USDA Natural Resources Conservation Service

Ecological site R149BY002MA
Coastal Dunes

Last updated: 9/17/2024
Accessed: 05/11/2025

General information

Provisional. A provisional ecological site description has undergone quality control and quality assurance review. It contains a working state and transition model and enough information to identify the ecological site.

MLRA notes

Major Land Resource Area (MLRA): 149B–Long Island-Cape Cod Coastal Lowland

149B—Long Island-Cape Cod Coastal Lowland

This area is in the Embayed Section of the Coastal Plain Province of the Atlantic Plain. It is part of the partially submerged coastal plain of New England. It is mostly an area of nearly level to rolling plains, but it has some steeper hills (glacial moraines). Ridges border the lower plains. The Peconic and Carmans Rivers are on the eastern end of Long Island. The parts of this area in Massachusetts and Rhode Island have no major rivers. This entire area is made up of deep, unconsolidated glacial outwash deposits of sand and gravel. A thin mantle of glacial till covers most of the surface. Some moraines form ridges and higher hills in this area of generally low relief. Sand dunes and tidal marshes are extensive along the coastline.

Classification relationships

USDA-NRCS (USDA, 2006):
Land Resource Region (LRR): S—Northern Atlantic Slope Diversified Farming Region
Major Land Resource Area (MLRA): 149B—Long Island-Cape Cod Coastal Lowland
USDA-FS (Cleland et al., 2007):
Province: 221 Eastern Broadleaf Forest Province
Section: 221A Lower New England
Subsection: 221Ab Cape Cod Coastal Lowland and Islands
Subsection: 221An Long Island Coastal Lowland and Moraine

Ecological site concept

The site consists of very deep, excessively drained and poorly developed eolian sands derived from marine deposits. The site occurs on both active and stabilized coastal sand dunes. Slopes range from 0 to 35 percent. Representative soil is Hooksan.

Associated sites

R149BY012MA	**Coastal Backbarrier Dune Flats** Coastal Backbarrier Dune Flats

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Morella pensylvanica*
Herbaceous	(1) *Ammophila breviligulata*

Physiographic features

The site occurs on both active and stabilized coastal sand dunes and dikes influenced by a maritime environment of wind exposure, shifting sands, and salt spray in varying degrees depending on the distance from the coast. Flooding occurs rarely.

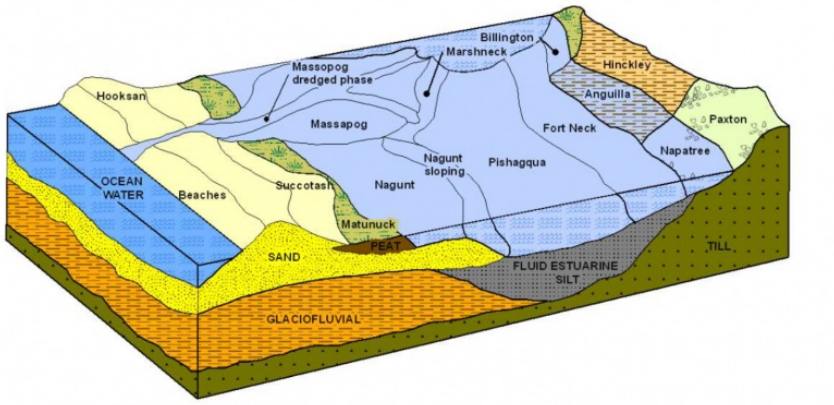


Figure 1.

Table 2. Representative physiographic features

Landforms	(1) Lowland > Dune (2) Dike
Runoff class	Negligible to low
Flooding frequency	None to rare
Ponding frequency	None
Elevation	0–394 ft
Slope	0–35%
Water table depth	20–72 in
Aspect	Aspect is not a significant factor

Climatic features

Coastal regions' climate generally considered maritime, experiences a more moderate climate than inland, i.e., cooler summers and warmer winters and delayed onset of spring. However, coastal regions do experience the brunt of extreme weather such as nor'easters and tropical storms, e.g., hurricanes.

Table 3. Representative climatic features

Frost-free period (characteristic range)	147-155 days
Freeze-free period (characteristic range)	194-206 days
Precipitation total (characteristic range)	45-49 in
Frost-free period (actual range)	146-156 days
Freeze-free period (actual range)	191-209 days
Precipitation total (actual range)	44-50 in
Frost-free period (average)	151 days
Freeze-free period (average)	200 days
Precipitation total (average)	47 in

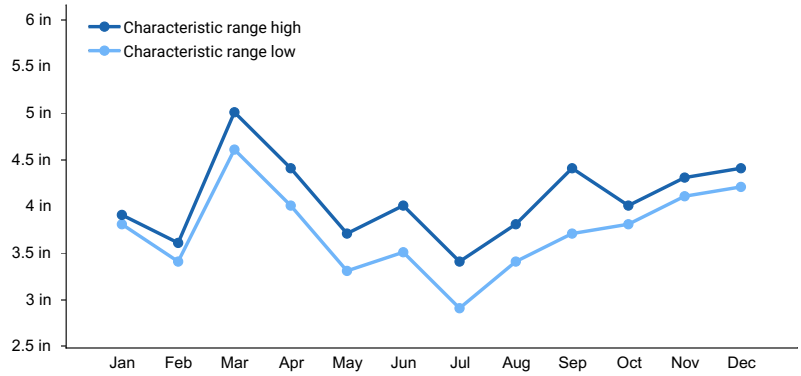


Figure 2. Monthly precipitation range

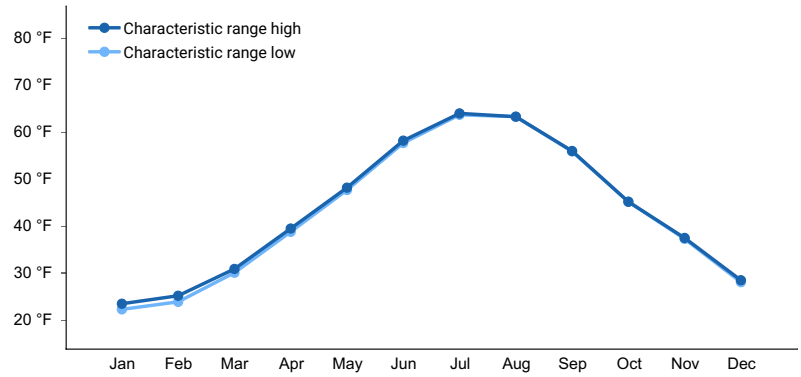


Figure 3. Monthly minimum temperature range

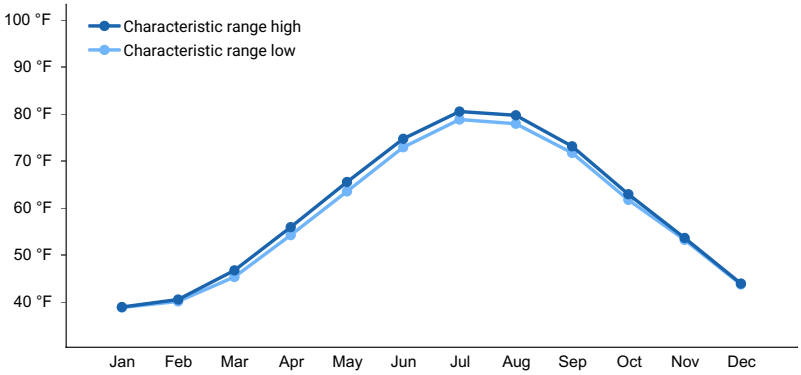


Figure 4. Monthly maximum temperature range

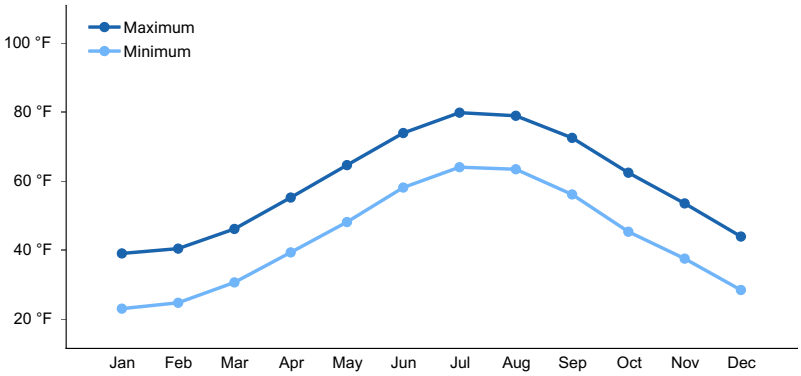


Figure 5. Monthly average minimum and maximum temperature

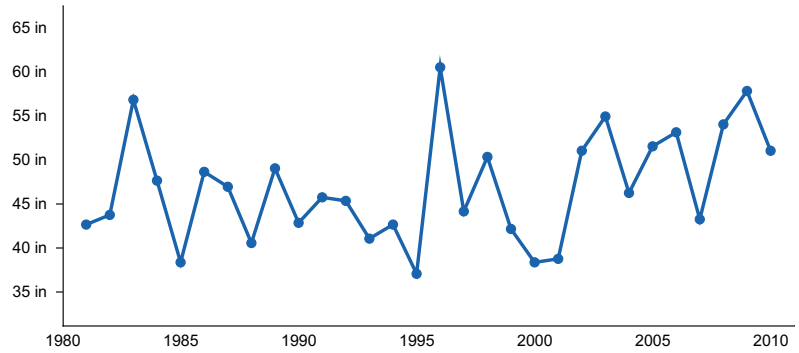


Figure 6. Annual precipitation pattern

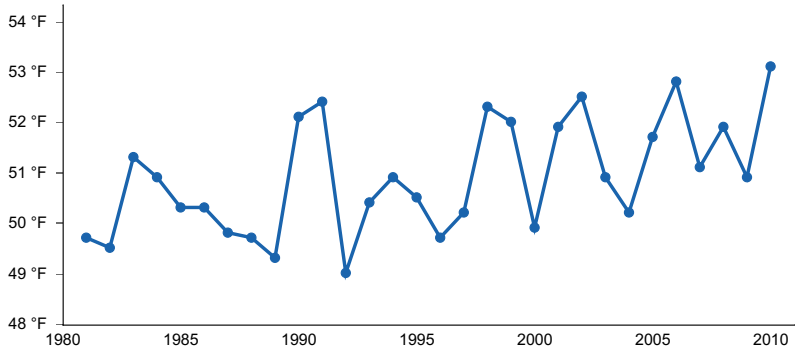


Figure 7. Annual average temperature pattern

Climate stations used

- (1) HYANNIS [USC00193821], Hyannis, MA
- (2) BRIDGEHAMPTON [USC00300889], Sag Harbor, NY

Influencing water features

N/A

Wetland description

N/A

Soil features

The site consists of very deep, moderately well to excessively drained and poorly developed soils derived from wind, water, and glacially deposited parent materials. The site occurs on both active and stabilized coastal sand dunes. Representative soil is Hooksan.

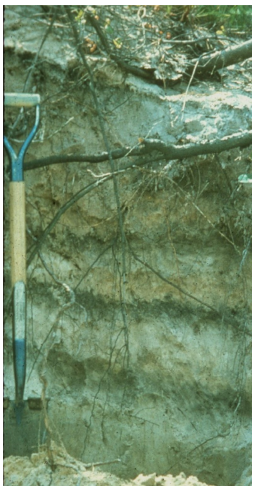


Figure 8. Hooksan photo by Pete Fletcher, Horseneck Beach, W

Table 4. Representative soil features

Parent material	(1) Eolian deposits (2) Marine deposits (3) Glaciofluvial deposits
Surface texture	(1) Sand
Drainage class	Moderately well drained to excessively drained
Permeability class	Moderate to rapid
Depth to restrictive layer	72 in
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (Depth not specified)	2–4 in
Soil reaction (1:1 water) (Depth not specified)	4.5–7.8
Subsurface fragment volume <=3" (Depth not specified)	0%
Subsurface fragment volume >3" (Depth not specified)	0%

Ecological dynamics

[Caveat: The vegetation information contained in this section and is only provisional, based on concepts, not yet validated with field work.*]

The vegetation groupings described in this section are based on the terrestrial ecological system classification and vegetation associations developed by NatureServe (Comer et al. 2003). Terrestrial ecological systems are specifically defined as a group of plant community types (associations) that tend to co-occur within landscapes with similar ecological processes, substrates, and/or environmental gradients. They are intended to provide a classification unit that is readily mappable, often from terrain and remote imagery, and readily identifiable by conservation and resource managers in the field. A given system will typically manifest itself in a landscape at intermediate geographic scales of tens-to-thousands of hectares and will persist for 50 or more years. A vegetation association is a plant community that is much more specific to a given soil, geology, landform, climate, hydrology, and disturbance history. It is the basic unit for vegetation classification and recognized by the US National Vegetation Classification (FDGC 2008, USNVC 2017). Each association will be named by the diagnostic and often dominant species that occupy the different height strata (tree, shrub, and herb). Within the NatureServe Explorer database, ecological systems are numbered by a community Ecological System Code (CES) and individual vegetation associations are assigned an identification number called a Community Element Global Code (CEGL)

(NatureServe 2019).

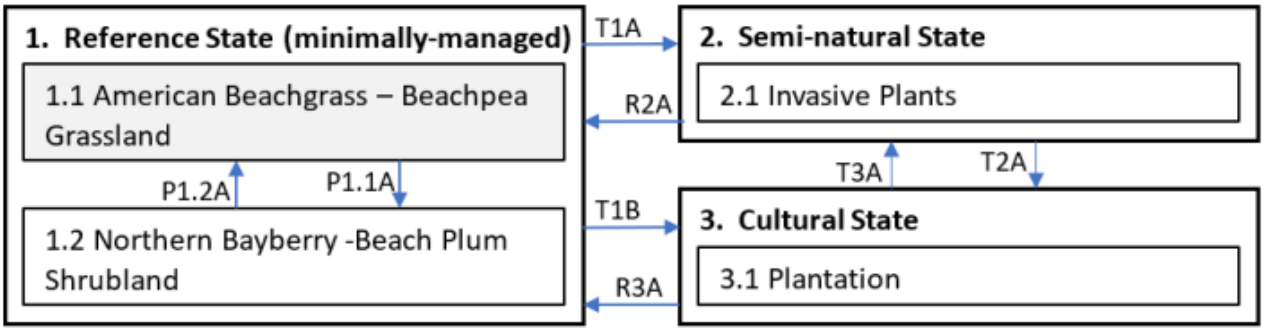
[*Caveat] The information presented is representative of very complex vegetation communities. Key indicator plants and ecological processes are described to help inform land management decisions. Plant communities will differ across the MLRA because of the naturally occurring variability in weather, soils, and geography. The reference plant community is not necessarily the management goal. The drafts of species lists are merely representative and are not botanical descriptions of all species occurring, or potentially occurring, on this site. They are not intended to cover every situation or the full range of conditions, species, and responses for the site.

This ecological site is characterized by a mix of xeric plant communities coinciding Northern Atlantic Coastal Plain Dune and Swale system (CES203.264). The prevailing ecological processes are due to maritime environment, including frequent salt spray, wind exposure, overwash, and sand movement. Other disturbances considered as threats include: development and fragmentation, barriers to connectivity to the open ocean, off-road vehicles, trampling, and invasive plants: Japanese black pine (*Pinus thunbergii*), Japanese sedge (*Carex kobomugi*), and common reed (*Phragmites australis*).

Plant community succession on the site coincides with coastal dune succession. Young, active foredunes, are nearest the ocean and are exposed to significant environmental stresses of onshore winds, high light intensity, high temperatures, and salt spray. Vegetation on the young dunes is a grassland community dominated by American beachgrass (ammophila breviligulata). Beachgrass plays a valuable role in jump starting succession and in stabilizing dunes. Beach pea is a common associate and can dominate at times (Sneddon et al. 2010). Other associated species includes American searocket (*Cakile edentula*), and seaside sandmat (*Chamaesyce polygonifolia*), pinweed (*Lechea maritima*), seabeach sedge (*Carex silicea*), coastal jointweed (*Polygonella articulata*), and seaside goldenrod (*Solidago sempervirens*). Northern bayberry (*Morella pensylvanica*), beach plum (*Prunus maritima*), and pitch pine (*Pinus rigida*) can occur sporadically within the grassland. Common exotic and invasive plants are Japanese black pine (*Pinus thunbergii*), beach rose (*Rosa rugosa*) and beach wormwood [dusty miller] (*Artemisia stelleriana*). The community is interspersed with small to large areas of bare sand. The active foredune communities coincides with Maritime Dune Community (Swain and Kearsley 2011) and Northern Beachgrass dune community (Sneddon et al. 2010). Northern bayberry dune shrublands (Sneddon et al. 2010) are a mid-seral community occurring on more stabilized dunes. Other shrubs include beach plum (*Prunus maritima*), Canadian serviceberry (*Amelanchier canadensis*), and occasionally, eastern baccharis (*Baccharis halimifolia*). American beachgrass (*Ammophila breviligulata*), wavy hairgrass (*Deschampsia flexuosa*) and seaside goldendrod (*Solidago sempervirens*) are interspersed among the shrubs. On older and more stabilized backdunes or secondary dunes, a pitch pine dune woodland (Sneddon et al. 2010) community will occur. This woodland community is dominated by pitch pine (*Pinus rigida*) with scattered black oak (*Quercus velutina*). Other trees include black cherry (*Prunus serotina*), red maple (*Acer rubrum*), and American Beech (*Fagus grandifolia*). The understory is can be very open with northern bayberry (*Morella pensylvanica*) and beach plum (*Prunus maritima*) (Sneddon et al. 2010). Woolly beachheather (*Hudsonia tomentosa*) and kinnikinnik (*Arctostaphylos uva-ursi*) are found in open areas. Herbaceous plants include starflower (*Trientalis borealis*), whorled yellow loosestrife (*Lysimachia quadrifolia*), wild sarsaparilla (*Aralia nudicaulis*), western brackenfern, and wavy hairgrass (*Deschampsia flexuosa*). Common vines include eastern poison ivy (*Toxicodendron radicans*), roundleaf greenbrier (*Smilax rotundifolia*), and Virginia creeper (*Parthenocissus quinquefolia*).

State and transition model

149BY002 – Coastal Dunes



Transition	*Drivers/practices*
T1A	disturbance, invasive plant establishment
T1B, T2A	cutting, land clearing, plant establishment, wind erosion control
R2A, R3A	herbaceous weed treatment, plant removal, plant establishment, successional management
T3A	abandonment, disturbance, invasive plant establishment
P1.1A	succession
P1.2A	disturbance, herbaceous weed treatment, plant removal, plant establishment, successional management

State 1
Reference State - Coastal Dunes

This ecological site is characterized by a mix of xeric plant communities coinciding Northern Atlantic Coastal Plain Dune and Swale system (CES203.264) (NatureServe 2019). The predominant reference plant community is largely herbaceous: • Northern Beachgrass Dune, (American Beachgrass - Beach Pea Grassland, [*Ammophila breviligulata - Lathyrus japonicus* Grassland] - CEGL006274); and under stable dune conditions, it may succeed to shrublands, predominantly: • Northern Bayberry Dune Shrubland (Northern Bayberry - Beach Plum Shrubland, [*Morella pensylvanica - Prunus maritima* Shrubland] – CEGL006295). Other associated plant communities include: • Northern Beach-heather Dune Dwarf-shrubland (Woolly Beach-heather - Bearberry Dwarf-shrubland [*Hudsonia tomentosa - Arctostaphylos uva-ursi* Dwarf-shrubland] – CEGL006143), and • North Atlantic Coastal Plain Dune Vine/shrubland (Cat Greenbrier - Eastern Poison-ivy Vine-Shrubland [*Smilax glauca - Toxicodendron radicans* Vine-Shrubland] – CEGL003886). On older more stabilized backdunes may support: • Pitch Pine Dune Woodland (Pitch Pine / Woolly Beach-heather Woodland [*Pinus rigida* / *Hudsonia tomentosa* Woodland] – CEGL006117). • Long Island Maritime Beech Forest (American Beech / Roundleaf Greenbrier Forest [*Fagus grandifolia* / *Smilax rotundifolia* Forest – CEGL006043]) [Source: NatureServe 2019, USNVC 2017]

Community 1.1
Northern Beachgrass Dune

Northern Beachgrass Dune, (American Beachgrass - Beach Pea Grassland, [*Ammophila breviligulata - Lathyrus japonicus* Grassland] - CEGL006274) is the typical community type. This association is characterized and

dominated by American beechgrass (*Ammophila breviligulata*), which is often the only plant present, especially on foredunes or other areas of active and rapid sand deposition. Beach pea (*Lathyrus japonicus*) is the most common associate and sometimes codominant. Other associated species include seaside goldenrod (*Solidago sempervirens*), beach pinweed (*Lechea maritima*), seaside threeawn (*Aristida tuberculosa*), little bluestem (*Schizachyrium scoparium*), beach sedge (*Carex silicea*), coastal jointweed (*Polygonella articulata*), and dusty miller (*Artemisia stelleriana*). Dwarf-shrubs, such as wooly beachheather (*Hudsonia tomentosa*), beach rose (*Rosa rugosa*), northern bayberry (*Morella pensylvanica* [= Myrica pensylvanica]), or stunted beach plum (*Prunus maritima*), can occur sporadically and form patches within the grassland [Source: NatureServe 2018 [accessed 2019], USNVC 2017 [accessed 2019]. Cross-referenced plant community concepts (typically by political state): Maritime Dunes (Swain 2016) [MA] Maritime Dunes (Edinger et al. 2014) [NY] Maritime Herbaceous Dune (Enser et al. 2011 [RI] Northern Beachgrass Dune (Sneddon et al 2010) [Cape Cod National Seashore]

Community 1.2
Northern Bayberry Dune Shrubland

Northern Bayberry Dune Shrubland (Northern Bayberry - Beach Plum Shrubland, [*Morella pensylvanica* - *Prunus maritima* Shrubland] – CEGL006295) typically occurs on more stabilized dunes. Northern bayberry (*Morella pensylvanica* [= Myrica pensylvanica] and beach plum (*Prunus maritima*) dominate. Another common and often codominant shrub is seaside rose (*Rosa rugosa*), while not native, where naturalized it's restricted to duneland sites. Other common shrubs or stunted trees in less abundance can include: eastern baccharis (*Baccharis halimifolia*) and sporatic red cedar (*Juniperus virginiana*) and black cherry (Prunius serotina). The herbaceous layer tends to be sparse where shrub growth is dense, and can include dune grassland species: American beachgrass (*Ammophila breviligulata*), seaside goldenrod (*Solidago sempervirens*), wooly beachheather (*Hudsonia tomentosa*), beach pinweed (*Lechea maritima*), Greene's rush (*Juncus greenei*), seabeach sedge (*Carex silicea*), coastal jointweed (*Polygonella articulata*), annual saltmarsh American-aster (*Symphyotrichum subulatum* [= Aster subulatus]) or occasionally adjacent upland species such as, common wrinkleleaved goldenrod *Solidago rugosa* ssp.aspera, small flowered evening primrose (*Oenothera parviflora*),little bluestem (*Schizachyrium scoparium*), and others. Typical vine associates are poison ivy (*Toxicodendron radicans*), Virginia creeper *Parthenocissus quinquefolia*, and various Greenbriars (Smilax spp). Open, bare patches to sparsely vegetated sand are present in some examples [Source: NatureServe 2018 [accessed 2019], USNVC 2017 [accessed 2019]. Cross-referenced plant community concepts (typically by political state): Maritime Shrubland (Swain 2016) [MA] Maritime Shrubland (Edinger et al. 2014) [NY] Maritime Shrub Dune (Enser et al. 20110 [RI] Northern Bayberry Dune Shubland (Sneddon et al 2010) [Cape Cod National Seashore]

Pathway P1.1A
Community 1.1 to 1.2

Succession

Pathway P1.2A
Community 1.2 to 1.1

Disturbance, herbaceous weed treatment, plant removal, plant establishment, successional management

Conservation practices

Restoration and Management of Rare and Declining Habitats
Upland Wildlife Habitat Management
Restoration and Management of Natural Ecosystems
Herbaceous Weed Control

State 2
Semi-Natural State

Semi-natural dunescapes may be dominated by occasional non-native plants include Japanese Sedge (*Carex kobomugi*), dusty miller (Aretemisia stelleriana), sea poppy (*Glaucium flavum*), beach rose (*Rosa rugosa*), Morrow's

honeysuckle (*Lonicera morrowii*), and Japanese pine (*Pinus thunbergii*).

Community 2.1
Invasive plant community

Carex kobomugi (Japansese sedge) *Ammophila arenaria* (European beechgrass)

State 3
Cultural State

The non-native Japanese Pine (*Pinus thunbergii*) and beach rose (*Rosa rugosa*) may have been be planted.

Community 3.1
Plantation(?) Pinus thunbergii

Transition T1A
State 1 to 2

Disturbance, invasive plant establishment

Transition T1B
State 1 to 3

Cutting, land clearing plant establishment, wind erosion control

Conservation practices

Brush Management
Land Clearing
Invasive Plant Species Control

Restoration pathway R2A
State 2 to 1

Herbaceous weed treatment, plant removal, plant establishment, successional management American beachgrass (*Ammophila breviligulata*) plugs generally planted on a grid (0.5 m on center?) [Avoid planting the non-native European beachgrass (*Ammophila arenaria*)]

Conservation practices

Brush Management
Critical Area Planting
Restoration and Management of Rare and Declining Habitats
Upland Wildlife Habitat Management
Early Successional Habitat Development/Management
Record Keeping
Restoration and Management of Natural Ecosystems
Invasive Plant Species Control
Herbaceous Weed Control

Transition T2A
State 2 to 3

Cutting, land clearing, plant establishment, wind erosion control

Conservation practices

Land Clearing
Invasive Plant Species Control

Restoration pathway R3A
State 3 to 1

Herbaceous weed treatment, plant removal, plant establishment, successional management

Conservation practices

Brush Management
Critical Area Planting
Restoration and Management of Rare and Declining Habitats
Upland Wildlife Habitat Management
Early Successional Habitat Development/Management
Restoration and Management of Natural Ecosystems
Herbaceous Weed Control

Transition T3A
State 3 to 2

Abandonment, disturbance, invasive plant establishment

Additional community tables

Animal community

Wildlife
Terns, gulls, shorebirds and some songbirds nest in dune especially Piping Plover and Least Tern which prefer sparse vegetation. Dunes may also provide food and cover for some migrating birds. Diamondback Terrapins nest in dunes. Moths that inhabit stable dunes with patches of low shrubs include the Chain-dotted Geometer and Dune Sympistis.

Other information

Conservation Strategies
Maintain dynamic coastal process allowing dunes to develop; maintain or enhance connectivity across the beach-dune complex and avoid development that contributes to fragmentation; prevent recreational overuse, e.g., driving and trampling, and encourage the public to use marked trails; effect dune restoration where excessive disturbance warrants, e.g., American beachgrass planting for stabilization, removal of invasive plants for ecological integrity.

Inventory data references

Site Development and Testing Plan
Future work is needed, as described in a project plan, to validate the information presented in this provisional ecological site description. Future work includes field sampling, data collection and analysis by qualified vegetation ecologists and soil scientists. As warranted, annual reviews of the project plan can be conducted by the Ecological Site Technical Team. A final field review, peer review, quality control, and quality assurance reviews of the ESD are necessary to approve a final document.

References

USNVC [United States National Vegetation Classification]. 2017 (Date accessed). United States National Vegetation Classification Database V2.01. Federal Geographic Data Committee, Vegetation Subcomittee, Washington DC.

Other references

Cleland, D.T., J.A. Freeouf, J.E. Keys, G.J. Nowacki, C. Carpenter, and W.H. McNab. 2007. Ecological Subregions: Sections and Subsections of the Coterminous United States. USDA Forest Service, General Technical Report WO-76. Washington, DC.

Comer, P., D. Faber-Langendoen, R. Evans, S. Gawler, C. Josse, G. Kittel, S. Menard, M. Pyne, M. Reid, K. Schulz, K., Snow, and J.Teague. 2003. Ecological Systems of the United States: A Working Classification of U.S. Terrestrial Systems. NatureServe, Arlington, Virginia.

Cowardin, L.M. et. al. 1979. Classification of Wetlands and Deepwater habitats of the United States. FWS/OBS-79/31, U.S. Department of the Interior, Fish and Wildlife Service, Washington, DC.

Edinger, G.J., Evans, D.J., Gebauer, S., Howard, T.G., Hunt, D.M., and A.M. Olivero, A.M. (eds.). 2014. Ecological Communities of New York State, Second Edition: A revised and expanded edition of Carol Reschke's Ecological Communities of New York State. New York Natural Heritage Program, New York State Department of Environmental Conservation, Albany, NY.

FGDC [Federal Geographic Data Committee]. 2008. National Vegetation Classification Standard, Version 2. Federal Geographic Data Committee, Vegetation Subcommittee, Washington DC.

Greller, A. A Classification of Mature Forests on Long Island, New York. Bulletin of the Torrey Botanical Club 104:376–382.

NatureServe. 2009. International Ecological Classification Standard: Terrestrial Ecological Classifications. NatureServe Central Databases. Arlington, VA, U.S.A. Data current as of 06 February 2009.

NatureServe 2018. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available http://explorer.natureserve.org. (Accessed: January 2019).

Parshall, T., D.R. Foster, E. Faison, D. MacDonald, and B.C.S. Hansen. 2003. Long-term history of vegetation and fire in pitch pine–oak forests on cape cod, Massachusetts. Ecology 84:736–748.

Sneddon, L. A., Zaremba, R. E., and M. Adams. 2010. Vegetation classification and mapping at Cape Cod National Seashore, Massachusetts. Natural Resources Technical Report NPS/NER/NRTR--2010/147. National Park Service, Philadelphia, PA.

Swain, P.C. 2016. Classification of the Natural Communities of Massachusetts. Version 2.0. Natural Heritage & Endangered Species Program, Massachusetts Division of Fisheries and Wildlife. Westborough, MA.

Smith, R. D., et. al. 1995. An approach for assessing wetland functions using hydrogeomorphic classification, reference wetlands, and functional indices. Technical Report WRP-DE-9, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

Smith, S. M., Hanley, M., & Killingbeck, K. T. 2008. Development of vegetation in dune slack wetlands of Cape Cod National Seashore (Massachusetts, USA). Plant Ecology, 194(2), 243-256.

United States Department of Agriculture, Natural Resources Conservation Service, 2006. Land Resource Regions and Major land Resource Areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296.

United States Department of Agriculture, Natural Resources Conservation Service, 2015. National Soils Information System (NASIS).

USNVC [United States National Vegetation Classification]. 2017. United States National Vegetation Classification Database, V2.01. Federal Geographic Data Committee, Vegetation Subcommittee, Washington DC. http://usnvc.org/explore-classification/ (Accessed: 2018)

Contributors

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Approval

Nels Barrett, 9/17/2024

Rangeland health reference sheet

Interpreting Indicators of Rangeland Health is a qualitative assessment protocol used to determine ecosystem condition based on benchmark characteristics described in the Reference Sheet. A suite of 17 (or more) indicators are typically considered in an assessment. The ecological site(s) representative of an assessment location must be known prior to applying the protocol and must be verified based on soils and climate. Current plant community cannot be used to identify the ecological site.

Author(s)/participant(s)	
Contact for lead author	
Date	05/21/2020
Approved by	Nels Barrett
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:**

2. **Presence of water flow patterns:**

3. **Number and height of erosional pedestals or terracettes:**

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):**

5. **Number of gullies and erosion associated with gullies:**

6. **Extent of wind scoured, blowouts and/or depositional areas:**

7. **Amount of litter movement (describe size and distance expected to travel):**

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):**

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):**

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:**

11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):**

12. **Functional/Structural Groups (list in order of descending dominance by above-ground annual-production or live foliar cover using symbols: >>, >, = to indicate much greater than, greater than, and equal to):**

    Dominant:

    Sub-dominant:

    Other:

    Additional:

13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):**

14. **Average percent litter cover (%) and depth (in):**

15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):**

16. **Potential invasive (including noxious) species (native and non-native). List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state for the ecological site:**

17. **Perennial plant reproductive capability:**