USDA Natural Resources Conservation Service

Ecological site F144AY009CT
Wet Till Depressions

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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): 144A–New England and Eastern New York Upland, Southern Part

MLRA 144A: New England and Eastern New York Upland, Southern Part

The eastern half of the eastern part of this MLRA is in the Seaboard Lowland Section of the New England Province of the Appalachian Highlands. The western half of the eastern part and the southeastern half of the western part are in the New England Upland Section of the same province and division. The northwestern half of the western part is in the Hudson Valley Section of the Valley and Ridge Province of the Appalachian Highlands. This MLRA is a very scenic area of rolling to hilly uplands that are broken by many gently sloping to level valleys that terminate in coastal lowlands. Elevation ranges from sea level to 1,000 feet in much of the area, but it is 2,000 feet on some hills. Relief is mostly about 6 to 65 feet in the valleys and about 80 to 330 feet in the uplands.

This area has been glaciated and consists almost entirely of till hills, drumlins, and bedrock-controlled uplands with a mantle of till. It is dissected by narrow glacio-fluvial valleys. The southernmost boundary of the area marks the farthest southward extent of Wisconsinian glaciation on the eastern seaboard. The river valleys and coastal plains are filled with glacial lake sediments, marine sediments, and glacial outwash. The bedrock in the eastern half of the area consists primarily of igneous and metamorphic rocks of early Paleozoic age. Granite is the most common igneous rock, and gneiss, schist, and slate are the most common metamorphic rocks. In the parts of the MLRA in eastern and southeastern New York, Devonian- to Pennsylvanian-age sandstone, shale, and limestone are dominant. Carbonate rocks, primarily dolomite and limestone, are the dominant kinds of bedrock in the part of this MLRA in northwestern Connecticut.

Classification relationships

USDA-NRCS (USDA 2006):
Land Resource Region (LRR): N—East and Central Farming and Forest Region
Major Land Resource Area (MLRA): 144A— New England and Eastern New York Upland, Southern Part.

USDA-FS (Cleland et al. 2007)
Province: 221 - Eastern Broadleaf Province
Section: 221A - Lower New England
Subsection: 221Aa – Boston Basin
221Ac – Narragansett-Bristol Lowland and Islands
221Ad – Southern New England Coastal Lowland
221Ae – Hudson Highlands
221Ag - Southeast New England Coastal Hills and Plains
221Ah - Worcester-Monadnock Plateau
221Ai – Gulf of Maine Coastal Plain
221Ak - Gulf of Maine Coastal Lowland
Section: 221B – Hudson Valley

Subsection: 221Ba – Hudson Limestone Valley
221Bb - Miami – Taconic Foothills
221Bc – Hudson Glacial Lake Plains

Ecological site concept

The Wet Till Depressions ecological site consists of very deep, coarse-loamy, poorly drained soils formed in till often with a restrictive densic or fragipan layer, derived mainly from granite, gneiss and/or schist. They are nearly level to gently sloping soils in depressions in uplands. They also occur in drainageways in uplands, in toeslope positions of hills, drumlins, and ground moraines, and in till plains. Slope ranges from 0 to 15 percent. Representative soils are Hasbrouck, Leicester, Ridgebury, Scriba, Siwanoy, Stissing, Allis, and Mattapoisett. The forested reference community is highly varied but typified by a red maple (*Acer rubrum*) swamp or conifer swamps such as Atlantic white cedar (*Chamaecyparis thyoides*) swamps. Within swamps, hydro-geologic setting is a primary determinant of water regimes, water chemistry, plant community structure and floristics, and groundwater recharge and discharge relationships (Golet et al 1992).

Associated sites

F144AY041MA	**Very Wet Till Depressions**
F144AY008CT	**Moist Till Uplands**

Similar sites

F144AY026CT	**Moist Silty Outwash**
F144AY031MA	**Very Wet Outwash**

Table 1. Dominant plant species

Tree	(1) *Acer rubrum* (2) *Nyssa sylvatica*
Shrub	(1) *Ilex verticillata* (2) *Vaccinium corymbosum*
Herbaceous	(1) *Symplocarpus foetidus* (2) *Carex stricta*

Physiographic features

The site occurs on nearly level to gently sloping soils in a variety of landforms. The water table is at or near the surface for most of the year, with rare flooding and frequent ponding.

Table 2. Representative physiographic features

Landforms	(1) Till plain > Depression (2) Upland > Drainageway (3) Drumlin (4) Till plain (5) Ground moraine (6) Hill (7) Ridge
Runoff class	Negligible to very high
Flooding frequency	None to rare
Ponding frequency	None to frequent
Elevation	0–1,801 ft
Slope	0–15%
Water table depth	0–13 in

Aspect	Aspect is not a significant factor

Climatic features

The Koppen-Geiger climate classification of the area in which this MLRA occurs varies between Dfb (Warm-summer humid continental) in the North, and Dfa (Hot-summer humid continental) in the southern portion of the MLRA. Precipitation is usually uniformly distributed throughout the year. Near the coast, however, it is slightly lower in summer. Precipitation is slightly higher in spring and fall in inland areas. Rainfall occurs as high-intensity, convective thunderstorms during the summer. During the winter, most of the precipitation occurs as moderate-intensity storms (northeasters) that produce large amounts of rain or snow. The freeze-free period increases in length to the south.

Table 3. Representative climatic features

Frost-free period (characteristic range)	129-152 days
Freeze-free period (characteristic range)	155-183 days
Precipitation total (characteristic range)	48-51 in
Frost-free period (actual range)	114-152 days
Freeze-free period (actual range)	137-184 days
Precipitation total (actual range)	44-52 in
Frost-free period (average)	135 days
Freeze-free period (average)	164 days
Precipitation total (average)	49 in

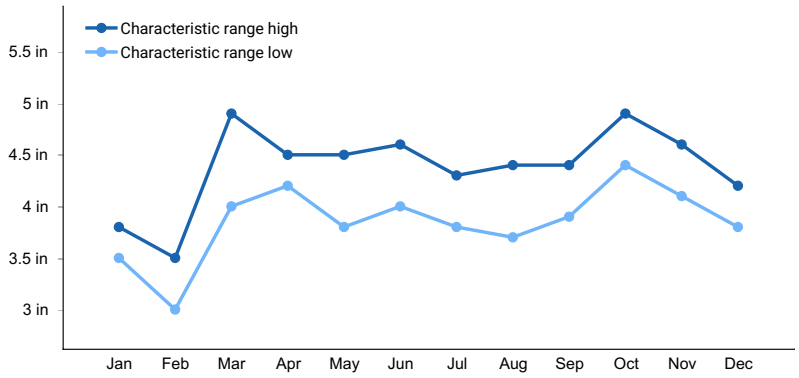


Figure 1. Monthly precipitation range

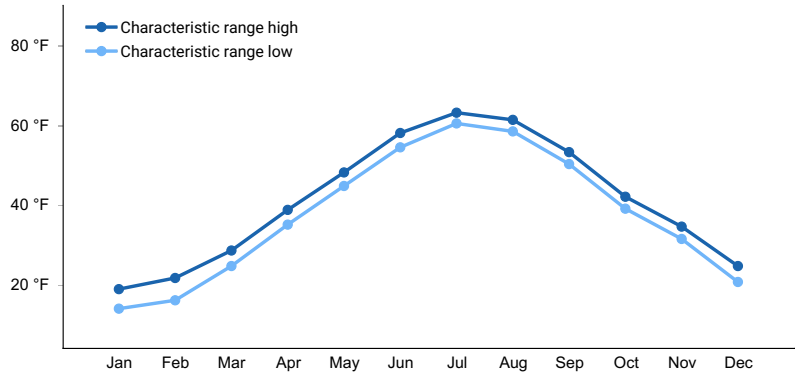


Figure 2. Monthly minimum temperature range

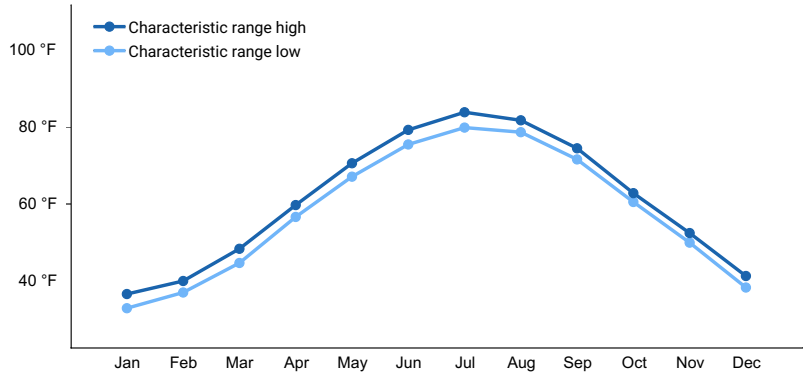


Figure 3. Monthly maximum temperature range

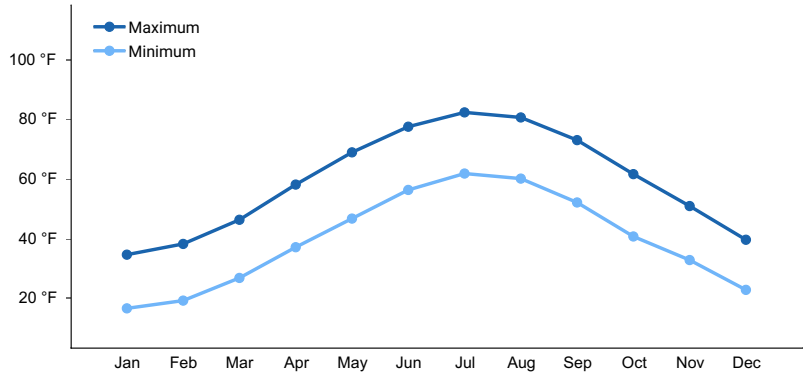


Figure 4. Monthly average minimum and maximum temperature

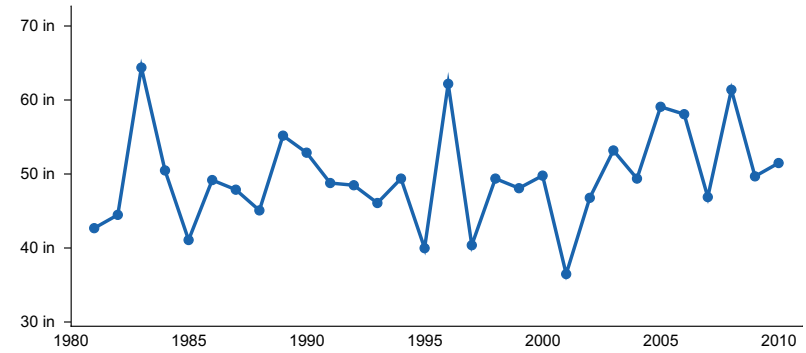


Figure 5. Annual precipitation pattern

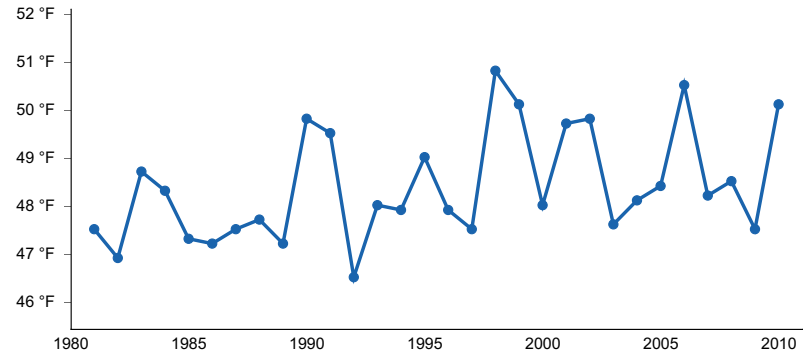


Figure 6. Annual average temperature pattern

Climate stations used

- (1) STORRS [USC00068138], Storrs Mansfield, CT
- (2) NORTON WEST [USC00195984], Mansfield, MA
- (3) MASSABESIC LAKE [USC00275211], Manchester, NH

- (4) DANBURY [USC00061762], Bethel, CT
- (5) SUFFERN [USC00308322], Mahwah, NY
- (6) WORCESTER RGNL AP [USW00094746], Leicester, MA
- (7) HAVERHILL [USC00193505], Haverhill, MA

Influencing water features

Poorly drained
Water is removed so slowly that the soil is wet at shallow depths periodically during the growing season or remains wet for long periods. Internal free water occurrence is shallow or very shallow and common or persistent. Free water is commonly at or near the surface long enough during the growing season that most mesophytic crops cannot be grown, unless the soil is artificially drained. The soil, however, is not continuously wet directly below plow depth. Free water at shallow depth is common. The water table is commonly the result of low or very low saturated hydraulic conductivity, nearly continuous rainfall, or a combination of these.

Very poorly drained
Water is removed from the soil so slowly that free water remains at or very near the surface during much of the growing season. Internal free water occurrence is very shallow and persistent or permanent. Unless the soil is artificially drained, most mesophytic crops cannot be grown. The soils are commonly level or depressed and frequently ponded. In areas where rainfall is high or nearly continuous, slope gradients may be greater.

Wetland description

National Wetland Classification (Cowardin et al., 1979):

Palustrine, class variable, leaf morphology variable, water regime variable, chemistry modifier variable.

Soil features

The site consists of shallow to very deep, somewhat poorly to very poorly drained soils formed in a variety of parent materials. Representative soils are Hasbrouck, Leicester, Ridgebury, Scriba, Siwanoy, Stissing, Whitman, Allis, and Mattapoisett.

Table 4. Representative soil features

Parent material	(1) Till–granite and gneiss (2) Alluvium–schist (3) Eolian deposits–shale (4) Glaciolacustrine deposits–phyllite (5) Colluvium–quartzite (6) Sandstone (7) Metamorphic and sedimentary rock (8) Limestone
Surface texture	(1) Fine sandy loam (2) Silt loam (3) Loam (4) Stony loam (5) Very stony fine sandy loam (6) Loamy sand (7) Gravelly silt loam (8) Very stony silt loam
Family particle size	(1) Coarse-loamy (2) Coarse-silty (3) Fine (4) Fine-loamy (5) Loamy (6) Sandy
Drainage class	Very poorly drained to somewhat poorly drained
Permeability class	Very slow to moderate

Depth to restrictive layer	12–72 in
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0–10%
Available water capacity (0-40in)	1–7 in
Soil reaction (1:1 water) (0-40in)	3.5–8.4
Subsurface fragment volume <=3" (Depth not specified)	5–20%
Subsurface fragment volume >3" (Depth not specified)	0–11%

Ecological dynamics

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

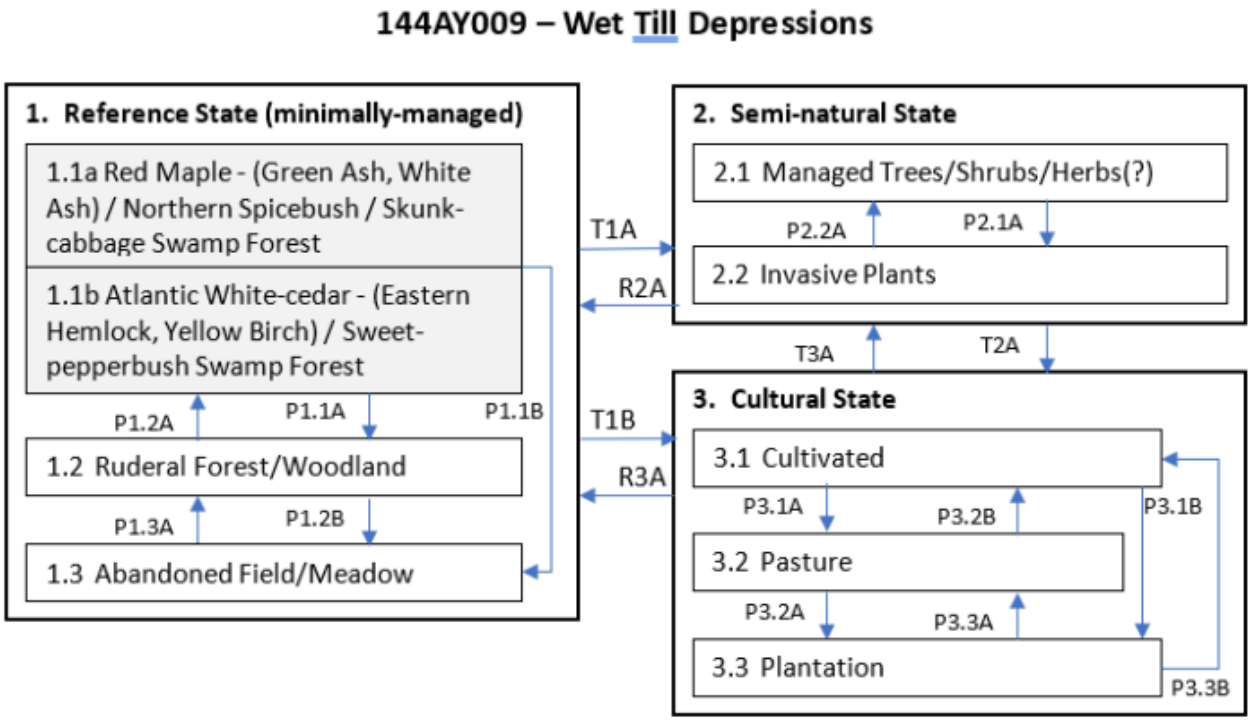
The vegetation groupings described in this section are based on the terrestrial ecological system classification and vegetation associations developed by NatureServe (Comer 2003). Terrestrial ecological SYSTEMS are specifically defined as a group of plant community-types called ASSOCIATIONS that tend to [co-]occur within landscapes with similar ecological processes, substrates, and/or environmental gradients. Any 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 (US FDGC 2008). Each association will be named by the diagnostic and often dominant species that occupy the different height strata (tree, sapling, shrub, and herb). Within the NatureServe Explorer database (NatureServe, 2015), 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).

Additional and more localized vegetation information is provided by the State Natural Heritage Programs of Connecticut (Metzler and Barrett 2001), Massachusetts (Swain and Kearsley 2001), New Hampshire (Sperduto and Nichols, 2011), New York (Edinger et al., 2014), and Rhode Island (Enser and Lungren, 2006).

The Wet Till Depressions ecological site is characteristic of, the North-Central Appalachian Acidic Swamp system (CES202.604), North-Central Interior and Appalachian Rich Swamp system (CES202.605), North-Central Interior and Appalachian Acidic Peatland system (CES202.606), Northern Atlantic Coastal Plain Basin Peat Swamp system (CES203.522), Northern Atlantic Coastal Plain Basin Swamp and Wet Hardwood Forest system (CES203.520). The forested reference community is highly varied but typified by a red maple swamp or conifer swamps such as Atlantic white cedar swamps. Within swamps, hydro-geologic setting is a primary determinant of water regimes, water chemistry, plant community structure and floristics, and groundwater recharge and discharge relationships (Golet et al 1992). This swamp forest is subject to natural disturbances by storm extremes ranging from windthrows to downbursts to ice-storms. Other agents-of-change include direct land conversions and fragmentation by agricultural, development, drainage, and logging. Indirect effects include changes to hydrology and water chemistry by development activities in the watershed. Invasive species are many including (but not limited to) common reed (*Phragmites australis* ssp. australis), garlic mustard (*Alliaria petiolata*), and purple loosestrife (*Lythrum salicaria*).

[*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.

State and transition model



Transition	*Drivers/practices*
T1A	Forest mgmt., Disturbance
T1B, T2A	Disturbance/cutting/clearing, Brush removal
R2A, R2B	Restoration & Mgmt, Forest Stand Improvement, Early Successional Habitat Development, Upland Wildlife Mgmt, Invasive spp. Control, Plant establishment
T3A	Abandonment, Plant establishment, Forest mgmt.
P2.1A	Disturbance, Invasive species establishment
P2.2A	Invasive spp. Control, Forest mgmt..
P1.3A, P1.2A	Abandonment, succession
P3.1A, P3.2A, P3.3A, P3.1B, P3.2B, P3.3B	Changing agricultural phases
P1.1A, P1.1B, P1.2B	Disturbance, Early Successional Habitat Development

State 1
Reference State (minimally-managed)

The reference plant community includes: • *Acer rubrum* - Fraxinus (pennsylvanica, americana) / *Lindera benzoin* / *Symplocarpus foetidus* Swamp Forest Translated name: Red Maple - (Green Ash, White Ash) / Northern Spicebush / Skunk-cabbage Swamp Forest Common name: Southern New England-Northern Piedmont Red Maple Seepage Swamp Forest (CEGL006406) • *Chamaecyparis thyoides* - (*Tsuga canadensis*, *Betula alleghaniensis*) / *Clethra alnifolia* Swamp Forest Translated Name: Atlantic White-cedar - (Eastern Hemlock, Yellow Birch) / Sweet-pepperbush Swamp Forest Common Name: Inland Atlantic White-cedar Swamp Forest (CEGL006189) Other plant communities may include • *Acer rubrum* / *Ilex mucronata* - *Vaccinium corymbosum* Swamp Forest Translated Name: Red Maple / Catberry - Highbush Blueberry Swamp Forest Common Name: Northeast Red Maple Acidic Swamp Forest (CEGL006220) • *Acer rubrum* / *Rhododendron viscosum* - *Clethra alnifolia* Swamp Forest Translated Name: Red Maple / Swamp Azalea - Sweet-pepperbush Swamp Forest Common Name: Lower New England Red Maple Swamp Forest (CEGL006156) • *Liquidambar styraciflua* - *Acer rubrum* - *Quercus phellos* /

Eubotrys racemosa Swamp Forest Translated Name: Sweetgum - Red Maple - Willow Oak / Swamp Doghobble Swamp Forest Common Name: Sweetgum - Red Maple Swamp Forest (CEGL6110) NY only • *Acer rubrum* - *Nyssa sylvatica* - *Betula alleghaniensis* / Sphagnum spp. Swamp Forest Translated Name: Red Maple - Blackgum - Yellow Birch / Peatmoss species Swamp Forest Common Name: Red Maple - Blackgum Basin Swamp Forest (CEGL006014) • *Betula alleghaniensis* - *Acer rubrum* - (*Tsuga canadensis*, *Abies balsamea*) / *Osmunda cinnamomea* Swamp Forest Translated Name: Yellow Birch - Red Maple - (Eastern Hemlock, Balsam Fir) / Cinnamon Fern Swamp Forest Common Name: Hardwood - Conifer Seepage Forest (CEGL006380) • *Quercus palustris* - (*Quercus bicolor*) - *Acer rubrum* / *Vaccinium corymbosum* / *Osmunda cinnamomea* Wet Forest Translated Name: Pin Oak - (Swamp White Oak) - Red Maple / Highbush Blueberry / Cinnamon Fern Wet Forest Common Name: Northeastern Pin Oak - Swamp White Oak Wet Forest (CEGL006240) • *Chamaecyparis thyoides* - (*Tsuga canadensis*, *Betula alleghaniensis*) / *Clethra alnifolia* Swamp Forest Translated Name: Atlantic White-cedar - (Eastern Hemlock, Yellow Birch) / Coastal Sweet-pepperbush Swamp Forest Common Name: Inland Atlantic White-cedar Swamp Forest (CEGL006189) • *Chamaecyparis thyoides* / *Ilex glabra* - *Rhododendron viscosum* Swamp Forest Translated Name: Atlantic White-cedar / Inkberry - Swamp Azalea Swamp Forest Common Name: Coastal Plain Atlantic White-cedar Swamp Forest (CEGL006188)

Community 1.1
1.1a Red Maple - (Green Ash, White Ash) / Northern Spicebush / Skunk-cabbage Swamp Forest (CEGL006406) 1.1b Atlantic White-cedar - (Eastern Hemlock, Yellow Birch) / Sweet-pepperbush Swamp Forest (CEGL006189)

Community 1.1a Southern New England-Northern Piedmont Red Maple Seepage Swamp Forest *Acer rubrum* - Fraxinus (pennsylvanica, americana) / *Lindera benzoin* / *Symplocarpus foetidus* Swamp Forest (Translated) Red Maple - (Green Ash, White Ash) / Northern Spicebush / Skunk-cabbage Swamp Forest (CEGL006406) The reference community is typified by a red maple – hardwoods swamp forest. These communities may be perched or show seepage and maybe considered minerotrophic (slightly enriched). Canopy dominants include red maple (*Acer rubrum*) with green ash (*Fraxinus pennsylvanica*) or white ash (*Fraxinus americana*). Other trees include pin oak (*Quercus palustris*), swamp white oak (*Quercus bicolor*) and black gum (*Nyssa sylvatica*). Shrubs density varies with openness and hydrology. Shrubs include northern spicebush (*Lindera benzoin*) and winterberry holly (Ilex verticillate), silky dogwood (*Cornus amomum*) and northern arrowwood (*Viburnum dentatum* var lucidum [=*Viburnum recognitum*]). Groundcover is variable w/ skunk cabbage (*Symplocarpus foetidus*) and and/or ferns: cinnamon fern (Osmundastrum cinnamomeum [= *Osmunda cinnamomea*)], royal fern (Osmundastrum cinnamomeum *Osmunda regalis*), marsh fern (Thelypteris palustrius); and sedges: Gray's sedge (*Carex grayi*) , fringed sedge (Carex crinata), hop sedge (*Carex lupulina*). Depending on the water table fluctuations, the "perched" wetlands may contain a more diverse shrub layer. Invasive shrubs and herbs, including Japanese barberry (Berberis thunbergia), multiflora rose (*Rosa multiflora*), Morrow's honeysuckle (*Lonicera morrowii*), garlic mustard (Alliaria petiolate), and Japanses stiltgrass (*Microstegium vimineum*), may be abundant. (Source: NatureServe 2018 [accessed 2019], USNVC 2017 [accessed 2019]). Cross-referenced plant community concepts (typically by political state): CT: Red maple / northern spicebush Forest (Metzler and Barrett, 2006) MA: Red maple swamp (Swain and Kearsley, 2001) NH: Red maple / skunk cabbage Swamp (Sperduto and Nichols, 2011) NY: Red maple – hardwood Swamp (Edinger et al., 2014) Community 1.1b • *Chamaecyparis thyoides* - (*Tsuga canadensis*, *Betula alleghaniensis*) / *Clethra alnifolia* Swamp Forest Translated Name: Atlantic White-cedar - (Eastern Hemlock, Yellow Birch) / Coastal Sweet-pepperbush Swamp Forest Common Name: Inland Atlantic White-cedar Swamp Forest (CEGL006189) • This forested wetland is dominated by Atlantic white cedar (*Chamaecyparis thyoides*) or mixed with red maple (*Acer rubrum*), yellow birch (*Betula alleghaniensis*), eatern hemlock (*Tsuga canadensis*), and occasionally white pine (*Pinus strobus*), and blackgum (*Nyssa sylvatica*). The shrub layer is diverse with common winterberry (Ilex verticillate), highbush blueberry (*Vaccinium corymbosum*), smooth winterberry (*Ilex laevigata*), swamp azalea (*Rhododendron viscosum*), mountain laurel (*Kalmia latifolia*), maleberry (*Lyonia ligustrina*), withe-rod (*Viburnum nudum* var. cassinoides), and sweet pepperbush (*Clethra alnifolia*). Herbaceous cover is inversely proportional to canopy and shrub cover and commonly includes Cinnamon fern (Osmundastrum cinnamomeum), interrupted feren (*Osmunda claytoniana*), royal fern (*Osmunda regalis*), skunk cabbage (*Symplocarpus foetidus*), water arum (*Calla palustris*), starflower (Lysimachia borealis [= *Trientalis borealis*]), sarsaparilla (*Aralia nudicaulis*), three-leaved goldthread (*Coptis trifolia*), partridgeberry (*Mitchella repens*), northern log sedge (Carex folliculate), three-seeded sedge (*Carex trisperma*), and occasionally greater bladder sedge (*Carex intumescens*)and tussock sedge (*Carex stricta*). In sites with more organic matter, the nonvascular layer is often well-developed and includes abundant peat mosses (Sphagnum spp.). Localized seepage in these basins may be expressed with indicators such as northern spicebush (*Lindera benzoin*) and [purple] water avens (*Geum rivale*). (Source: NatureServe 2018 [accessed 2019], USNVC 2017 [accessed 2019]). Cross-referenced plant community concepts (typically by political

State): CT: Atlantic white cedar – yellow birch Swamp (Metzler and Barrett, 2006) MA: Inland Atlantic white cedar Swamp (Swain and Kearsley, 2001) NH: Atlantic white cedar - yellow birch - pepperbush Swamp (Sperduto and Nichols, 2011) NY: Inland Atlantic white cedar Swamp (Edinger et al., 2014) RI: Atlantic white cedar Swamp (Enser and Lundgren, 2006)

Community 1.2
Ruderal Forest/Woodland

Community 1.3
Abandoned Field/Meadow

Disturbance

Pathway P1.1A
Community 1.1 to 1.2

Disturbance

Pathway P1.1B
Community 1.1 to 1.3

Disturbance

Pathway P1.2A
Community 1.2 to 1.1

Succession

Pathway P1.2B
Community 1.2 to 1.3

Disturbance

Pathway P1.3A
Community 1.3 to 1.2

Abandonment, Succession

State 2
Semi-natural State

The Semi-natural State would expect plant communities where ecological processes are primarily operating with some land conditioning in the past or present, e.g., managed forests, or plant communities that are an artifact of land management e.g., predominately invasive plants.

Community 2.1
Managed Trees/Shrubs/Herbs(?)

Community 2.2
Invasive Plants

Pathway P2.1A
Community 2.1 to 2.2

Disturbance, Invasive species establishment

Pathway P2.2A
Community 2.2 to 2.1

Invasive spp. Control, Forest mgmt.

State 3
Cultural State

The Cultural State would expect the ecological site to be very strongly conditioned by land management conversion, by transformation to Cultivated/Pasture/Plantation.

Community 3.1
Cultivated

Community 3.2
Pasture

Community 3.3
Plantation

Pathway P3.1A
Community 3.1 to 3.2

Changing agricultural phases

Pathway P3.1B
Community 3.1 to 3.3

Changing agricultural phases

Pathway P3.2A
Community 3.2 to 3.1

Changing agricultural phases

Pathway P3.2B
Community 3.2 to 3.3

Changing agricultural phases

Pathway P3.3A
Community 3.3 to 3.1

Changing agricultural phases

Pathway P3.3B
Community 3.3 to 3.2

Changing agricultural phases

Transition T1A
State 1 to 2

altered by human- induced Disturbance or Management

Conservation practices

Tree/Shrub Establishment
Forest Land Management
Forest stand improvement for habitat and soil quality

Transition T1B
State 1 to 3

Disturbance, clearing, cutting

Restoration pathway R2A
State 2 to 1

Plant removals, plantings, Invasive plant control, successional mgmt., forestry practices Restoration & Mgmt, Forest Stand Improvement, Early Successional Habitat Development, Upland Wildlife Mgmt, Invasive spp. Control, Plant establishment

Conservation practices

Brush Management
Tree/Shrub Establishment
Early Successional Habitat Development/Management
Forest Stand Improvement
Restoration and Management of Natural Ecosystems
Native Plant Community Restoration and Management
Forest Land Management
Invasive Plant Species Control

Transition T2A
State 2 to 3

Land clearing, cutting

Conservation practices

Brush Management
Land Clearing
Herbaceous Weed Control

Restoration pathway R3A
State 3 to 1

Plant removals, plantings, Invasive plant control, successional mgmt., forestry practices Restoration & Mgmt, Forest Stand Improvement, Early Successional Habitat Development, Upland Wildlife Mgmt, Invasive spp. Control, Plant establishment

Conservation practices

Restoration and Management of Natural Ecosystems
Native Plant Community Restoration and Management

Transition T3A

State 3 to 2

Abandonment. Plant establishment, Forest mgmt.

Conservation practices

Tree/Shrub Establishment
Forest Stand Improvement
Forest Land Management

Additional community tables

Inventory data references

Future work is needed, as described in a future 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.

Other references

REFERENCES

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Approval

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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	10/15/2020
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:**