
Inland Red Maple Swamp	*Acer rubrum - Nyssa sylvatica - Magnolia virginiana / Viburnum nudum* var. *nudum / Osmunda cinnamomea - Woodwardia areolata* Forest	CEGL006238	G3?
Beachgrass Dune	*Ammophila breviligulata - Panicum amarum* var. *amarum* Herbaceous Vegetation	CEGL004043	G2
Upper Ocean Beach	*Cakile edentula* ssp. *edentula - Chamaesyce polygonifolia* Sparse Vegetation	CEGL004400	G4G5
Spikerush Lawn Tidal Marsh	***Eleocharis rostellata - Spartina patens* Herbaceous Vegetation**	CEGL006611	GNR
Beach Heather Dune	*Hudsonia tomentosa / Panicum amarum* var. *amarulum* Dwarf-shrubland	CEGL003950	G2G3
Tidal Salt Scrub	*Iva frutescens / Spartina patens* Shrubland	CEGL006848	G5
Forked Rush Dune Swale	*Juncus (dichotomus, scirpoides) - Drosera intermedia* Herbaceous Vegetation	CEGL004111	G2G3
Needlerush Marsh	*Juncus roemerianus* Herbaceous Vegetation	CEGL004186	G5
Maritime Shrubland	*Morella cerifera / Spartina patens* Shrubland	CEGL003839	G3G4
Wet Maritime Shrubland	*Morella cerifera / Hydrocotyle verticillata* Shrubland	CEGL003840	G2G3
Shrub Bog	*Morella cerifera - Vaccinium corymbosum* Shrubland	CEGL003906	G2G4
Backdune Grassland	*Morella (pensylvanica, cerifera) / Schizachyrium littorale - Eupatorium hyssopifolium* Shrub Herbaceous Vegetation	CEGL004240	G2
Bayberry Dune Shrubland	*Morella pensylvanica / Diodia teres* Shrubland	CEGL003881	G2
Switchgrass Swale	*(Morella cerifera) - Panicum virgatum - Spartina patens* Herbaceous Vegetation	CEGL004129	G2G4
Brackish Meadow	***Panicum virgatum – Spartina patens* var. *monogyna – Carex silicea* Herbaceous Vegetation**	CEGL006150	GNR
Phragmites Wetland	*Phragmites australis* Herbaceous Vegetation	CEGL004141	GNA
Eastern Reed Tidal Marsh	*Phragmites australis* Tidal Herbaceous Vegetation	CEGL004187	GNA
Loblolly Pine Dune Woodland	*Pinus taeda / Hudsonia tomentosa* Woodland	CEGL006052	G1G2
Loblolly Pine Maritime Forest	*Pinus taeda – Quercus (falcata, nigra) / Morella cerifera / Vitis rotundifolia* Forest	CEGL006040	G2
Loblolly Pine Wetland Forest	*Pinus taeda / Morella cerifera / Osmunda regalis* Forest	CEGL006137	G3
Deciduous Maritime Scrub Forest	*Prunus serotina / Morella cerifera / Smilax rotundifolia* Scrub Forest	CEGL006319	G1G2
Loblolly Pine Tidal Woodland	***Pinus taeda / Morella cerifera / Spartina patens* Tidal Woodland**	CEGL006849	GNR

Salt panne	*Salicornia spp., Sarcocornia perennis, Spartina alternifolia* Herbaceous Vegetation	CEGL004308	G5
Interdunal Swale	*Schoenoplectus pungens - Fimbristylis (castanea, caroliniana)* Herbaceous Vegetation	CEGL004117	G1G2
Transitional Tidal Marsh	***Schoenoplectus americanus - Spartina patens* Herbaceous Vegetation**	CEGL006112	GNR
Vine Dune	*Smilax glauca - Toxicodendron radicans* Vine-Shrubland	CEGL003886	G1G2
Low Salt Marsh	*Spartina alterniflora - Distichlis spicata* Tidal Herbaceous Vegetation	CEGL006586	GNR
Giant Cordgrass Marsh	*Spartina cynosuroides* Herbaceous Vegetation	CEGL004195	G4
High Salt Marsh	*Spartina patens - Distichlis spicata - (Juncus roemerianus)* Herbaceous Vegetation	CEGL004197	G4G5
Brackish Interdunal Swale	***Spartina patens - Eleocharis parvula* Herbaceous Vegetation**	CEGL006342	GNR
Overwash Dune Grassland	*Spartina patens - Schoenoplectus pungens - Solidago sempervirens* Herbaceous Vegetation	CEGL004097	G2G3
Brackish Tidal Shrubland	***Morella cerifera - Baccharis halimifolia / Eleocharis fallax* Shrubland**	CEGL006846	GNR
Brackish Tidal Marsh	*Typha angustifolia - Hibiscus moscheutos* Herbaceous Vegetation	CEGL004201	G4G5

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Appendix I. Plants listed in plots and accuracy assessment points

Nomenclature follows the PLANTS 3.5 Database developed by the Natural Resource Conservation Service in cooperation with the Biota of North America Program (United States Department of Agriculture, National Resources Conservation Service 2004).

Plant Symbol	Scientific Name	Common name	Family
ACRU	*Acer rubrum*	red maple	*Aceraceae*
AGMA3	*Agalinis maritima*	saltmarsh false foxglove	*Scrophulariaceae*
AGPU5	*Agalinis purpurea*	purple false foxglove	*Scrophulariaceae*
AMAR2	*Ambrosia artemisiifolia*	annual ragweed	*Asteraceae*
AMCA4	*Amelanchier canadensis*	Canadian serviceberry	*Rosaceae*
AMLA	*Amelanchier laevis*	Allegheny serviceberry	*Rosaceae*
AMBR	*Ammophila breviligulata*	American beachgrass	*Poaceae*
ANGE	*Andropogon gerardii*	big bluestem	*Poaceae*
ANGL2	*Andropogon glomeratus*	bushy bluestem	*Poaceae*
ANVI2	*Andropogon virginicus*	broomsedge bluestem	*Poaceae*
APCA	*Apocynum cannabinum*	Indianhemp	*Apocynaceae*
ARTU	*Aristida tuberculosa*	seaside threeawn	*Poaceae*
ATPR	*Atriplex prostrata*	triangle orache	*Chenopodiaceae*
BAHA	*Baccharis halimifolia*	eastern baccharis	*Asteraceae*
BITR	*Bidens tripartita*	threelobe beggarticks	*Asteraceae*
BOCY	*Boehmeria cylindrica*	smallspike false nettle	*Urticaceae*
BRTE	*Bromus tectorum*	cheatgrass	*Poaceae*
CAED	*Cakile edentula*	American searocket	*Brassicaceae*
CASE13	*Calystegia sepium*	hedge false bindweed	*Convolvulaceae*
CARA2	*Campsis radicans*	trumpet creeper	*Bignoniaceae*
CAAL5	*Carex albolutescens*	greenwhite sedge	*Cyperaceae*
CAHO8	*Carex hormathodes*	marsh straw sedge	*Cyperaceae*
CAPE6	*Carex pensylvanica*	Pennsylvania sedge	*Cyperaceae*
CASI6	*Carex silicea*	beach sedge	*Cyperaceae*
CELO3	*Cenchrus longispinus*	mat sandbur	*Poaceae*
CETR	*Cenchrus tribuloides*	sanddune sandbur	*Poaceae*
CHPO6	*Chamaesyce polygonifolia*	seaside sandmat	*Euphorbiaceae*
CHLA5	*Chasmanthium latifolium*	Indian woodoats	*Poaceae*
CHLA6	*Chasmanthium laxum*	slender woodoats	*Poaceae*
CHAM	*Chenopodium ambrosioides*	Mexican tea	*Chenopodiaceae*

Plant Symbol	Scientific Name	Common name	Family
CIHO2	*Cirsium horridulum*	yellow thistle	*Asteraceae*
COCA5	*Conyza canadensis*	Canadian horseweed	*Asteraceae*
CYGR2	*Cyperus grayi*	Gray's flatsedge	*Cyperaceae*
CYST	*Cyperus strigosus*	strawcolored flatsedge	*Cyperaceae*
DIAC	*Dichanthelium aciculare*	needleleaf rosette grass	*Poaceae*
DIAC2	*Dichanthelium acuminatum*	tapered rosette grass	*Poaceae*
DISC3	*Dichanthelium scoparium*	velvet panicum	*Poaceae*
DISP2	*Dichanthelium sphaerocarpon*	roundseed panicgrass	*Poaceae*
DISP4	*Dichanthelium spretum*	Eaton's rosette grass	*Poaceae*
DITE2	*Diodia teres*	poorjoe	*Rubiaceae*
DIVI5	*Diospyros virginiana*	common persimmon	*Ebenaceae*
DISP	*Distichlis spicata*	saltgrass	*Poaceae*
DRIN3	*Drosera intermedia*	spoonleaf sundew	*Droseraceae*
ECWA	*Echinochloa walteri*	coast cockspur grass	*Poaceae*
ELPA3	*Eleocharis palustris*	common spikerush	*Cyperaceae*
ELPAC	*Eleocharis parvula*	dwarf spikerush	*Cyperaceae*
ELRO2	*Eleocharis rostellata*	beaked spikerush	*Cyperaceae*
ELNU	*Elephantopus nudatus*	smooth elephantsfoot	*Asteraceae*
ERCA	*Eragrostis capillaris*	lace grass	*Poaceae*
ERSP	*Eragrostis spectabilis*	purple lovegrass	*Poaceae*
ERIGE2	*Erigeron*	fleabane	*Asteraceae*
EUCA5	*Eupatorium capillifolium*	dogfennel	*Asteraceae*
EUHY	*Eupatorium hyssopifolium*	hyssopleaf thoroughwort	*Asteraceae*
EURO4	*Eupatorium rotundifolium*	roundleaf thoroughwort	*Asteraceae*
EUGR5	*Euthamia graminifolia*	flat-top goldentop	*Asteraceae*
EUTE7	*Euthamia tenuifolia*	slender goldentop	*Asteraceae*
FERU2	*Festuca rubra*	red fescue	*Poaceae*
FIAU2	*Fimbristylis autumnalis*	slender fimbry	*Cyperaceae*
FICA4	*Fimbristylis castanea*	marsh fimbry	*Cyperaceae*
FUPU	*Fuirena pumila*	dwarf umbrella-sedge	*Cyperaceae*
GAOB	*Galium obtusum*	bluntleaf bedstraw	*Rubiaceae*
HESU3	*Heterotheca subaxillaris*	camphorweed	*Asteraceae*
HIMO	*Hibiscus moscheutos*	crimsoneyed rosemallow	*Malvaceae*
HIERA	*Hieracium*	hawkweed	*Asteraceae*
HUTO	*Hudsonia tomentosa*	woolly beachheather	*Cistaceae*
HUSED	*Huperzia selago var. densa*	fir clubmoss	*Lycopodiaceae*

Plant Symbol	Scientific Name	Common name	Family
HYAM	*Hydrocotyle americana*	American marshpennywort	*Apiaceae*
HYUM	*Hydrocotyle umbellata*	manyflower marshpennywort	*Apiaceae*
HYVE2	*Hydrocotyle verticillata*	whorled marshpennywort	*Apiaceae*
HYGE	*Hypericum gentianoides*	orangegrass	*Clusiaceae*
ILOP	*Ilex opaca*	American holly	*Aquifoliaceae*
IVFR	*Iva frutescens*	Jesuit's bark	*Asteraceae*
JUAC	*Juncus acuminatus*	tapertip rush	*Juncaceae*
JUCA3	*Juncus canadensis*	Canadian rush	*Juncaceae*
JUDI	*Juncus dichotomous*	forked rush	*Juncaceae*
JUEF	*Juncus effusus*	common rush	*Juncaceae*
JUGE	*Juncus gerardii*	saltmeadow rush	*Juncaceae*
JUGR	*Juncus greenei*	Greene's rush	*Juncaceae*
JUMA4	*Juncus marginatus*	grassleaf rush	*Juncaceae*
JURO	*Juncus roemerianus*	needlegrass rush	*Juncaceae*
JUSC	*Juncus scirpoides*	needlepod rush	*Juncaceae*
JUDU2	*Juncus tenuis*	poverty rush	*Juncaceae*
JUVI	*Juniperus virginiana*	eastern redcedar	*Cupressaceae*
KOVI	*Kosteletzkya virginica*	Virginia saltmarsh mallow	*Malvaceae*
KRVI	*Krigia virginica*	Virginia dwarfdandelion	*Asteraceae*
LEMA	*Lechea maritima*	beach pinweed	*Cistaceae*
LETE	*Lechea tenuifolia*	narrowleaf pinweed	*Cistaceae*
LEVI3	*Lepidium virginicum*	Virginia pepperweed	*Brassicaceae*
LICA17	*Limonium carolinianum*	lavendar thrift	*Plumbaginaceae*
LIME2	*Linum medium*	stiff yellow flax	*Linaceae*
LIST2	*Liquidambar styraciflua*	sweetgum	*Hamamelidaceae*
LOJA	*Lonicera japonica*	Japanese honeysuckle	*Caprifoliaceae*
LOSE	*Lonicera sempervirens*	trumpet honeysuckle	*Caprifoliaceae*
LUPA	*Ludwigia palustris*	marsh seedbox	*Onagraceae*
LYAP4	*Lycopodiella appressa*	southern bog clubmoss	*Lycopodiaceae*
LYAM	*Lycopus americanus*	American water horehound	*Lamiaceae*
LYLI2	*Lythrum lineare*	wand lythrum	*Lythraceae*
MAVI2	*Magnolia virginiana*	sweetbay	*Magnoliaceae*
MAAN3	*Malus angustifolia*	southern crabapple	*Rosaceae*
MISC	*Mikania scandens*	climbing hempvine	*Asteraceae*
MIRE	*Mitchella repens*	partridgeberry	*Rubiaceae*
MOCE2	*Morella cerifera*	wax myrtle	*Myricaceae*

Plant Symbol	Scientific Name	Common name	Family
MOPE6	*Morella pennsylvanica*	northern bayberry	*Myricaceae*
NUCA	*Nuttallanthus canadensis*	Canada toadflax	*Scrophulariaceae*
NYSY	*Nyssa sylvatica*	blackgum	*Nyssaceae*
OEBI	*Oenothera biennis*	common evening primrose	*Onagraceae*
OEHU	*Oenothera humifusa*	seabeach evening-primrose	*Onagraceae*
OPHU	*Opuntia humifusa*	devil's-tongue	*Cactaceae*
OSCI	*Osmunda cinnamomea*	cinnamon fern	*Osmundaceae*
OSRE	*Osmunda regalis*	royal fern	*Osmundaceae*
PAAMA2	*Panicum amarum var. amarulum*	coastal panicgrass	*Poaceae*
PAVI2	*Panicum virgatum*	switchgrass	*Poaceae*
PAQU2	*Parthenocissus quinquefolia*	Virginia creeper	*Vitaceae*
PAAC4	*Paspalum acuminatum*	brook crowngrass	*Poaceae*
PHPY4	*Photinia pyrifolia*	red chokeberry	*Rosaceae*
PHAU7	*Phragmites australis*	common reed	*Poaceae*
PITA	*Pinus taeda*	loblolly pine	*Pinaceae*
PLFO	*Pluchea foetida*	stinking camphorweed	*Asteraceae*
PLOD	*Pluchea odorata*	sweetscent	*Asteraceae*
POAR4	*Polygonella articulata*	coastal jointweed	*Polygonaceae*
POPE2	*Polygonum pensylvanicum*	Pennsylvania smartweed	*Polygonaceae*
POPU5	*Polygonum punctatum*	dotted smartweed	*Polygonaceae*
PRENA	*Prenanthes*	rattlesnakeroot	*Asteraceae*
PRMA2	*Prunus maritima*	beach plum	*Rosaceae*
PRSE2	*Prunus serotina*	black cherry	*Rosaceae*
PSOBO	*Pseudognaphalium obtusifolium ssp. obtusifolium*	rabbit-tobacco	*Asteraceae*
PTCA	*Ptilimnium capillaceum*	herbwilliam	*Apiaceae*
QUFA	*Quercus falcata*	southern red oak	*Fagaceae*
QUNI	*Quercus nigra*	water oak	*Fagaceae*
QUPH	*Quercus phellos*	willow oak	*Fagaceae*
RASC3	*Ranunculus sceleratus*	cursed buttercup	*Ranunculaceae*
RHAR	*Rhexia aristosa*	awnpetal meadowbeauty	*Melastomataceae*
RHVI	*Rhexia virginica*	handsome Harry	*Melastomataceae*
RHMA	*Rhexia mariana*	Maryland meadowbeauty	*Melastomataceae*
RHCO	*Rhus copallinum*	winged sumac	*Anacardiaceae*
RHCA12	*Rhynchospora capitellata*	brownish sedge	*Cyperaceae*
ROPA	*Rosa palustris*	swamp rose	*Rosaceae*
RORU	*Rosa rugosa*	rugosa rose	*Rosaceae*

Plant Symbol	Scientific Name	Common name	Family
RUAL	*Rubus allegheniensis*	Allegheny blackberry	*Rosaceae*
RUAR	*Rubus arcticus*	arctic blackberry	*Rosaceae*
RUAR2	*Rubus argutus*	sawtooth blackberry	*Rosaceae*
RUFL	*Rubus flagellaris*	northern dewberry	*Rosaceae*
RUAC3	*Rumex acetosella*	common sheep sorrel	*Polygonaceae*
SAST5	*Sabatia stellaris*	rose of Plymouth	*Gentianaceae*
SABI	*Salicornia bigelovii*	dwarf saltwort	*Chenopodiaceae*
SADE10	*Salicornia depressa*	Virginia glasswort	*Chenopodiaceae*
SAMA11	*Salicornia maritima*	slender grasswort	*Chenopodiaceae*
SAKA	*Salsola kali*	Russian thistle	*Chenopodiaceae*
SAVA3	*Samolus valerandi*	seaside brookweed	*Primulaceae*
SAAL5	*Sassafras albidum*	sassafras	*Lauraceae*
SCLI11	*Schizachyrium littorale*	shore little bluestem	*Poaceae*
SCSC	*Schizachyrium scoparium*	little bluestem	*Poaceae*
SCPU10	*Schoenoplectus pungens*	common threesquare	*Cyperaceae*
SCRO5	*Schoenoplectus robustus*	sturdy bulrush	*Cyperaceae*
SCCY	*Scirpus cyperinus*	wooldgrass	*Cyperaceae*
SCAN2	*Scleranthus annuus*	German knotgrass	*Caryophyllaceae*
SCVE2	*Scleria verticillata*	low nutrush	*Cyperaceae*
SEPA10	*Setaria parviflora*	marsh bristlegrass	*Poaceae*
SIAT	*Sisyrinchium atlanticum*	eastern blue-eyed grass	*Iridaceae*
SMGL	*Smilax glauca*	cat greenbrier	*Smilacaceae*
SMRO	*Smilax rotundifolia*	roundleaf greenbrier	*Smilacaceae*
SOFI	*Solidago fistulosa*	pine barrens goldenrod	*Asteraceae*
SOSE	*Solidago sempervirens*	seaside goldenrod	*Asteraceae*
SPAL	*Spartina alterniflora*	smooth cordgrass	*Poaceae*
SPCY	*Spartina cynosuroides*	big cordgrass	*Poaceae*
SPPA	*Spartina patens*	saltmeadow cordgrass	*Poaceae*
SPMA10	*Spergularia maritima*	media sandspurry	*Caryophyllaceae*
SPPR2	*Spiranthes praecox*	greenvein ladies'-tresses	*Orchidaceae*
SYPA11	*Symphyotrichum patens*	late purple aster	*Asteraceae*
THPA	*Thelypteris palustris*	marsh fern	*Thelypteridaceae*
TORA2	*Toxicodendron radicans*	eastern poison ivy	*Anacardiaceae*
TRVI2	*Triadenum virginicum*	Virginia marsh St. Johnswort	*Clusiaceae*
TRAR4	*Trifolium arvense*	rabbitfoot clover	*Fabaceae*
TRPU4	*Triplasis purpurea*	purple sandgrass	*Poaceae*

Plant Symbol	Scientific Name	Common name	Family
TYAN	*Typha angustifolia*	narrowleaf cattail	*Typhaceae*
UTSU	*Utricularia subulata*	zigzag bladderwort	*Lentibulariaceae*
VACO	*Vaccinium corymbosum*	highbush blueberry	*Ericaceae*
VIRO2	*Viola rotundifolia*	roundleaf yellow violet	*Violaceae*
VIRO3	*Vitis rotundifolia*	muscadine	*Vitaceae*
VUMY	*Vulpia myuros*	rat-tail fescue	*Poaceae*
WOAR	*Woodwardia areolata*	netted chainfern	*Blechnaceae*
XYTO	*Xyris torta*	slender yelloweyed grass	*Xyridaceae*

The Department of the Interior protects and manages the nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors its special responsibilities to American Indians, Alaska Natives, and affiliated Island Communities.

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National Park Service
U.S. Department of the Interior

Natural Resource Stewardship and Science
1201 Oakridge Drive, Suite 150
Fort Collins, CO 80525

www.nature.nps.gov