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Vegetation Classification and Mapping at Roosevelt-Vanderbilt National Historic Sites, New York

Natural Resource Technical Report NPS/NETN/NRTR—2014/XXX

ON THE COVER

Northern Riverside Rock Outcrop, Vanderbilt Mansion National Historic Site, New York. Photograph by Jennifer Garrett, New York Natural Heritage Program..

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Natural Resource Technical Report NPS/NETN/NRTR—2014/XXX

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Executive Summary

The National Park Service – National Vegetation Inventory Program (NVIP) funded a project, beginning in 2002, to classify and map the vegetation of the Roosevelt-Vanderbilt National Historic Sites (ROVA) and create current digital geospatial databases. The inventory work was performed by the New York Natural Heritage Program (NYNHP), the National Park Service (NPS) (including staff of ROVA and the NPS Northeast Region, the North Carolina State University Center for Earth Observation, NatureServe, and Cogan Technology, Inc. The NPS Northeast Temperate Network, Inventory and Monitoring Program (NETN) coordinated the project.

Vegetation sampling, classification, and mapping to plant associations and land use types were conducted at ROVA, which includes the Home of Franklin D. Roosevelt National Historic Site (hereafter known as “Home of Franklin D. Roosevelt NHS” and contains Roosevelt Farm and Forest), Vanderbilt Mansion National Historic Site (hereafter known as "Vanderbilt Mansion NHS"), and Eleanor Roosevelt National Historic Site (hereafter known as “Val-Kill”). To classify the vegetation, 147 representative classification plots were sampled throughout the 2,029 acre (821 hectare) project area using traditional phytosociological methods (i.e., relevé sampling). The relevé plots were located and sampled primarily in 2003, 2004, and 2007. Three hundred and sixty vascular plant species were identified; the plot data were classified into 50 local vegetation associations using multivariate statistical analyses and the associations were described in detail. These local vegetation associations were also crosswalked to the U.S. National Vegetation Classification (USNVC) in order to provide a regional and global context for the park vegetation. The associations represented 43 USNVC alliances, 19 USNVC groups, 13 USNVC macrogroups, eight USNVC divisions and formations, and three USNVC subclasses and classes. A dichotomous field key was developed for these vegetation associations to assist with field recognition and classification.

A map showing the locations of vegetation associations in the park was created, following the NVIP protocols. Digital geospatial databases were created for the ROVA project in its entirety. In early spring 2006, following the vegetation classification plot data analysis, the 2003 preliminary vegetation map of the Home of Franklin D. Roosevelt NHS (excluding Roosevelt Farm and Forest), Val-Kill, and Vanderbilt Mansion NHS was edited and refined to produce a revised vegetation map prior to thematic accuracy assessment (AA). In addition, in early spring of 2008, the 2007 Roosevelt Farm and Forest preliminary vegetation map was edited and refined to produce a revised vegetation map prior to AA. Using ArcMap 9.2 (ESRI 1999-2006), both preliminary maps were revised by editing polygon boundaries on-screen based on the classification plot data, field observations, classification analyses, aerial photography signatures, and topographic maps.

These revised maps were used to plan an AA for each phase of the project. A total of 216 AA observations were made in 2006 and 2008. Following analysis of the AA data, a final vegetation type and land use map was created in 2009, resulting in corrected USNVC associations and Anderson Level I and II land use categories. User’s and producer’s accuracies for each USNVC map class and overall accuracies for USNVC classes were calculated and presented in contingency matrices. The overall accuracies for the USNVC portion of the map are 39.3% at the

association level, 56.4% at the alliance level, 79.8% at the group level, 80.2% at the macrogroup level, 91.6% at the division and formation levels, and 94.1% at the subclass and class levels.

Five NYNHP natural communities established within ROVA represent significant occurrences from a statewide perspective, they are: (1) hemlock-northern hardwood forest (combination of five hemlock-northern hardwood forest USNVC associations) on 183 acres (71 hectares); (2) diverse oak-tulip tree forest, northern portion is considered old-growth; (3) two vernal pool complexes in good ecological condition; (4) red-cedar rocky summit; and (5) freshwater tidal marsh with excellent species and physiognomic diversity.

To complete this vegetation inventory project the standard deliverables were produced as described and presented herein. All deliverables are available online at the USGS-NPS Vegetation Characterization Program website (http://www.usgs.gov/core_science_systems/csas/vip/parks.html) or by contacting the Northeast Temperate Network's data manager (http://science.nature.nps.gov/im/units/netn/index.cfm).

This final report includes vegetation association descriptions, the field key to vegetation associations, description of the physiognomic map classes and photo-signatures, accuracy assessment (AA) information, and project methods and results. Other project products include a spatial GIS database containing the attributed vegetation polygons, classification plots, and AA points; digital photographs characterizing classification plots and landscape features/objects of interest within ROVA; and metadata for project spatial data that are Federal Geographic Data Committee (FGDC)-compliant.

The organizations participating in the project performed the following roles: New York Natural Heritage Program performed all field data collection in support of vegetation classification, vegetation mapping, and AA, classification analysis, mapping, and the majority of the report writing. NatureServe assisted with the interpretation of vegetation types to the USNVC and provided global information on applicable USNVC vegetation types. The North Carolina State University Center for Earth Observation conducted positional accuracy assessment and final product quality control. Cogan Technology, Inc. provided additional editing and quality control, AA analysis, and updating of data and the report to the 2008 version of the USNVC, to current NVIP standards, and to current NPS Natural Resource Technical Report series standards.

Keywords: vegetation association, vegetation classification, vegetation mapping, Roosevelt-Vanderbilt National Historic Site (ROVA), Home of Franklin D. Roosevelt National Historic Site, Vanderbilt Mansion National Historic Site, Eleanor Roosevelt National Historic Site, Val-Kill, and Roosevelt Farm and Forest.

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New York Natural Heritage Program (NYNHP) staff contributed significantly to this project. Jennifer Garrett sampled accuracy assessment observation points in 2006 and Lauren Lyons-Swift assisted with surveying accuracy assessment observation points. Aissa Feldmann provided invaluable editing and Shereen Brock assisted with report formatting.

List of Acronyms

AA	Accuracy Assessment
ac	Acre(s)
BTEX	B*enzene, Toluene, Ethylbenzene, Xylenes*
^{o}C	Degrees Celsius
CA	Cluster Analysis
CEGL	Community Element Code – Global
CES	Ecological System Code
cm	Centimeter(s)
dbh	Diameter at Breast Height
DEM	Digital Elevation Model
DO	Dissolved Oxygen
DOQQ	Digital Orthophoto Quarter Quadrangle
DVD	Digital Video Disk
°F	Degrees Fahrenheit
FFDB	Field Form Database
e.g.	for example (exempli gratia)
ERDAS	Earth Resources Data Analysis System
ESRI	Environmental Systems Research Institute
et al.	and others (et alia)
FGDC	Federal Geographic Data Committee
ft	Foot/Feet
GIS	Geographic Information System
GPS	Global Positioning System Receiver
ha	Hectare(s)
HHDB	Hand-Held Database
HTML	Hyper Text Markup Language
HVV	The combined National Park Service units of (1) the Home of Franklin D. Roosevelt National Historic Site (excluding Roosevelt Farm and Forest), (2) the Vanderbilt Mansion National Historic Site, and (3) the Eleanor Roosevelt National Historic Site (also known as "Val-Kill"). These areas were treated as a separate project area from the Roosevelt Farm and Forest for some aspects of this project.
I&M	Inventory and Monitoring Program
in	Inch(es)
km	Kilometer(s)
m	Meter(s)
m^2	Square Meters
mi	Mile(s)
MrSID	Multiresolution Seamless Image Database
N/A	Not Applicable

NAD83	North American Datum of 1983
NBII	National Biological Information Infrastructure Program
NCSU	North Carolina State University
NETN	Northeast Temperate Inventory and Monitoring Network
NHS	National Historic Site(s)
NMS	Non-metric Multidimensional Scaling
NPS	National Park Service
NRC	Natural Resources Challenge
NVCS	National Vegetation Classification Standard
NVIP	National Vegetation Inventory Program
NY	New York
NYS	New York State
NYSC	New York State Classification
NYS DEC	New York State Department of Environmental Conservation
pH	Symbol for the logarithm of the reciprocal of hydrogen ion concentration in gram atoms per liter (used to express the acidity or alkalinity of a solution on a scale of 0 to 14, where less than 7 represents acidity, 7 neutrality, and more than 7 alkalinity)
RFF	The Roosevelt Farm and Forest parcel of the Home of Franklin D. Roosevelt National Historic Site. This parcel was treated as a separate project area from the other National Park Service lands for some aspects of this project.
ROVA	Roosevelt-Vanderbilt National Historic Sites, an administrative unit of the National Park Service. Includes the three legislative units of (1) the Home of Franklin D. Roosevelt National Historic Site, (2) the Vanderbilt Mansion National Historic Site, and (3) the Eleanor Roosevelt National Historic Site (informally known as “Val-Kill”).
sp./spp.	Species (singular/plural)
STD	Standard
TDS	Total Dissolved Solids
TIFF	Tagged Image File Format
TNC	The Nature Conservancy
TWINSPAN	Two-Way Indicator Species Analysis
U.S.	United States of America
USDA	U.S. Department of Agriculture
USDA-NRCS	U.S. Department of Agriculture-Natural Resources Conservation Service
USDI	U.S. Department of the Interior
USGS	U.S. Geological Survey
USNVC	U.S. National Vegetation Classification
UTM	Universal Transverse Mercator
XML	Extensible Markup Language

Introduction

The Director of the National Park Service (NPS) approved the Natural Resource Challenge (NRC) in 1999 to encourage national parks to focus on the preservation of the nation's natural heritage through science, natural resource inventories, and expanded resource monitoring (NPS 1999). The NRC provided funding for 12 baseline inventories to be completed in each of 270 parks with significant natural resources. Vegetation mapping is one of the 12 baseline inventories. Through the NRC, the 270 focus national parks were organized regionally into 32 Inventory and Monitoring (I&M) networks for the purpose of accomplishing natural resource inventory and monitoring projects.

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

NPS Vegetation Inventory Program

The NPS National Vegetation Inventory (NVIP), one of the 12 basic natural resource inventories, was established in 1994 by the National Park Service and the U.S. Geological Survey (USGS), who worked in cooperation with The Nature Conservancy (TNC) and Environmental Systems Research Institute (ESRI) on initial protocol development. The NVIP was incorporated into the NPS I&M Program and is administered by the National Park Service at the national level (http://science.nature.nps.gov/im/inventory/veg/index.cfm). Its staff oversees funding and provides technical guidance and oversight for individual park projects, which are implemented by individual I&M networks and NPS parks. The objectives of the NVIP are to classify vegetation to ecological community types in each of more than 250 NPS parks in the United States outside of Alaska and to map vegetation in each park using the classification scheme developed for the park (Lea 2011). Vegetation plot data collected within or near the park using standard methods is the primary source for vegetation classification (TNC and ESRI 1994a, FGDC 2008).

Vegetation maps are produced from interpretation of remotely sensed imagery augmented by ground observations tagged with GIS points collected as Universal Transverse Mercator (UTM) coordinates defined by the North American Datum of 1983 (NAD 83). Maps have a scale of 1:24,000 and a minimum mapping unit of 0.5 hectares (ha), or 1.24 acres (ac).The vegetation maps must meet the FGDC National Map Accuracy Standards for positional accuracy (which specify horizontal errors of less than 40.0 feet (ft). or 12.2 meters (m) on the ground for 1:24,000-scale maps). Additionally, a thematic accuracy assessment of a subset of polygons randomly selected from the completed map is conducted to estimate individual map class accuracy and overall map accuracy (Lea and Curtis 2010). Digital vegetation products are accompanied by FGDC-compliant metadata, which describe the content, quality, condition, and

other characteristics of the spatial dataset and are critical elements that expedite the interpretation and exchange of information among users. All final NVIP products are made available at the NPS Data Store (https://irma.nps.gov/App/Portal/Home) and at the USGS Core Science Systems Program (http://www.usgs.gov/core_science_systems/csas/vip/products.html).

A complete NVIP project for a park includes, at a minimum, the following products:

-Detailed vegetation report
-Digital vegetation map
-Vegetation classification plot data
-Accuracy assessment data and analysis
-Dichotomous vegetation key
-Photo-interpretation key

U.S. National Vegetation Classification

Following the NPS NVIP protocols (Lea 2011), the classified vegetation types are named within the context of the U.S. National Vegetation Classification (USNVC) (FGDC 2008, NatureServe 2013, http://usnvc.org, Table 1), whenever adequately applicable taxonomic units have been named and described; vegetation units found in parks that appear to represent vegetation that is not described by the USNVC may be named and described for local project use within the format established by the National Vegetation Classification Standard (NVCS) (Lea 2011).

The USNVC represents the taxonomic content of the NVCS, which is a hierarchical system that allows vegetation classification at multiple scales and was adopted as an information sharing standard for vegetation by the Federal Geographic Data Committee (FGDC 1997). In 2008, the FGDC issued a new NVCS which established new hierarchy levels (Table 1) and new criteria for establishing taxonomic units within each level (FGDC 2008). The current USNVC content has been developed by a number of cooperators (FGDC 1997, FGDC 2008) and is maintained online at http://usnvc.org and by NatureServe at http://www.natureserve.org/explorer/. At the time of this report, information on alliances was not available on these sites. Pursuant to changes imposed by the 2008 NVCS revision, all alliance content was being reviewed with the anticipation of moderately extensive revision to many units and new content available sometime after the publication of this report in 2014.

The basic unit of vegetation classification in the USNVC is the association, a plant community type that is relatively homogeneous in composition and structure, and occurs in a uniform habitat. Each association is assigned a unique Community Element Global code (CEGL) by NatureServe. For example, the Eastern Hemlock - American Beech - Northern Red Oak Forest (CEGL006088) is a widespread association in southern New England that ranges south into localized parts of the northern Piedmont and High Allegheny Mountains. Associations recognized by the USNVC are sometimes directly equivalent to communities in state-specific vegetation classifications such as Ecological Communities of New York State (Edinger et al. 2002) and can usually be cross-walked to the state classification.

The use of the USNVC and the NVIP vegetation mapping protocols facilitates effective resource stewardship by increasing compatibility of products between parks and promoting widespread use of the information throughout the NPS, federal and state agencies, academia, and citizens.

Table 1. USNVC Hierarchy levels for natural and semi-natural vegetation, in descending taxonomic order (adapted from FGDC (2008)) . A description of individual units in each level can be found at http://usnvc.org) and at http://www.natureserve.org/explorer/.

USNVC LEVEL	DESCRIPTION OF CRITERIA FOR UNITS
Upper Levels: Physiognomic characters of vegetation play a predominant role.	
Level 1 – Class	Broad combinations of general dominant growth forms that are adapted to basic temperature (energy budget), moisture, and/or substrate or aquatic conditions.
Level 2 - Subclass	Combinations of general dominant and diagnostic growth forms that reflect global macroclimatic factors driven primarily by latitude and continental position, or that reflect overriding substrate or aquatic conditions.
Level 3 – Formation	Combinations of dominant and diagnostic growth forms that reflect global macroclimatic factors as modified by altitude, seasonality of precipitation, substrates, and hydrologic conditions.
Middle Levels: Both floristic and physiognomic characters of vegetation play a significant role	
Level 4 – Division	Combinations of dominant and diagnostic growth forms and a broad set of diagnostic plant taxa that reflect biogeographic differences in composition and continental differences in mesoclimate, geology, substrates, hydrology, and disturbance regimes.
Level 5 – Macrogroup	Combinations of moderate sets of diagnostic plant species and diagnostic growth forms that reflect biogeographic differences in composition and sub-continental to regional differences in mesoclimate, geology, substrates, hydrology, and disturbance regimes.
Level 6 – Group	Combinations of relatively narrow sets of diagnostic plant species (including dominants and co-dominants), broadly similar composition, and diagnostic growth forms that reflect biogeographic differences in composition and sub-continental to regional differences in mesoclimate, geology, substrates, hydrology, and disturbance regimes
Lower Levels: Floristic characters of vegetation play a predominant role**.**	
Level 7 – Alliance	Diagnostic species, including some from the dominant growth form or layer, and moderately similar composition that reflect regional to subregional climate substrates, hydrology, moisture/nutrient factors, and disturbance regimes.
Level 8 – Association	Diagnostic species, usually from multiple growth forms or layers, and more narrowly similar composition that reflect topo-edaphic climate, substrates, hydrology, and disturbance regimes.

The vegetation maps and associated classification and accuracy information support a wide variety of resource assessment, park management, and planning needs. In addition the data/information can be used to provide a structure for framing and answering critical scientific questions about vegetation communities and their relationship to environmental conditions and ecological processes across landscapes.

New York Natural Heritage Program Relation to the USNVC

In 1990, the New York Natural Heritage Program (NYNHP) published Ecological Communities of New York State (Reschke 1990), a classification of natural and human-influenced communities (NYNHP 2013). From 40,000-acre beech-maple mesic forests to 40-acre maritime beech forests, salt marshes, and alpine meadows, the NYNHP classification is the primary source for natural community classification in NY and is a fundamental reference for natural community classifications in the northeastern U.S. and southeastern Canada. This classification has been continually updated as new field data are available and has been incorporated into the

USNVC (NatureServe 2013). Reschke (1990) has been incorporated into and updated by Ecological Communities of New York State (Edinger et al. 2002).

Any vegetation classification is an attempt to define discrete entities in the face of continuous ecological gradients. Sometimes these entities (communities) exhibit a narrow range of variation from one example to the next; multiple occurrences of woodland vernal pool, as defined in the NY classification, are likely to be quite similar to each other in terms of their vegetation composition, environmental setting, and associated animal species. As described above, communities defined at the association level in the USNVC are also defined by a specific suite of species occurring in a uniform habitat. For NY ecological communities like the vernal pool, a one-to-one link (crosswalk) between NY's classification and the USNVC is often possible (e.g., vernal pool is equivalent to USNVC type Eastern Woodland Vernal Pool, CEGL006453). Other NY community types, such as shrub swamp, are more broadly defined and encompass examples with significantly different dominant species and environmental features. This results in a one-to-many crosswalk with the USNVC, linking shrub swamp with multiple NVC types dominated by different characteristic species.

The New York Natural Heritage Program is an active participant in NatureServe's international network of natural heritage programs and biodiversity data centers. There are currently natural heritage programs in all 50 states and several interstate regions; there are 21 conservation data centers, the international equivalent of natural heritage programs, in Canada, Latin America, and South America. These programs work with NatureServe to develop biodiversity data, maintain compatible standards for data management, and provide information about rare species and natural communities that is consistent across many geographic scales from sites to continents. NYNHP collaboration with NatureServe, other states, and nations places local information into a broader regional context. With NatureServe, the NYNHP tracks the rarity of species and natural communities at global and state scales, informing conservation planning by distinguishing between species with only a few populations globally (globally rare and state rare) and those that have only a few populations in NY but are otherwise common (globally common and state rare).

NPS Northeast Temperate Network

The Northeast Temperate Network (NETN) (Figure 1) is headquartered in Woodstock, Vermont and encompasses 13 park units managed by the NPS: Acadia National Park (ACAD), Appalachian National Scenic Trail (APPA; Maine to Maryland), Boston Harbor Islands National Recreation Area (BOHA), Eleanor Roosevelt National Historic Site, Home of Franklin D. Roosevelt National Historic Site, Marsh-Billings-Rockefeller National Historical Park (MABI), Minuteman National Historic Park (MIMA), Morristown National Historic Park (MORR), Saint-Gaudens National Historic Site (SAGA), Saratoga National Historical Park (SARA), Saugus Iron Works (SAIR), Vanderbilt Mansion National Historic Site (VAMA), and Weir Farm National Historic Site (WEFA) (Figure 1). VAMA, HOFR, and ELRO are collectively managed and known as Roosevelt-Vanderbilt National Historic Sites (ROVA). Together the 13 park units

comprise nearly 57,933 ha (143,156 ac) and range considerably in size (3 to 34,398 ha, or 9 to 85,000 ac) and topographic relief.

NETN parks are located within the temperate deciduous forest biome (characteristic trees are broadleaf/deciduous including species of oak, maple, beech, hickory, and chestnut). Deciduous forest regions are exposed to warm and cold air masses, which cause this area to have four distinct seasons. Temperature varies widely from season to season with cold winters and hot, wet summers. The areas in which deciduous forests are located receive from 75 to 150 cm (29.5 to 59.1 inches) of precipitation occurring evenly throughout the year. The diversity of ecological communities found within NETN park units range from tidal wetlands and other coastal communities to freshwater wetlands and vernal pools, as well as deciduous, mixed, and hemlock forests.

Project Area

Roosevelt-Vanderbilt administers three National Historic Sites located in Hyde Park in

Figure 1. Map of Northeast Temperate Network Park Units (Source: USDI NPS 2013).

northwestern Dutchess County, just north of the city of Poughkeepsie, in southeastern New York (Figures 2 and 3). Vanderbilt Mansion National Historic Site (Vanderbilt Mansion NHS) was established in 1940 on 85.8 ha (212 ac) and is characterized by outstanding architecture and breathtaking views of the Hudson River. The Home of Franklin D. Roosevelt National Historic Site (Home of Franklin D. Roosevelt NHS) occupies 291 ha (719 ac) and opened to the public as a NHS in 1946, one year to the day after the President's death; it includes Roosevelt Farm and Forest. Eleanor Roosevelt National Historic Site (Val-Kill) occupies 73.3 ha (181 ac) and was established in 1977 to preserve Mrs. Roosevelt's cherished home on the Roosevelt estate. Together, the sites host more than 500,000 visitors annually. ROVA is located entirely on the Hyde Park USGS topographic quadrangle map. It is within the town of Hyde Park, which is located in northwestern Dutchess County just north of the city of Poughkeepsie.

ROVA is located along the eastern bank of the Hudson River and contains an excellent diversity of forested habitats and wetlands that provide abundant habitat for a variety of wildlife. Vertebrate inventories conducted at ROVA documented 16 species of amphibians, 20 species of fish, 71 confirmed breeding birds, and 5 species of small mammals (Steadman 1991, Schmidt 1995, Hayes 2006).

An overview of the land use history, physiography, geology, stream drainage, and climate of ROVA is presented in the Soil Survey of Dutchess County, New York (USDA NRCS 2004a). General information on the cultural and natural history of ROVA is presented in NPS park brochures as well as NPS official web sites (http://www.nps.gov/hofr/roosevelt-vanderbilt-national-historic-sites.htm).

The study area presented on Figures 2 and 3 includes the total area photo-interpreted and delineated with ecological community types, which includes adjoining property outside of the ROVA boundary. These ecological communities were delineated because they extend beyond ROVA administrative boundaries; knowing the context of each community type provides valuable conservation information to park managers and may identify potential land conservation opportunities that could enhance the ecological integrity of the park.

Park Environmental Attributes

Ecoregions

The distribution of plant and animal species closely corresponds with ecoregional boundaries which define areas of ecological homogeneity with similarities in soil, physiography, climate, hydrology, geology, and vegetation. The ecoregions are based on The Nature Conservancy (TNC) classifications for the U.S. and are modified from USDA Forest Service ecoregions (Bailey 1997). There are seven TNC Ecoregions and 34 Ecoregion Subsections in New York.

ROVA lies in the Hudson Limestone Valley Subsection of the Lower New England/Northern Piedmont Ecoregion (Figure 4). This ecoregion extends from southern Maine and New Hampshire (formerly glaciated, low mountain, and lake studded landscape) through the limestone valleys of western Massachusetts and Connecticut, Vermont, and eastern New York and through eastern Pennsylvania to northern Virginia (Bailey 1997). The entire Lower New England/Northern Piedmont Ecoregion is expansive, covering 23.3 million acres (9,429,175 hectares) of land and water. The ecoregion is 60-70% forested and includes numerous globally

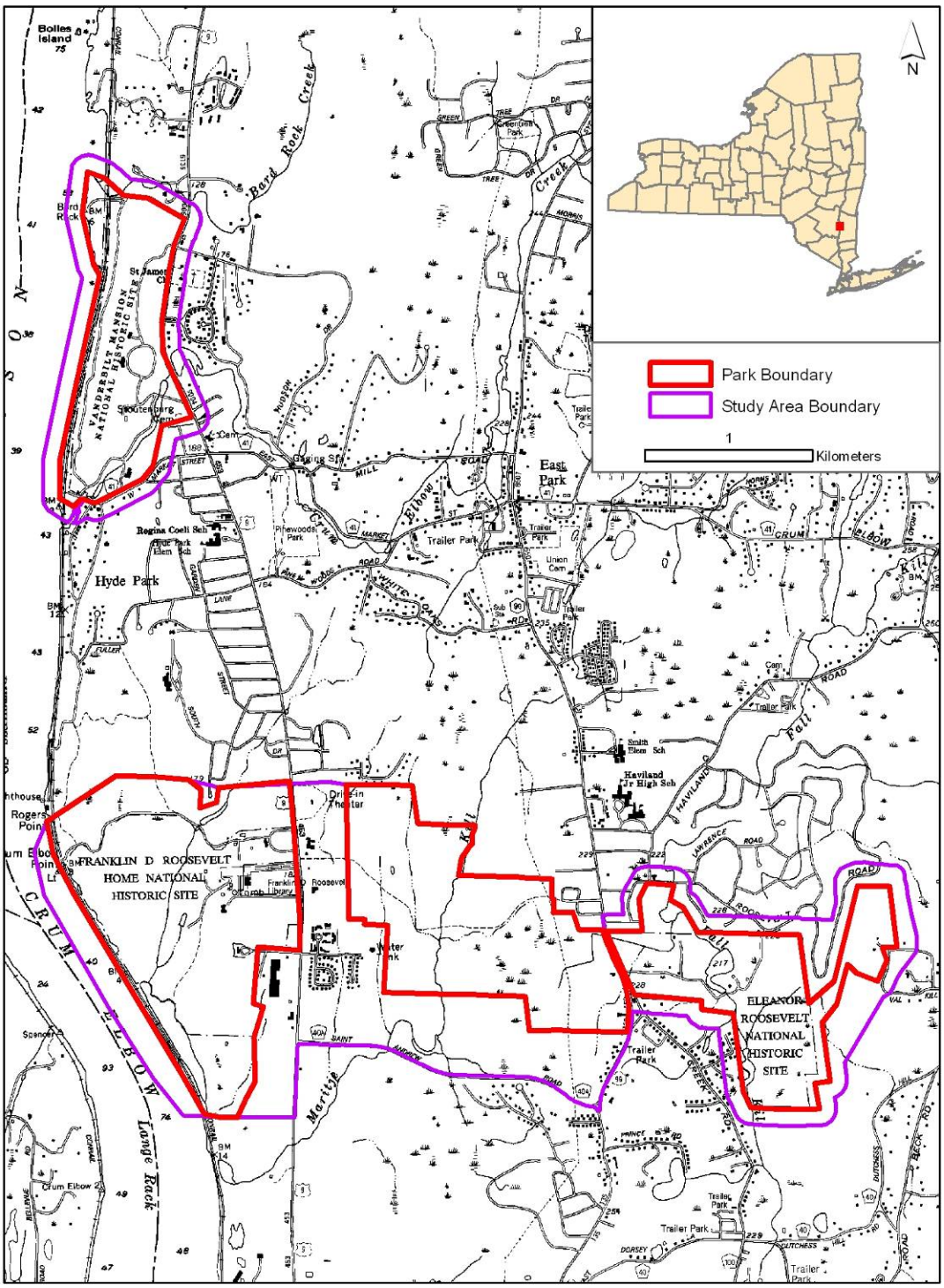

Figure 2. Location of Roosevelt-Vanderbilt National Historic Sites in Dutchess County, New York.

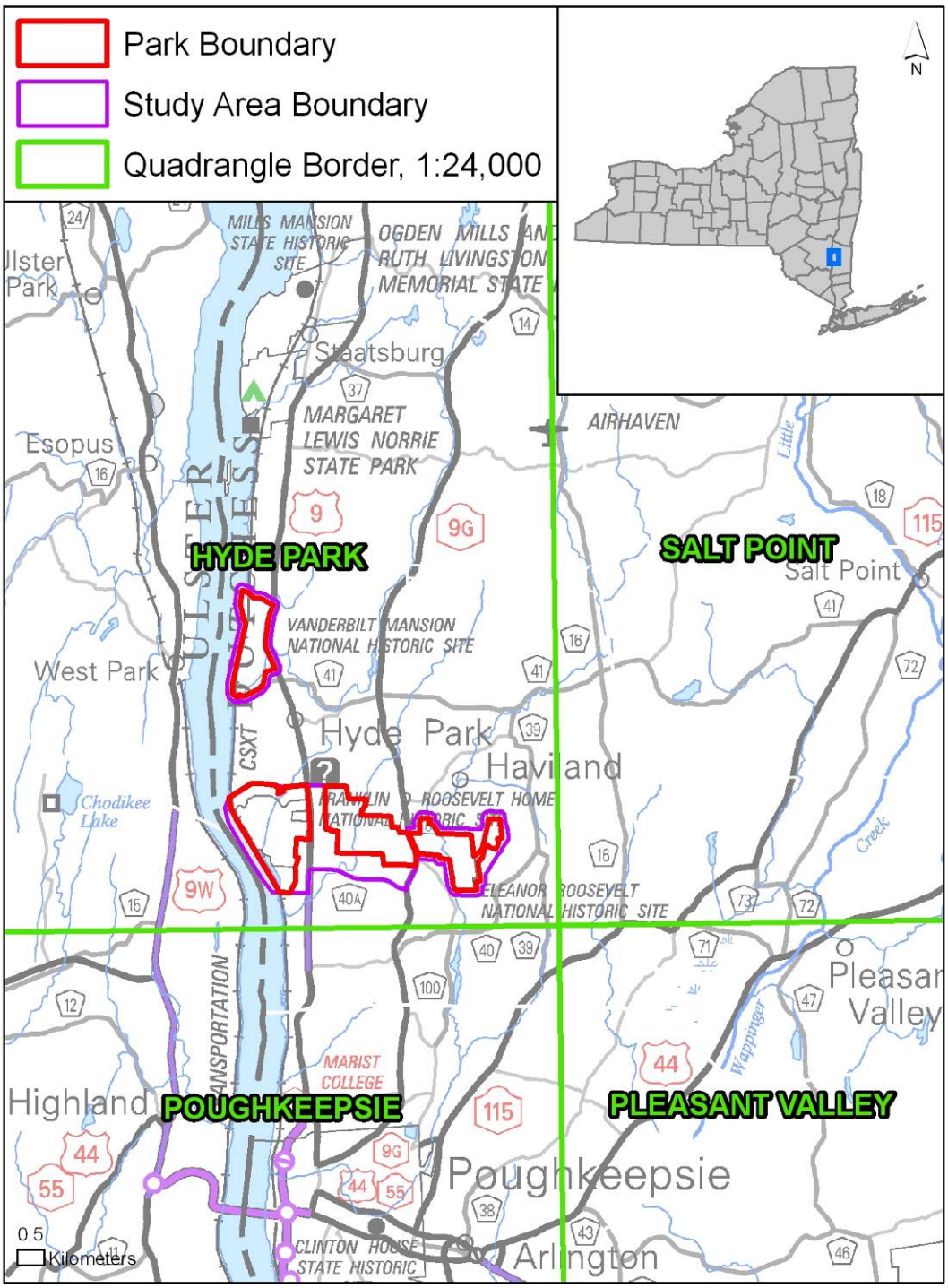

Figure 3. Location of Roosevelt-Vanderbilt National Historic Sites on 1:24,000 USGS topographic quadrangle maps.

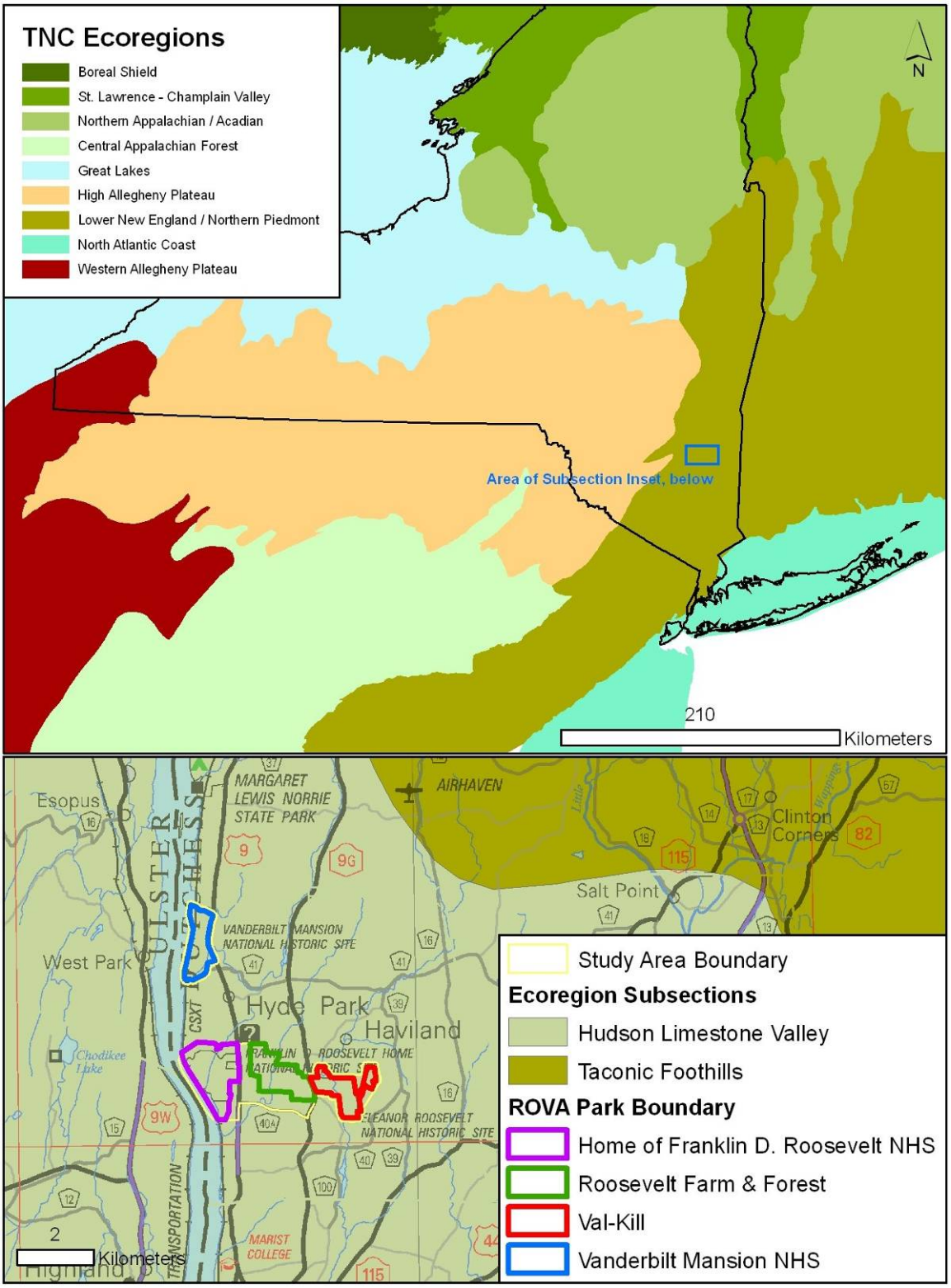

Figure 4. Ecoregions and Subsections (Bailey 1997) of Roosevelt-Vanderbilt National Historic Sites.

rare species and habitats such as small-whorled pogonia (*Isotria medeoloides*) and pitch pine - scrub oak barrens. Much of the ecoregion is underlain by carbonate-rich, Paleozoic bedrock. In addition, most of the region is situated southeast of the Niagara Escarpment, where the land surface slopes gradually toward the southwest through rolling topography. Bedrock outcrops are limited to only small areas (Bailey 1997).

Geology

The surficial geology of the Lower Hudson (inclusive of all three park units comprising ROVA) exhibits a pronounced glacial imprint. Evidence suggests multiple glaciation events occurred here throughout the Pleistocene Epoch, with the advance (28,000 years ago) and ultimate retreat (11,000 years ago) of the Wisconsinan glacier largely masking or destroying the geological record that came before. Valleys running in parallel with the north-south path of the ice flow (e.g. Hudson River Valley) offered little resistance and only enhanced the glacier's ability to reshape and transport rock and soils. In the 11,000 years since the retreat of the glacier, only moderate erosional changes along streams and floodplains have occurred to create the landforms we see today. As a result much of the superficial geology described for the area is the product of the Wisconsinan glacier and post-glacial Lake Hudson which formed and persisted behind the glacier's terminal moraine for 5000-8000 years after the glacier's retreat (Cadwell 1989).

The majority of the parent and underlying surficial geology within Vanderbilt Mansion NHS is bedrock (exposed or generally within 1 meter of the surface); although there are two exceptions to this. The surficial geology adjacent to Bard Rock on the northwestern corner of VAMA is characterized by a deposit of lacustrine/quartz sand (well-sorted, stratified, and of variable thickness from 2- 20 meters). The second exception is a lacustrine delta deposit beginning under the Vanderbilt mansion itself and extending eastward under the public parking area and continuing a short distance outside the east boundary of the park. The delta deposit is characterized by stratified and generally well-sorted coarse to fine gravel and sand of variable thickness from 3-15 meters thick.(Cadwell 1989).

The surficial geology of Home of Franklin D. Roosevelt NHS is roughly divided along the steep embankment running north to south just behind (west of) the estate grounds. The western two-thirds of the park unit (lower in elevation and adjacent to the Hudson River) is comprised of bedrock as the parent and underlying materials. The eastern section of the park, where all the main structures on the estate are located (and higher in elevation), is characterized by the stratified coarse to fine gravel to sand of the lacustrine delta formation (Cadwell 1989).

The bedrock underlying both the Vanderbilt Mansion NHS and Home of Franklin D. Roosevelt NHS is mainly comprised of sedimentary rock, including greywacke (a variety of sandstone) and shale from the Taconic Overthrust (Allochthonus) Sequence and Austin Glen Formation. These sediments were originally deposited during the Upper Ordovician Period and are part of the early Mohawkian Series (Fisher et al. 1970, Figure 5).

Surficial geology within Roosevelt Farm and Forest is characterized by bedrock underlayment and outcrops in the western half and a proglacial fluvial deposition of outwash sand and gravel in the east. In addition to these two major geological

occurrences, a narrow band of lacustrine delta parent material (contiguous with neighboring HOFR to the west) just edges over this unit's western boundary (Cadwell 1989).

Bedrock underlying Roosevelt Farm and Forest is also mainly comprised of greywacke and shale from the Taconic Overthrust (Allochthonus) Sequence and Austin Glen formation, which developed in the Upper Ordovician. About 10% of the unit is underlain by shale, dolostone, and quartzite from the Taconic Overthrust (Allochthonus) Sequence and Stuyvesant Falls Formation, which also developed in the Early Ordovician (Fisher et al. 1970, Figure 5).

Virtually contiguous to the east, Val-Kill picks up where Roosevelt Farm and Forest left off, with its western two-thirds being underlain by outwash sand and gravel. The surficial geology of the eastern one-third of this unit changes to material characteristic of having been deposited beneath the glacier (vs. plowed in front of it) – specifically a poorly sorted, relatively impermeable glacial till (Cadwell 1989).

Bedrock underlying Val-Kill is mainly comprised of greywacke and shale from the Taconic Overthrust (Allochthonus) Sequence and Austin Glen formation, deposited in the Upper Ordovician. About 10% of this unit is underlain by bedrock that was deposited in the Lorraine, Trenton, and Black River Groups and Metamorphic Equivalents during the early Cambrian through Middle Ordovician; it consists of pebble-to-block-size clasts (rock fragments) in a pelitic (fine-grained clay) material. The clasts developed in the late medial to late Ordovician and are from the Mohawkian-Cincinnatian series. A very small percentage of this park unit is underlain by shales and cherts from the Lorraine, Trention, and Black River Groups with Metamorphic Equivalents (Fisher et al. 1970, Figure 5).

Soils

Detailed classifications, descriptions, and maps of the soil types within ROVA are presented in the Soil Survey of Dutchess County, New York (USDA NRCS 2004a). Along the Hudson River, soils are often wet and swampy, consisting of alluvial clays and loams. Most sandy areas near the Hudson River are underlain by clay and deep drainage is poor (the drainage in the clay loam soils is poorer resulting in surface water that forms ponds and marshes) (USDA NRCS 2004a). The hills rising from the river flats are gravel topped with sands of various descriptions.

The soils in the region including ROVA are heavily influenced by the retreating glaciers that left substantial amounts of meltwater (USDA NRCS 2004a). This meltwater created large temporary lakes in the lowland areas between the ice front and topographic highlands by plugging meltwater channels with vast amounts of glacial debris. These lakes served as receiving basins for large quantities of sediment that were transported by the meltwater streams. Stratified glacial material is deposited in a fluvial or lacustrine environment. If sand and gravel are deposited immediately adjacent to the glacier, as in the formation of kames and eskers, the deposits are called ice-contact. Ice-contact kames can be seen in the town of LaGrange and at Moores Hill. Sediment deposited by a meltwater stream flowing away from the glacier is called outwash. Hoosic series is an example of soils found at ROVA formed of these deposits.

A wide variety of stratified and unstratified material was deposited in association with the glacier during both advance and retreat phases (USDA NRCS 2004a). Unstratified till deposits within

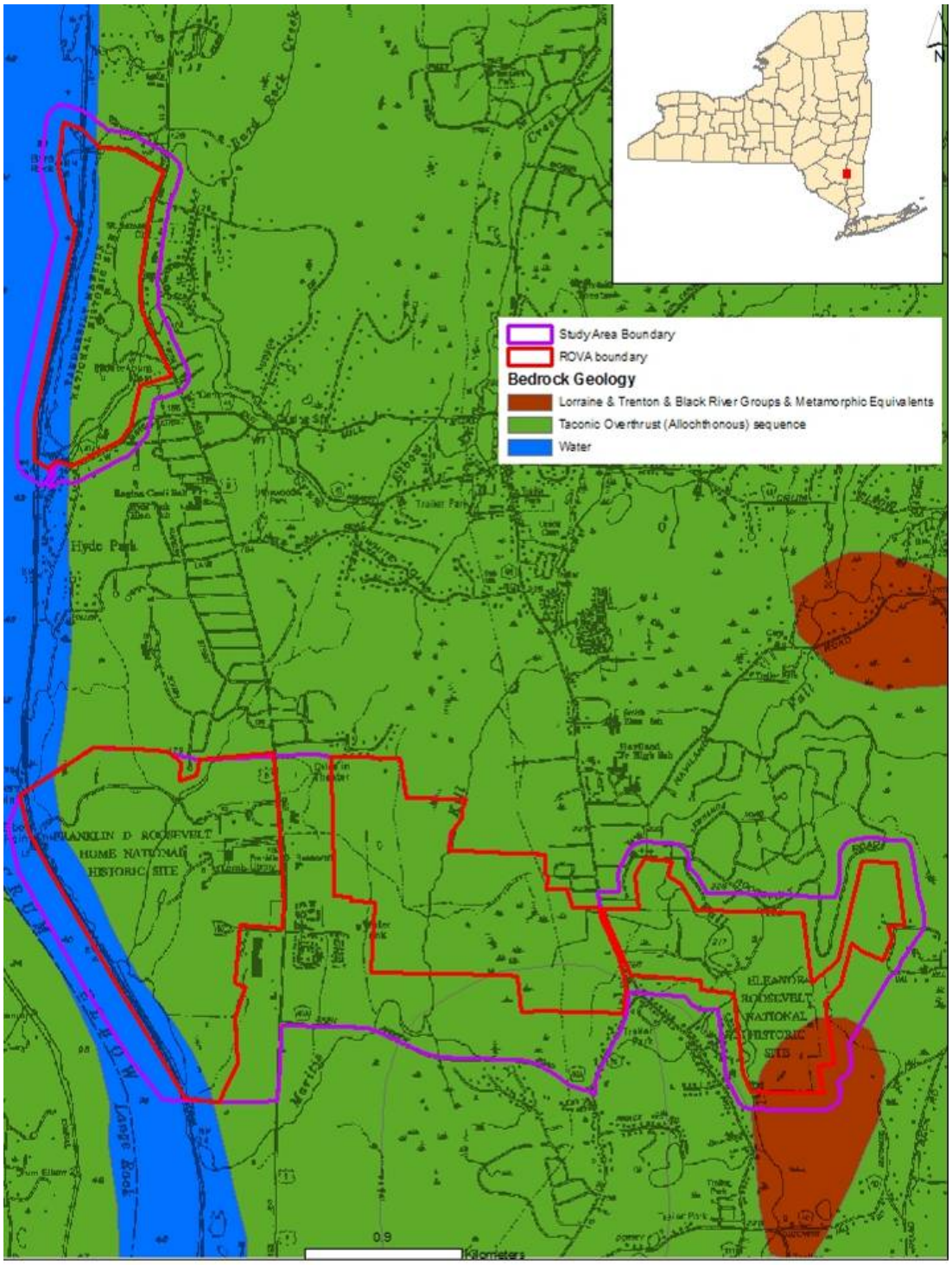

Figure 5. Bedrock geology (Fisher et al. 1970) of Roosevelt-Vanderbilt National Historic Sites.

the county are generally compact (dense), clay rich, and contain abundant rock clasts. This type of till is called hardpan and may contain isolated layers of stratified sand and gravel. The till is generally thin in the hilly regions where there are scattered bedrock exposures, but may be many feet thick adjacent to bedrock valley walls. An example of very common soil types formed in glacial till within ROVA includes those in the Nassau series.

The following eleven major soil associations have formed and been identified at ROVA (USDA NRCS 2004a) (Figure 6):

Nassau-Cardigan Complex, hilly; very rocky
Hoosic Gravelly Loam, 25 to 45 percent slopes
Manlius-Nassau complex, hilly; rocky
Knickerbocker Fine Sandy Loam, hilly; rolling
Fredon Silt Loam; Silt Loam series
Sun Silt loam; Silt Loam series
Nassau-Rock Outcrop complex; steep
Wayland Silt Loam; Silt Loam Series
Dutchess-Cardigan Complex, undulating; rocky
Carlisle Muck; hydric soils
Hoosic Urban Land Complex; nearly level

Hydrology

The most influential hydrologic feature within ROVA is the Hudson River, whose basin encompasses about 34,706 square kilometers (13,400 square miles) in eastern New York and parts of Vermont, New Jersey, Massachusetts, and Connecticut (http://ny.water.usgs.gov/projects/hdsn/fctsht/su.html#HDR0). Both Vanderbilt Mansion NHS and Home of Franklin D. Roosevelt NHS are located along the east bank of the Hudson River, which is actually a freshwater estuary until it contacts a dam at Troy, New York, 121 kilometers (75 miles) to the north. The river affects an estuarine influence far inland, resulting in unique plant communities and uncommon animal species established/occurring in eastern Dutchess County. The elevation of Hudson River influence ranges from near river level at Home of Franklin D. Roosevelt NHS to 656 feet (200 m) at Vanderbilt Mansion NHS. A statewide significant 25-acre (10-ha) tidal marsh lies between Home of Franklin D. Roosevelt NHS and the Hudson River. A Water Resource Management Plan was completed for ROVA in 1997 by NPS staff (USDI, NPS 1997) but did not include Roosevelt Farm and Forest. The hydrological resources include a variety of palustrine and tidal riverine systems. Approximately 4.35 miles (7 kilometers) of streams, 14 acres (5 ha) of permanent ponds, 40 acres (16 ha) of non-tidal wetlands, and numerous small vernal pools and intermittent streams occur in the park unit. The water quality is considered good overall but is at risk due to non-point sources (USDI, NPS 1997). A baseline water quality inventory and analysis, which included monitoring four streams and a freshwater tidal marsh in ROVA, was conducted (USDI, NPS 1997). The parameters used for monitoring included pH, dissolved oxygen (DO), alkalinity, chloride, total phosphorous, total dissolved solids (TDS), nitrate, fecal coliform/fecal strep, and benzene, toluene, ethylbenzene, and xylenes (BTEX). The plan also identified likely water pollution sources which included the Hyde Park Municipal Water Treatment Plant on Crum Elbow Creek, septic discharges from nearby private homes, salt used in road maintenance,

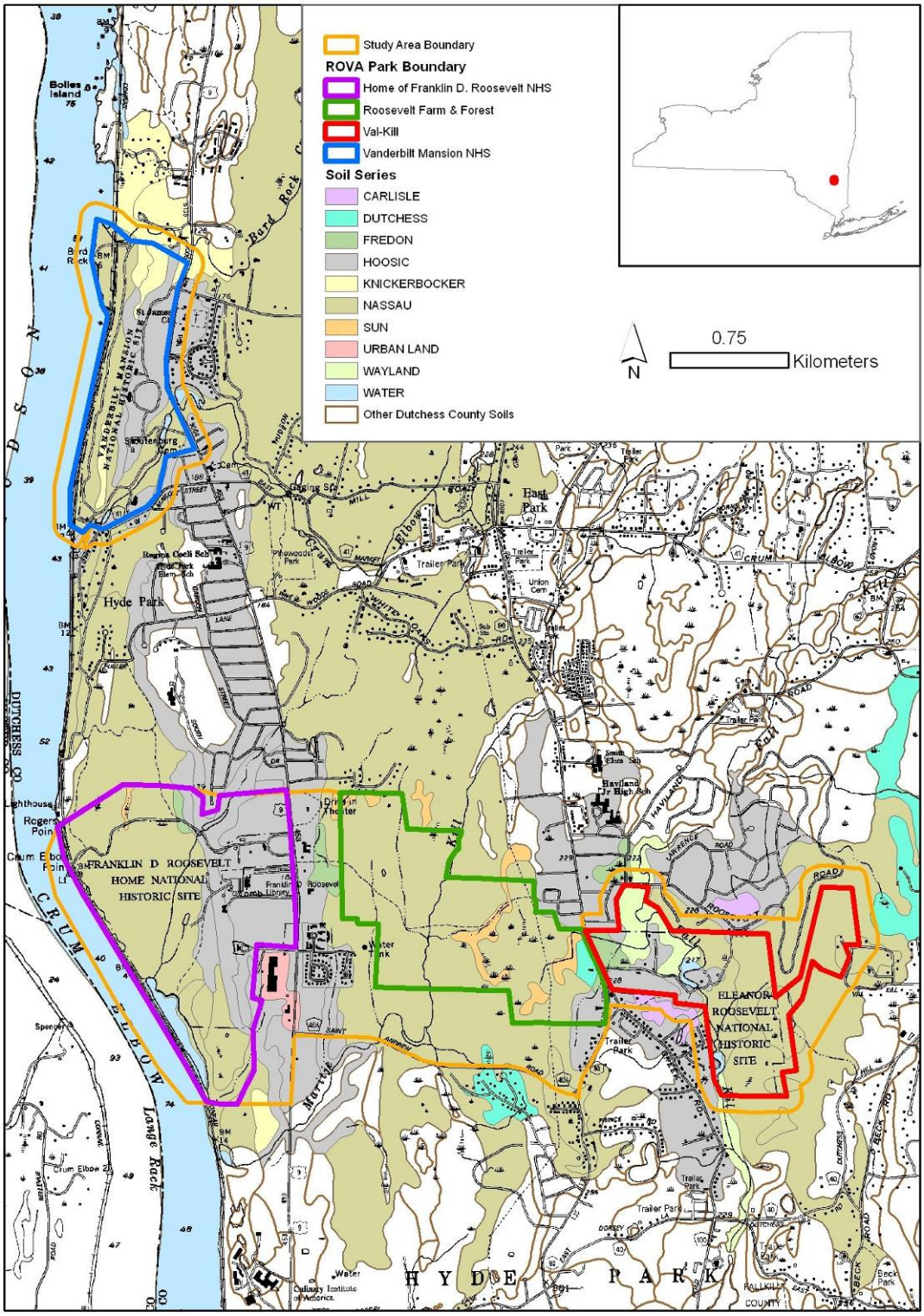

Figure 6. Soils (SSURGO2: Soils of Dutchess County) of Roosevelt-Vanderbilt National Historic Sites.

agricultural runoff, and the release of toxic material from industrial or commercial facilities (USDI, NPS 1997; Caldwell et al. 2006).

At Val-Kill, the Fall-Kill Creek was dammed by the Roosevelt family in 1925, creating an extensive wetlands complex that provides important habitat for many plant and wildlife species including the state-threatened Blanding's Turtle (*Emydoidea blandingii;* Klemens et al. 1992). This area includes a large red maple-hardwood swamp, shrub swamps, and impounded marshes. A series of eutrophic ponds, shallow emergent marshes, seasonal vernal ponds, and additional red maple-hardwood, red maple-blackgum, and hemlock-hardwood swamps also occur scattered throughout the ROVA boundaries.

Methods

Summary of Project Timing

This project was undertaken in 2002 and initially included the Home of Franklin D. Roosevelt NHS (excluding Roosevelt Farm and Forest), Val-Kill, and Vanderbilt Mansion NHS based on NPS ownership at that time. A preliminary vegetation map was developed for these three areas (i.e., all of ROVA excluding the Roosevelt Farm and Forest parcel and hereafter abbreviated as HVV) and delivered in May 2003. Classification plot sampling, analysis, and accuracy assessment (AA) for HVV were conducted between the years of 2003-2006. Data from classification plot sampling conducted during an earlier independent study by NY Natural Heritage Program in June 2002 at Crum Elbow Marsh (located in and adjacent to the Home of Franklin D. Roosevelt NHS) were also used in the vegetation classification and mapping.

During 2006, as the preliminary vegetation map was being revised, the NPS acquired an approximately 300 acre (121 ha) parcel known as the "lands between Route 9 and Route 9G". This area is referred to in this report as "Roosevelt Farm and Forest" (RFF) and is managed under Home of Franklin D. Roosevelt NHS. Soon after it was acquired, the NPS added this parcel into the ROVA vegetation inventory project and the NY Natural Heritage Program produced and delivered a preliminary vegetation map for RFF by April 2007. Classification plot sampling and AA for RFF were subsequently completed in 2007 and 2008, respectively. One final vegetation and land-use map was produced for the Home of Franklin D. Roosevelt NHS (including RFF) and Val-Kill, and a separate final vegetation and land use map was produced for Vanderbilt Mansion NHS (Figure 7).

Planning and Scoping

Planning and scoping of this inventory project began in October 2002 for HVV, based on NPS ownership at that time. On October 10, 2002, NYNHP Chief Ecologist Greg Edinger met with the NPS's David Hayes, Chief of Resources Management at ROVA to discuss the project schedule, mapping product specifications, access issues, natural resource management needs, available applicable GIS layers, and applicable previous and current research conducted in the park units.

In early 2006, the NYNHP submitted a proposal to conduct vegetation mapping at RFF, and planning and scoping of the project began soon after the proposal was accepted. Chief Ecologist Greg Edinger communicated with Beth Johnson (NPS I&M NER Program Manager) and David Hayes regarding logistics at ROVA. The project timeline, mapping product specifications, access issues, natural resource management needs, available applicable GIS layers, and applicable previous and current research conducted at the park were discussed.

Preliminary Data Collection and Review of Existing Information

Previous studies conducted within the three units of HVV were obtained from NPS and NYNHP files and reviewed for vegetation and environmental information (e.g., Dutton 1998a and 1998b, Glenn 1998). These reports included previous vegetation classifications, floristic surveys, and natural resource inventory studies within ROVA (e.g., Pandullo Quirk Associates 1979, Lewis 1983, Rudnicky 1984). General information describing the cultural and natural history of the three park units of HVV (and later for RFF) was obtained from various books, reports, and NPS

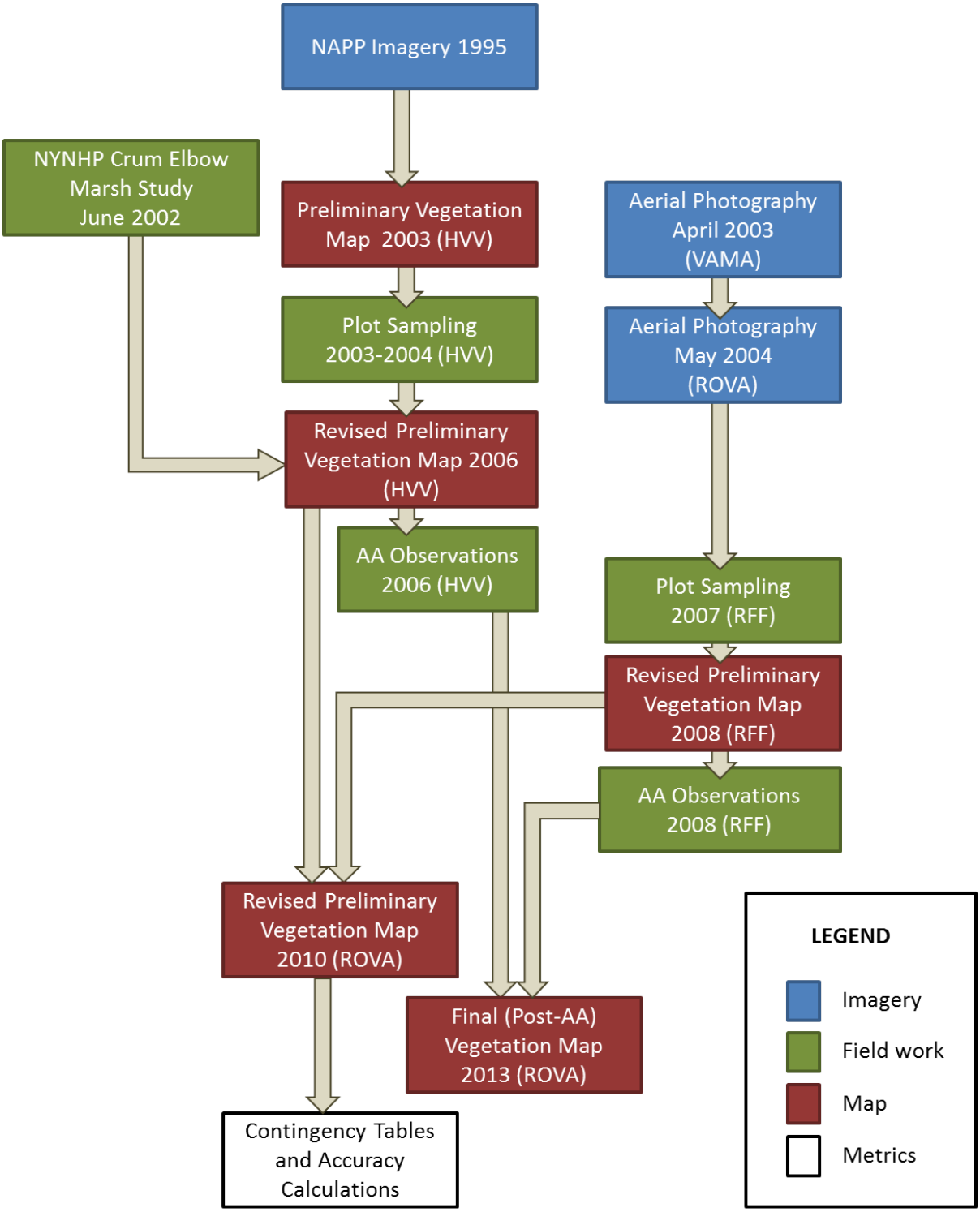

Figure 7 . Timeline summarizing relationship of imagery, field work, and maps leading to the production of the final vegetation classification map (post-AA) for Roosevelt-Vanderbilt National Historical Sites . (HVV = study area which includes Eleanor Roosevelt NHS, Vanderbilt Mansion NHS, and Home of Franklin D. Roosevelt NHS excluding the Farm and Forest; RFF = Roosevelt Farm and Forest; ROVA = HVV and RFF combined.

park brochures, as well as NPS official web sites (e.g., http://www.nps.gov/hofr/roosevelt-vanderbilt-national-historic-sites.htm). In addition, shapefiles containing digital information on plantations, salamander survey locations, and current park boundaries were obtained from ROVA staff.

Data layers available to NYNHP via New York State Department of Environmental Conservation (NYS DEC) in digital and hard copy formats were reviewed to help inform photointerpretation; these included soil maps (USDA NRDC 2004a; STATSGO - NY State Soil Survey Geographic Database (http://dbwww.essc.psu.edu/dbtop/doc/statsgo/statsgo_info.html)), bedrock and surficial geology maps (Cadwell and Dineen 1987, Fisher et al. 1970), NY State Museum digital geology data, wetland maps (National Wetlands Inventory Data for New York State (http://www.fws.gov/wetlands/Data/Mapper.html); New York State Regulatory Freshwater Wetland data (http://www.dec.ny.gov/lands/5124.html)), and the New York Natural Heritage Biotics database (NYNHP 2004-2008).

Aerial Photography Acquisition and Processing

On April 28, 2003, William Frament, USDA Forest Service (Northeastern Area State and Private Forestry, Durham, NH) acquired color infrared 1:8,000 scale (1 inch = 666.7 feet) aerial photography for a digital orthophoto mosaic of ROVA; however, the photography was incomplete in that it only covered Vanderbilt Mansion NHS. The following spring (May 12, 2004) during leaf-on conditions, Mr. Frament acquired a complete set of aerial photography for the four properties that currently comprise ROVA (including RFF). Frament scanned the aerial photographs at 600 dots per inch and delivered both the scanned image files, in Tagged Image File Format (TIFF), and the hard copy photographs to North Carolina State University (NCSU). The aerial photographs, the camera calibration certificate, and a shapefile of the photo centers provided by Mr. Frament are archived with the NPS-NETN of the NPS Northeast Region Inventory & Monitoring Program.

The mosaic was produced from 47 color infrared aerial photographs and published on September 24, 2004. To create the mosaic, scanned tagged image files (.tif images) of the aerial photographs were imported into ERDAS IMAGINE .img format where a photo block was created using a digital elevation model (DEM) and digital orthophoto quarter quadrangles (DOQQs) obtained from the U.S. Geological Survey (USGS) as reference. In preparation for this step, the DEM was resampled from 30 meters to 10 meters and the DOQQs were mosaicked. The photo block was manipulated until it could be triangulated with a root mean square error of less than 1. Single frame orthophotos (one for each aerial photograph) were then generated and mosaicked using auto-cutlines in ERDAS IMAGINE. Following computation of initial horizontal positional accuracy, the accuracy of the mosaic was improved by rectifying it with the DOQQ reference image using a second order polynomial with 16 ground control points. The resulting final mosaic was compressed using Multiresolution Seamless Image Database (MrSID) software with a 20:1 compression ratio. It is stored in the NETN archive in both .img and MrSID formats. The final mosaic was used as a base map for photo interpretation purposes and delineating natural communities remotely using ArcView 3.2 and ArcGIS version 9.3 toward the end of the project**.**

A metadata record for the mosaic was prepared in accordance with the current FGDC standards (FGDC 1998a) and was reviewed by CTI in 2013 using 2010 FGDC standard updates. Metadata were produced in Notepad and parsed using the USGS metadata compiler (USGS 2004). After

all errors and omissions identified by the parser were corrected, the metadata compiler was used to generate final TXT, HTML, and XML versions of the metadata record, which are stored in the NCSU archive. Key information for the mosaic is summarized in Table A-1 in Appendix A.

Photo Interpretation

The two preliminary vegetation maps and subsequent revised maps discussed in this report were created through aerial photograph interpretation. Aerial photograph interpretation is the act of examining aerial photographs in order to identify objects; in this case vegetation and land use types (Avery 1978). The photographs (color infrared, stereo pair, hard copy photographs) were examined through a stereoscope, which provides the viewer with a three-dimensional view. The DOQQs were also examined onscreen in ArcView 3.2 (ESRI 1992-2000). In addition, digital topographic quadrangle maps were examined in ArcView 3.2. Using information gathered from aerial photographs, the DOQQs, and the topographic maps, polygons representing different ecological communities were digitized onscreen using ArcView 3.2 and, toward the end of the project, ArcGIS version 9.3. The screen digitizing process permitted the simultaneous use of aerial photography and supplemental digital data layers that are useful in delineating USNVC association boundaries, including USGS quadrangle maps, New York state (NYS) Department of Transportation road coverages, NYS DEP hydrology coverages, and NPS boundaries.

Preliminary Vegetation Map Production

A digital orthorectified photomosaic was not completed in time to digitize the preliminary vegetation map of HVV prior to the 2003 field season. In order to complete the field work, the preliminary vegetation map was developed by using 1995 color infrared National Aerial Photography Program aerial photos and onscreen digitizing of NY ecological community (Edinger et al. 2002) boundaries using 1994-99 DOQQs (USGS 1994) as the base layer. The first set of deliverables for HVV, including the preliminary community delineations and draft classification, were completed and provided to the NPS for review on May 16, 2003.

The digital orthorectified photo mosaic of ROVA was available and used to digitize the preliminary vegetation map prior to the 2007 field season at RFF. The first set of deliverables for RFF, including the preliminary community delineations and draft classification, were completed and provided to the NPS for review in April 2007.

The NY ecological community types (Edinger et al. 2002) delineated on the two preliminary vegetation maps were differentiated based on vegetation structure, leaf phenology, and hydrologic regime because these characteristics can be easily identified on aerial photography. These maps were developed as a guide for vegetation classification plot sampling by field crews.

Field Data Collection for Vegetation Classification

All vegetation classification plot sampling followed the NVIP and NYNHP protocols (TNC and ESRI 1994, Edinger et al. 2000). To determine the number of classification plots to sample in HVV, the 2003 preliminary vegetation map of those lands was used as a guide. The 2007 preliminary vegetation map of RFF was used as a sampling guide for that site.
For each map, the number of vegetation cover types and the number of polygons per cover type were examined. Following NVIP protocol (TNC and ESRI 1994), each vegetation association containing three or more polygons was sampled at least three times in order to capture the naturally occurring variation within ROVA. For vegetation cover types with less than three

polygons, each polygon was selected for sampling. For vegetation cover types with numerous polygons or for types that covered large areas, polygons were selected that represented different aerial photograph signatures and environmental settings in order to capture the natural range of variability of the vegetation and habitat. Polygons that represented cultural vegetation and/or non-vegetated areas and labeled with Anderson I and Level II categories (Anderson et al. 1976) were not intentionally sampled, although some classification plots were later determined to represent vegetation within these categories.

Field Survey

Within each stand of vegetation that was represented by the polygon selected for sampling, a classification plot was established in an area that most represented the existing vegetation community (Mueller-Dombois and Ellenberg 1974). All vegetation data were collected following the NPS and NYNHP sampling protocols (TNC and ESRI 1994, Edinger et al. 2000), with 20 m × 20 m plots in forests and woodlands and 10 m × 10 m plots in shrublands and herbaceous vegetation. The vegetation was visually divided into eight strata: emergent trees (variable height), tree canopy (variable height), tree subcanopy (>5 m), tall shrub (2–5 m), short shrub (<2 m), herbaceous, non-vascular, and vines. The percent cover was estimated for each species in each stratum. Specimens of species that were not identifiable in the field were collected for later identification. The diameter at breast height (dbh; 4.3 ft = 1.3 m) was measured with a dbh tape for all trees larger than 4 in (10 cm) in diameter that were rooted in the plot. The diameters were recorded by species and strata.

In addition to floristic information, the following environmental variables were recorded at each plot: slope, aspect, topographic position, hydrologic regime, soil stoniness, average soil texture, and soil drainage. Any unvegetated area of the classification plot was characterized by the exposed substrate. Notes were taken on the classification plot's representativeness of the surrounding vegetation and any other significant environmental information, including landscape context, herbivory, stand health, recent disturbance, or evidence of historic disturbance. To more thoroughly inform photo-interpreters and classification ecologists concerning the geographic distribution of vegetation types, aerial photo signature analysis, and compositional variability of the observed plant associations, reference observation point data were also collected. Reference observation points typically represented an area approximating the minimum mapping unit and provided dominant and characteristic plant species as well as environmental information.

Classification plot data and reference observation point data were collected digitally in the field using an iPAQ hand-held computer with Visual CE database software. Data was entered into the NYNHP Hand-Held Database (HHDB) and imported to the desktop Field Form Database (FFDB). Prior to the development of the HHDB and FFDB, classification plot data were collected on paper forms. A sample plot form and screen shots from the HHDB used for this project are included in Appendix B. All field data for quantitative vegetation samples were then converted to the PLOTS Database version 2.0 (NatureServe 2004) and are provided as a supplement to this report. Nomenclature follows the PLANTS 3.5 Database developed by the NRCS in cooperation with the Biota of North America Program (USDA NRCS 2004b).

A representative digital photograph was acquired at most of the classification plot sampling locations. The location of each classification plot was recorded with a Magellan SportTrak

Global Positioning System (GPS) receiver set to Universal Transverse Mercator Zone 18, North American Datum 1983, meters.

Classification plot sampling was conducted at HVV in the spring/summer/early fall of 2003 and 2004. As mentioned above, data from classification plot sampling at Crum Elbow Marsh conducted during a June 2002 independent study by the NY Natural Heritage Program were also used in the analysis and vegetation classification and mapping process. In total, 89 classification plots plus eight reference observation points were sampled throughout these three park units (Figure 8). The distribution of classification plots by vegetation cover type is shown in Table 6 of the Results chapter of this report.

Classification plot sampling was conducted at RFF in the spring/summer/early fall 2007. In total, 58 classification plots plus ten reference observation points were sampled at RFF (Figure 8). The distribution of classification plots by vegetation cover type is shown in Table 6 of the Results chapter of this report.

Vegetation Classification and Characterization

The classification plot sampling data from HVV were analyzed separately from RFF because the surveys were conducted in different years. In 2005, data from the 89 vegetation classification plots from HVV were edited for accuracy and exported into an Excel spreadsheet format compatible with PC-ORD Multivariate Analysis software, version 4.0 (McCune and Mefford 2007). Two plots from Crum Elbow Marsh, CE1b and CE2b, were used in statistical analyses but not included in the project PLOTS database because they were sampled prior (2002) to this vegetation classification and mapping project.

In 2008, data from the 58 vegetation classification plots from RFF were also edited for accuracy and exported into an Excel spreadsheet format compatible with PC-ORD Multivariate Analysis software, version 4.0 (McCune and Mefford 2007). The FFDB export query automatically assigns standardized codes based on the PLANTS 3.5 Database developed by the USDA-NRCS in cooperation with the Biota of North America Program (USDA-NRCS 2004b). The common and scientific names of plants observed during the vegetation classification plot sampling at HVV are listed alphabetically by family in Appendix D. Some tree and shrub seedlings and immature herbaceous plants could only be identified to the genus level and are therefore listed in the appendix as such.

The following datasets were constructed for the classification analyses:

1. all plots/species separated by strata
2. all plots/species separated by strata/no exotics
3. all plots/species lumped (i.e., not separated) across strata
4. all plots/species lumped across strata/no exotics
5. forest plots/species lumped across strata/no exotics
6. upland forest plots/species lumped across strata/no exotics

The following three analyses with indicated settings were run from the PC-ORD software package for all (12) datasets (36 total analyses, Tables 2 and 3):

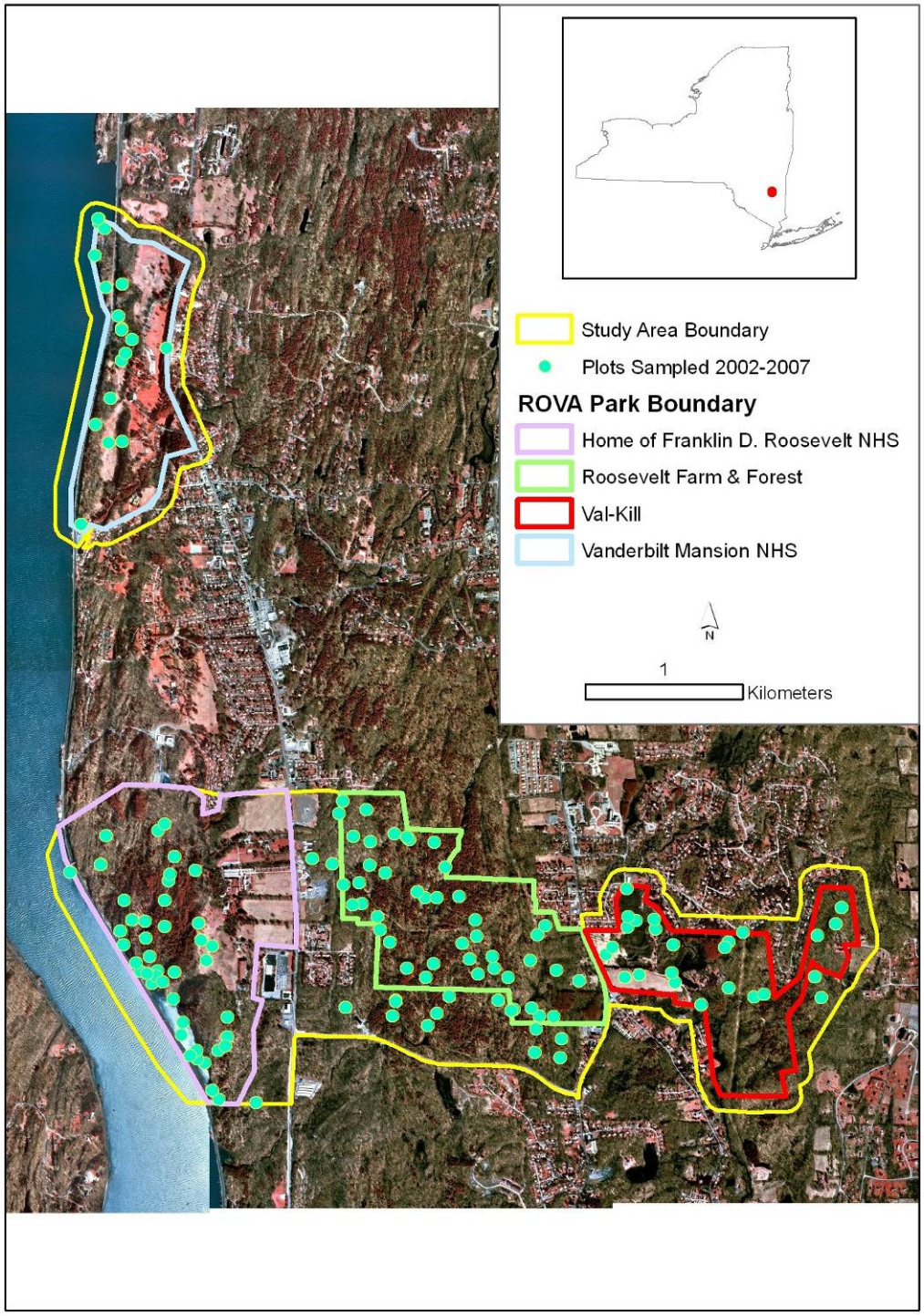

Figure 8. Locations of 2002-2004 vegetation sampling plots (89) and reference observation points (11) at Home of Franklin D. Roosevelt NHS, Val-Kill, and Vanderbilt Mansion NHS and 2007 vegetation sampling plots (58) and reference observation points (10) at Roosevelt Farm and Forest and adjacent areas.

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

Table 2. Classification analyses summary for Home of Franklin D. Roosevelt NHS (excluding Roosevelt Farm and Forest), Val-Kill, and Vanderbilt Mansion NHS.

	1. All plots/ Separate strata	**2. All plots/ Separate strata/ No exotics**	**3. All plots/ Lumped strata**	**4. All plots/ Lumped strata/ No exotics**	**5. Forest plots/ Lumped strata/ No exotics**	**6. Upland Forest/ Lumped strata/ No exotics**
NMS/ Autopilot/ Medium	91 x 372	90 x 324	91 x 278	90 x 236	49 x 162	35 x 120
Cluster An/ Rel. Euc./ Wards Meth	91 x 372	90 x 324	91 x 278	90 x 236	49 x 162	35 x 120
TWINSPAN (default settings)	91 x 372	90 x 324	91 x 278	90 x 236	49 x 162	35 x 120

Table 3. Classification analyses summary for Roosevelt Farm and Forest

	1. All plots/ Separate strata	**2. All plots/ Separate strata/ No exotics**	**3. All plots/ Lumped strata**	**4. All plots/ Lumped strata/ No exotics**	**5. Forest plots/ Lumped strata/ No exotics**	**6. Upland Forest/ Lumped strata/ No exotics**
NMS/ Autopilot/ Medium	58 x 361	57 x 348	58 x 212	57 x 199	29 x 110	34 x 125
Cluster An/ Rel. Euc./ Wards Meth	58 x 361	57 x 348	58 x 212	57 x 199	29 x 110	34 x 125
TWINSPAN (default settings)	58 x 361	57 x 348	58 x 212	57 x 199	29 x 110	34 x 125

For a detailed discussion of the statistical techniques used in this study, please refer to McCune and Grace (2002). Due to the large size of the dataset, it is impractical to include graphical representations of these analyses in this report.

The vegetation units derived from each of these classification analyses were evaluated against each other and compared to the community types recognized by Edinger et al. (2002), vegetation classifications at other New York national parks, and the ecologists' field experiences at ROVA. The units also were cross-walked to the USNVC by searching for alliances sharing similar dominant species, physiognomy, and environmental setting. Total floristic composition of ROVA units was used to determine the best-fitting USNVC vegetation association within the alliance. Global information prepared for the vegetation associations and presented in the

USNVC was appended to the local descriptions to provide resource managers with a broader context for understanding the extant vegetation established within the park units. Based on these evaluations, revised preliminary vegetation associations were identified and pre-accuracy assessment preliminary vegetation association maps were created for HVV and for RFF in 2006 and 2008, respectively.

Each preliminary vegetation association was assigned a park-specific local name derived from either the NYNHP community names in Ecological Communities of New York State (Edinger et al. 2002) or the common names for USNVC associations (NatureServe 2009). In some cases, new local names were developed in order to better represent the concept of the association at ROVA. For example, USNVC association CEGL006002 is known as "Traprock Ridge", which refers to the exposed outcrops of basaltic rock upon which this community typically occurs. However, examples of this community found at Home of Franklin D. Roosevelt NHS were not basaltic, so the common name was changed to "Red-cedar Rocky Summit" to better reflect the natural community in the park unit.

A park-specific dichotomous key to the USNVC associations was created for ROVA (Appendix E) to accompany the classification and vegetation association descriptions (Appendix F) and for use by park natural resource managers, research ecologists, interpretive staff, and others. A dichotomous key is a tool for identifying unknown entities, in this case, vegetation associations. The key to the associations begins with a “key to the keys” that directs the user to one the five major groups of associations based on physiognomy and wetland affiliation: Upland Woody Vegetation, Wetland Forests, Wet Shrublands, Open Uplands, and Herbaceous Wetlands. The keys are structured by a series of couplets, two statements that describe contrasting conditions between associations or groupings of associations. Choosing the successive statements that best fit the stand being examined in question leads the user to the correct association. The dichotomous key should be used with the detailed vegetation association descriptions to confirm that the association selected with the key is appropriate.

Revised Preliminary Vegetation Maps (pre-accuracy assessment)

Following the vegetation classification plot data analysis in early spring 2006, the 2003 HVV preliminary vegetation map was edited and refined to produce a revised preliminary vegetation map prior to thematic accuracy assessment (AA). In addition, the 2007 RFF preliminary vegetation map was edited and refined in early spring 2008 to produce a revised preliminary vegetation map prior to thematic AA. Using ArcMap 9.2 (ESRI 1999-2006), both preliminary maps were edited by revising polygon boundaries on-screen based on the classification plot data, field observations, classification analyses, aerial photography signatures, and topographic maps. Each polygon was assigned the USNVCS Community Element Global (CEGL) code of a preliminary vegetation association as a map class, based on the information sources listed above. Second, third, and fourth CEGL code choices were entered in cases of uncertainty or for polygons representing mosaics of two or more types.

Accuracy Assessment

Two sources of potential error in the vegetation maps include: (1) horizontal positional accuracy, in which a location on the photomosaic does not accurately align with the same location on the ground due to errors in orthorectification or triangulation and (2) thematic accuracy, in which the vegetation type assigned to a particular location on the map does not correctly represent the

vegetation at the same location within ROVA due to mapping error. The USGS/NPS Vegetation Mapping Program protocols (ESRI et al. 1994) were followed to assess the positional accuracy of the digital photomosaic and the thematic accuracy of both (HVV and RFF) revised preliminary vegetation maps.

Positional Accuracy Assessment

Horizontal positional error, in which a location on the photomosaic does not accurately align with the same location on the ground due to errors in orthorectification or triangulation, is one potential source of map error. The horizontal positional accuracy of the photomosaic was assessed using guidelines of the NVIP (ESRI et al. 1994). Well-defined positional accuracy ground control points were placed throughout all quadrants of the mosaic in ArcMap. Ground control points and zoomed-in screenshots of each point were plotted on hard copy maps with the mosaic as a background. These maps and plots were used to locate the ground control points in the field. Field staff recorded the ground control point coordinates with a Trimble ProXRS GPS unit with real-time differential correction. Mapped ground control points that were physically inaccessible were also noted. The field crew collected positional accuracy assessment data at 37 ground control points. Prior to calculating accuracy, two ground control points were identified as outliers with the SAS-JMP (Statistical Analysis System Institute-John's Macintosh Project) program and removed. The field-collected GPS coordinates for the remaining 35 points were compared to the coordinates obtained from the mosaic viewed in ArcMap. Both pairs of coordinates for each point were entered into a spreadsheet in order to calculate horizontal accuracy (in meters). The accuracy calculation formula is based on root mean square error (FGDC 1998b; Minnesota Governor's Council on Geographic Information and Minnesota Land Management Information Center 1999). Figure 9 shows the distribution of the 35 ground control points within the park and surrounding area.

Thematic Accuracy Assessment

Thematic errors in a vegetation map occur when the vegetation type assigned to a particular location on the map (the map class label) does not correctly represent the vegetation at the corresponding location on the ground (the field class label). The primary cause of map errors is misidentification of vegetation type during interpretation of remotely sensing data during map production. The NVIP protocols (ESRI et al. 1994, Lea and Curtis 2010) were followed to assess the thematic accuracy of the revised preliminary maps for HVV and RFF. The most common means of assessment involves selecting a representative (usually random) sample of sites from the map, visiting these sites in the field, evaluating and labeling the vegetation at these corresponding sites (reference data label) using criteria that are independent from the map class labeling, and calculating the rate of matches between the site's map class label with the class as evaluated in the field (the reference data label) (Lea and Curtis 2010). The reference data label is assumed to be the most accurate (generally, 100%) possible representation of the identity of the vegetation.

Thematic accuracy assessment is a complex and technical statistical process; entire books have been devoted to its explanation. For a level of explanation beyond that appropriate for a project report, the reader is referred to Lea and Curtis (2010).

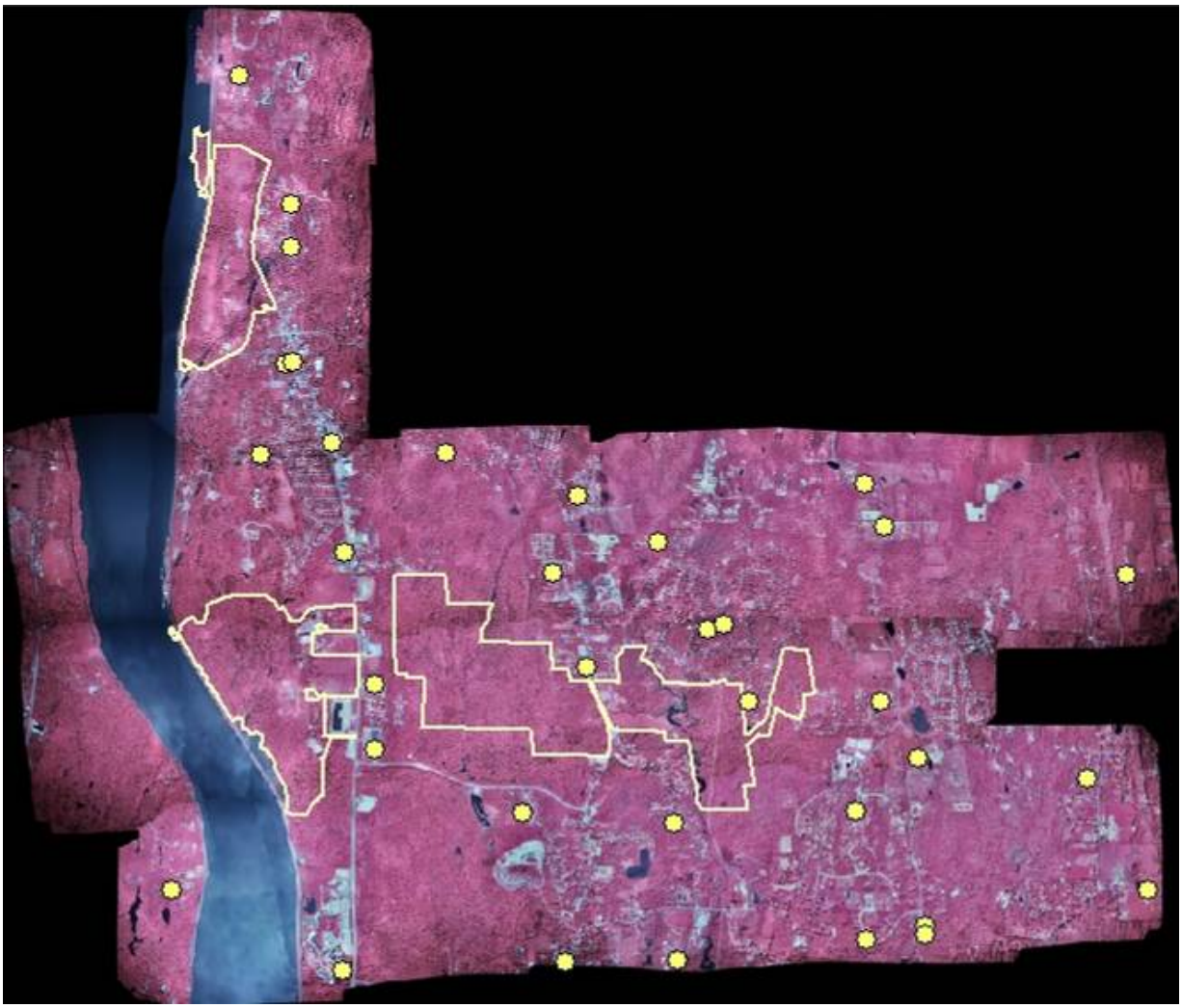

Figure 9. Ground control points (35) upon which estimated accuracy of the Roosevelt-Vanderbilt National Historic Sites mosaic is based.

Sample Design

The sample design used by the NPS to assess thematic accuracy employs simple random sampling within each individual map class (vegetation association) to estimate the map class user's accuracy. User's accuracy is specific to a map class and is the probability that the vegetation type represented by that map class label will match the vegetation type found at that site in the field (Lea and Curtis 2010). Individual map class samples also are pooled to calculate overall map accuracy, which is the probability that a map class label will match the vegetation type found at that site on the ground for any part of the map, regardless of map class. Those observations that have a common reference data label are pooled into *ad hoc* subsamples to estimate individual class producer's accuracies for their respective map classes. Producer's accuracy is also specific to a map class and is the probability that a class will be correctly detected by the map, wherever it is found in the field. Since samples are generated by simple random sampling within a class, individual class user's accuracies are estimated by dividing the number of correctly mapped observations (i.e., those whose map class and reference data labels match) by the number of observations in the sample. The samples that are derived from the

multiple simple random samples used to estimate overall accuracy and individual class producer's accuracies are pooled from multiple strata that were used to generate the simple random samples and represent a stratified random design (Czaplewski 2003, Congalton and Green 2009, Lea and Curtis 2010). Since the individual strata have different sizes, individual observations have a different probability of inclusion, and the more complex calculations (Lea and Curtis 2010), which employ a population contingency tables and weight stratum sizes, must be employed for accuracy estimation.

The sample size selection for each of the map classes to be assessed for ROVA followed a variation of the original NPS AA protocols (ESRI et al. 1994):

Scenario A: If the map class occupied a total area that was larger than 50 hectares and consisted of at least 30 polygons, one AA destination point was assigned to each of the 30 polygons selected randomly from the class.

Scenario B: If the map class occupied a total area that was larger than 50 hectares and consisted of fewer than 30 polygons, 20 polygons were selected at random. One AA destination point was assigned to each of the 20 selected polygons. If the map class covered more 50 hectares in total area and consisted of fewer than 20 polygons, one destination point was assigned to each polygon, and additional destination points were assigned to some of the polygons, according to the relative area of those polygons within the map class.

Scenario C: If the map class occupied a total area that was smaller than 50 hectares and consisted of more than 30 polygons, one AA destination point was assigned to each of 20 polygons selected randomly from the class.

Scenario D: If the map class occupied a total area that was smaller than 50 hectares and consisted of from five to thirty polygons, one AA destination point was assigned to each of five polygons selected randomly from the class.

Scenario E: If the map class occupied a total area that was smaller than 50 hectares and consisted of fewer than five polygons, one AA destination point was assigned to each polygon.

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

Before random points were determined, however, a transition zone was created 15 m (49.3 ft) in from the polygon boundary. This provided a "buffer" to prevent placing random AA destination points close enough to the polygon boundaries that GPS navigational and positioning error might present ambiguity as to which map class was observed (Lea and Curtis 2010). The value of 15 meters was established because it is the average error of the GPS receivers used by staff for this project. Therefore, no AA destination points were placed within 15 meters of a polygon boundary, unless the transition zone completely subsumed the polygon, which occurred in several situations, because a given polygon was either too small, or too narrow, to support a 15-meter transition zone. In these cases, the entire polygon was used as the sample "point" with the

exact location of the field survey left to the discretion of the ecologist performing the AA. These AA destination points are spatially represented by the centroid of each of these polygons in the AA shapefile, and differentiated by unique identification in the attribute table. Following this approach, 182 AA destination points were generated for the 2006 revised preliminary map of HVV and 103 AA destination points were generated for the 2008 revised preliminary map of RFF (Figure 10, Table 6 in Results chapter).

Reference Data Label Collection

For the thematic accuracy assessment of HVV in 2006, NY Natural Heritage staff attempted to navigate to as many of the 182 GIS-generated AA destination points as possible using a Garmin 60CX series GPS receiver. For the thematic accuracy assessment of RFF in 2008, NY Natural Heritage staff attempted to navigate to as many of the 103 GIS-generated AA destination points as possible, also using a Garmin 60CX series GPS receiver. The GPS receivers were set to Universal Transverse Mercator (UTM) Zone 18, North American Datum (NAD) 1983, meters. In most cases, three vectors (i.e., bearing and distance) were used to access within 10 m (32.75 ft) of AA destination points for open communities, or 20 m (65.5 ft) for forested communities, while remaining entirely within the target polygon to the extent possible. These cut-off levels were selected based on the 20m x 20 m forested and 10m x 10 m plot size recommended for those types.

At HVV, 128 (70%) out of the 182 GIS-generated AA destination points were accessible on foot. At RFF, 88 (84%) out of 103 AA destination points and seven observation reference points were accessible on foot (Figure 10; Table 6 in Results chapter).

At each destination point visited, the vegetation at the location was classified to the most appropriate NVC association; this information was applied to the destination point as the reference label (Lea and Curtis 2010) and recorded in the project's PLOTS database. Positional data for each destination point visited were collected digitally using an iPAQ hand-held computer with data entry software (NY Natural Heritage Hand-Held Database - HHDB) and imported to the NY Natural Heritage Field Form Database (FFDB). Sample screen shots from the HHDB used for the AA part of this project are included in Appendix B. Positional and reference label data were recorded in an ArcGIS shapefile.

Contingency Table

Under normal circumstances, each individual thematic AA observation is counted as one occurrence of a map class sampled and one occurrence of a vegetation class observed in the field. Mapped and observed vegetation associations are tabulated into a contingency table (also known as a "confusion matrix") in order to evaluate the thematic accuracies of the final vegetation association map. However, in the case of ROVA, because the AA sample design occurred in two stages, the first being a random selection of polygons and the second a random selection of a site within the polygon, single observations were first weighted by the area of the polygon selected in the first stage. The weighting was used to correct sampling bias introduced during the first stage of sample selection. Left uncorrected, the observations made in small polygons would have contributed disproportionally to the sample relative to the AA observations

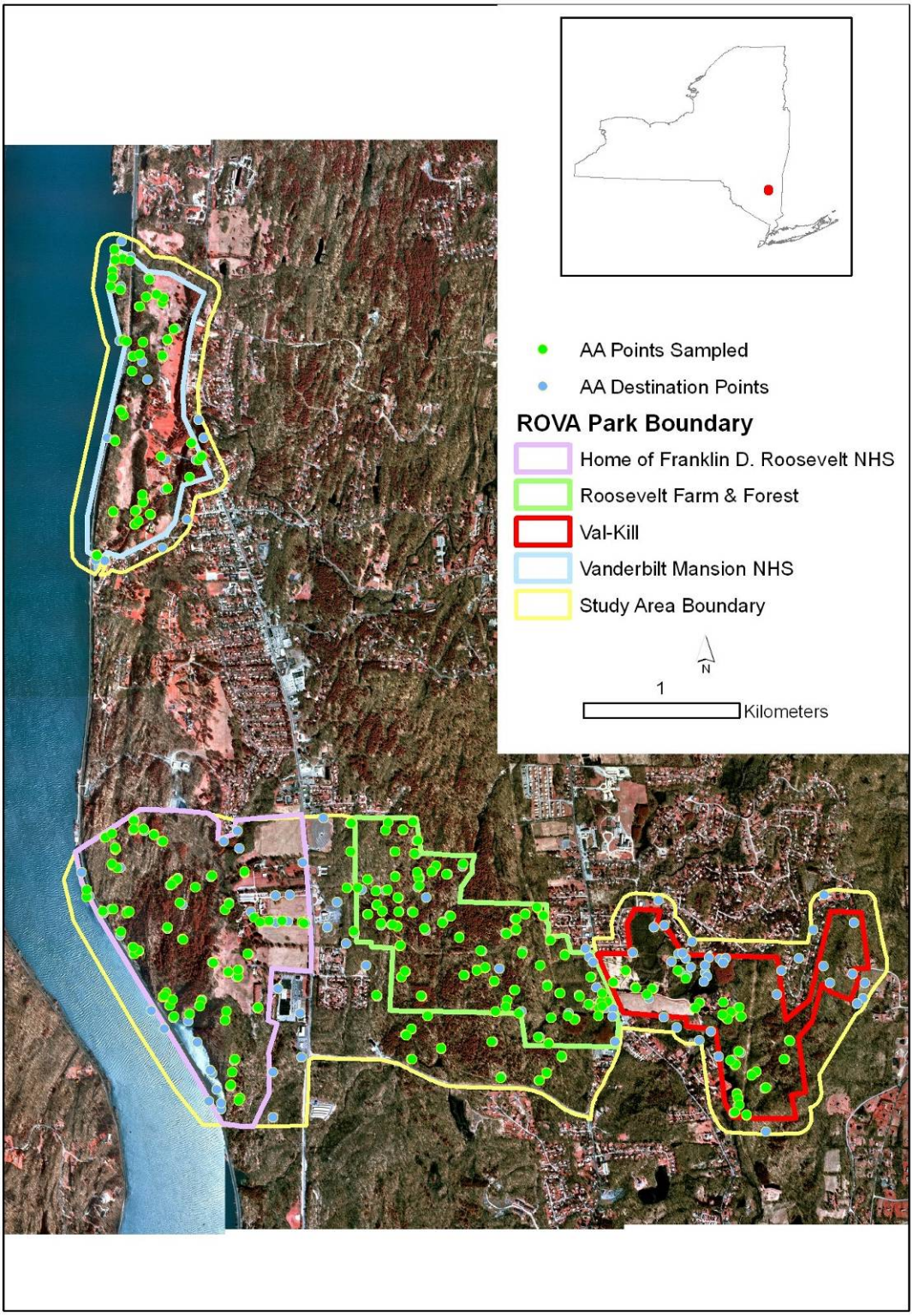

Figure 10. Locations of accuracy assessment (AA) points (216) sampled during 2006 - 2008 and AA destination points not sampled (69), within the Roosevelt-Vanderbilt National Historic Sites study area.

of much larger polygons.

The separate AA sample designs for HVV and RFF also represented another sampling stage (stratification) issue to be addressed before AA results from each individual unit could be pooled and accuracy across a unified ROVA map calculated. Each map class that occurs in both park units has a different area in each unit, and the independent allocations for the 2006 HVV and 2008 RFF AA campaigns create different probabilities of inclusion for a single observation across all NPS units in the map. Accordingly, individual AA observations in each unit (those for HVV and those for RFF) were individually weighted by the contribution of the area of their map class within their unit to the ROVA total area. This removed bias toward the unit (RFF or HVV) that had smaller areas of a map class than the other unit. Each AA observation was assigned a weight w_{ij}, which is calculated, in Microsoft Excel, as follows:

$$w_{ij} = \left(\frac{\Sigma A_{UNIT\_SUBSAMPLEi}}{\Sigma A_{SAMPLEi}} \right) * \left(\frac{A_{POLYGON_{ij}}}{\Sigma A_{POLYGONS_{i\bullet}}} \right) * \left(\frac{N_{SAMPLE_{i\bullet}}}{N_{POLYGON_{ij}}} \right)$$

For which:

w_{ij}	=the weight assigned to observation *j* in map class *i*
$\Sigma A_{UNIT\_SUBSAMPLEi}$	=the total area of all polygons labeled as map class *i* in the park unit subsample (the subsample is either HVV or RFF)
$\Sigma A_{SAMPLEi}$	=the total area of all polygons labeled as map class i in the sample (i.e., the sum of both park unit subsample units HVV and RFF)
$A_{POLYGONij}$	=the area of the single polygon in which observation j is located
$\Sigma A_{POLYGONi.}$	=the total area of all polygons in map class i in the park unit subsample (RFF or HVV) that have observations in them
$N_{SAMPLE\ i.}$	=the area of the single polygon in which observation j is located
$N_{POLYGONi.}$	=the total number of observations in the single polygon in which observation *j* is located

The weighting process assigned each AA observation a decimal number proportional to its proper representation of its assigned map class area within the map class sample, based on its selection (rather than all observations being treated as a value of 1 observation). For example, AA observation ROVA.156 in map class CEGL006173 in RFF was weighted as 2.88 observations because it was placed in a polygon that is relatively large (6 hectare) compared to the other polygons in the map class CEGL006173 within RFF. The sum of all weighted values within a single map class (sampling stratum) remained equal to the total number of observations assigned to the class.

To start the contingency table, a spreadsheet associating map class labels with their AA observation points was produced using ArcGIS 10.0 to spatially join AA observations points with their associated 2006 (HVV) and 2008 (RFF) revised preliminary vegetation map polygon . The resulting spatial join table was exported to an Excel spreadsheet.

Reference data (field) label values for each AA observation were imported into the Excel spreadsheet table from the PLOTS database. In Excel, a unified-ROVA sample contingency table was created using the spatial join table and the AA observation field data records. The resulting

contingency table rows represent the map class labels (extracted from the spatial database field CEGL1 of the 2006 HVV revised preliminary map for HVV and from the field CEGLCODE of the 2008 RFF revised preliminary map). The contingency table columns represent corresponding reference data label values. Each table cell contains a summed number of all observations (often, a decimal value because of the weighting) that had a unique combination of a map class label and reference data label represented by the row and column intersection at the cell.

The unified-ROVA sample contingency table was converted to a population contingency table using the methods described by Lea and Curtis (2010) by weighting the sample contingency table values by their respective map class areas (as necessary to account for the effects of the stratified random design on overall accuracy and producer's accuracies). Individual class user's accuracies were estimated as the total proportion of correctly mapped observations in the class (cells at the intersections of rows and labels having the same value) divided by the sum of the row proportions for the class. Individual class producer's accuracies were estimated as the total proportion of correctly mapped observations in the class divided by the sum of the column proportions for the class. Overall accuracy was estimated as the sum of all correctly mapped proportions (the sum of all values along the table diagonal).

In order to provide information for uses of the map that may demand more accuracy and require less thematic resolution, the accuracies of higher level units within the USNVC (alliances, groups, macrogroups, divisions/formations, and subclasses/classes) were calculated by aggregating the applicable cell proportions for each of their member associations in the population contingency table (Lea and Curtis 2010).

Based on the AA sampling data and the final classification of vegetation associations, the revised association level maps were edited to correct errors, create more accurate vegetation association polygon boundaries, and merge the two maps (HVV and RFF) into a single final map for ROVA. In this final map revision, AA data, plot data, field observations, aerial photography signatures, and topographic maps were used to revise polygon boundaries and attributes. In several instances, USNVC associations were assigned to one polygon of the same New York natural community type based on multiple plots/AA points/observation points. Many of these polygons were split into additional polygons where associations were clearly divided by topographic or aerial photography signatures/features.

Results

Vegetation Classification and Characterization

Detailed local descriptions for 50 community types (Tables 4 and 5) were written based on plot data, compositional statistics, photographs of each plot, thematic AA data, field ecologist observations within ROVA and adjacent environs, and the other research cited in the local descriptions. These vegetation types were interpreted to most appropriate USNVC association (NatureServe 2013), and range-wide global descriptions for each association were added to the local descriptions. Appendix F compiles the individual local and global association descriptions, arranged in order of the hierarchy recognized by the USNVC (http://usnvc.org/explore-classification/) to the Group level and then alphabetically by association local name within each Group. Each vegetation association is also cross-walked to Ecological Communities of New York State (Edinger et al. 2002; Tables F-1 and F-2 in Appendix F). Representative photographs of the vegetation associations were obtained for most associations and were archived by the Northeast Temperate Network along with other project deliverables.

The 50 USNVC associations recognized at ROVA represent 43 different USNVC alliances, and there are only five alliances that have multiple associations at ROVA: the Northern Red Oak – (Sugar Maple) Forest Alliance (with four associations), the Eastern Hemlock – Yellow Birch Forest Alliance (two associations), the Eastern Hemlock – Tulip Tree Forest Alliance (two associations), the Sugar Maple – White Ash – American Basswood Forest Alliance (two associations), and the Eastern White Pine Planted Forest Alliance (two associations). At the time of publication of this report (2014), all USNVC alliances were undergoing review and revision due to extensive changes imposed by revision of the upper hierarchy levels (FGDC 2008) that distributes associations within some individual currently recognized alliances across multiple higher levels of the hierarchy. Some of the alliance assignments of ROVA associations may change in the near future. For these reasons, alliance assignments are presented in the individual descriptions (Appendix F), but not in Tables 4 and 5.

The 50 USNVC associations recorded at ROVA represent 19 USNVC groups, 13 USNVC macrogroups, eight USNVC divisions and formations, and three USNVC subclasses and classes (Tables 4 and 5). At the scale of ROVA, USNVC divisions and formations have a 1:1 correspondence, as do USNVC subclasses and classes.

A dichotomous key was developed for the ROVA vegetation associations to accurately identify associations in the field and as a quick identification reference when working in the office (Appendix E). The dichotomous key should be used in conjunction with the detailed vegetation association descriptions and field photographs to confirm that the association selected with the key is appropriate. This key and the detailed vegetation association descriptions may be used by ROVA resource managers, research ecologists/botanists, interpretive staff, and others in order to accurately identify vegetation associations.

Vegetation Mapping

Thirty-nine (39) of the 50 associations occurred in large enough stands to serve as map classes in the ROVA final map (i.e., the HVV and RFF preliminary draft maps revised and combined) (Table 6, Figures 11 and 12).

Table 4. USNVC units and hierarchy placement for forests and woodlands at Roosevelt-Vanderbilt National Historic Sites.

Class / Subclass: Forest and Woodland (1) / Temperate Forest (1.C)
- **Formation** Cool Temperate Forest (1.C.2)
  - **Division:** Eastern North American Cool Temperate Forest (D008)
    - **Macrogroup:** Central Oak-Hardwood and Pine Forest (M012)
      - **Group:** Appalachian Oak - Chestnut Forest Group (G015)
        - **Association**: Red Oak - Heath Woodland / Rocky Summit (CEGL006134)
      - **Group:** Chinkapin Oak - Ash - Red-cedar Alkaline Forest Group (G016)
        - **Association**: Red-cedar Rocky Summit (CEGL006002)
      - **Group:** Northeastern and North-Central Oak-Hickory Forest Group (G158)
        - **Association:** Dry, Rich Oak - Hickory Forest (CEGL006301)
        - **Association:** Northeastern Dry Oak - Hickory Forest (CEGL006336)
    - **Macrogroup:** Eastern North American Ruderal Forest and Plantation (M013)
      - **Group:** Northern and Central Hardwood and Conifer Ruderal Forest Group (G030)
        - **Association:** Black Locust Successional Forest (CEGL007279)
        - **Association:** Early-Successional Aspen – Birch Woodland (CEGL006303)
        - **Association:** Eastern White Pine Successional Forest (CEGL007944)
        - **Association:** Northeastern Modified Successional Forest (CEGL006599)
        - **Association:** Northeastern Oak - Red Maple Successional Forest (CEGL006506)
        - **Association:** Norway Maple Forest (CEGL006407)
        - **Association:** Successional Tree-of-Heaven Forest (CEGL007191)
      - **Group:** Northern and Central Conifer and Hardwood Plantation Group (G032)
        - **Association:** Hardwood Plantation (CEGL006613)
        - **Association:** Mixed Pine Conifer Plantation (CEGL006313)
        - **Association:** Norway Spruce Plantation (CEGL007167)
        - **Association:** Red Pine Plantation (CEGL007177)
        - **Association:** White Pine Plantation (CEGL007178)
    - **Macrogroup:** Northern Mesic Hardwood and Conifer Forest (M014)
      - **Group:** Northern Hardwood – Hemlock - White Pine Forest Group (G163)
        - **Association:** Central Appalachian Hemlock - Chestnut Oak Forest (CEGL006923)
        - **Association:** Hemlock - Beech - Oak Forest (CEGL006088)
        - **Association:** Hemlock – Northern Hardwood Forest (CEGL006109)
        - **Association:** Hemlock / White Pine - Red Oak - Mixed Hardwood Forest (CEGL006566)
        - **Association:** High Allegheny Rich Red Oak - Sugar Maple Forest (CEGL006125)
        - **Association:** Mesic Sugar Maple – Ash - Oak – Hickory Forest (CEGL006046)
        - **Association:** Red Oak - Northern Hardwood Forest (CEGL006173)
        - **Association:** Semi-rich Northern Hardwood Forest (CEGL006211)
        - **Association:** Sugar Maple - Ash - Basswood Northern Rich Mesic Forest (CEGL005008)
        - **Association:** White Pine - Hemlock Dry-Mesic Coniferous Forest (CEGL006328)
- **Formation:** Temperate Flooded and Swamp Forest (1.C.3)
  - **Division:** Eastern North American Flooded and Swamp Forest (D011)
    - **Macrogroup:** Northern and Central Swamp Forest (M030)
      - **Group:** Northern and Central Conifer and Hardwood Acidic Swamp Group (G045)
        - **Association:** Hemlock - Hardwood Swamp (CEGL006226)
        - **Association:** Red Maple - Blackgum Basin Swamp (CEGL006014)
        - **Association**: Red Maple / Tussock Sedge Wooded Marsh (CEGL006119)
        - **Association:** Southern New England / Northern Piedmont Red Maple Seepage Swamp (CEGL006406)
      - **Group:** Central Flatwoods and Pond Forest Group (G597)
        - **Association:** Northeastern Pin Oak - Swamp White Oak Forest (CEGL006240)

Table 5. USNVC units and hierarchy placement for shrublands and herbaceous vegetation at Roosevelt-Vanderbilt National Historic Sites.

Class / Subclass: Shrubland and Grassland (2) / Temperate and Boreal Shrubland and Grassland (2.C)
- **Formation /** Temperate Grassland, Meadow, and Shrubland (2.C.1) /
- **Division:** Eastern North American Grassland, Meadow, and Shrubland (D024)
  - **Macrogroup:** Eastern North American Ruderal Grassland and Shrubland (M123)
    - **Group:** Northern and Central Ruderal Meadow and Shrubland Group (G059)
      - **Association:** Northeastern Old Field (CEGL006107)
      - **Association:** Northeastern Successional Shrubland (CEGL006451)
- **Formation:** Temperate and Boreal Scrub and Herb Coastal Vegetation (2.C.3)
- **Division:** Eastern North American Dune and Coastal Grassland and Shrubland (D026)
  - **Macrogroup:** Eastern North American Beach, Shoreline, and Flat (M176)
    - **Group:** Eastern North American Lake Flat and Beach Group (G342)
      - **Association:** Eastern Woodland Vernal Pool (CEGL006453)
    - **Group:** Eastern North American River Shoreline Group (G343)
      - **Association:** Northern Riverside Rock Outcrop (CEGL006284)
- **Formation:** Temperate and Boreal Bog and Fen (2.C.4)
- **Division:** North American Bog and Fen (D029)
  - **Macrogroup:** Appalachian, Interior Plateau, and Prairie Fen (M061)
    - **Group:** Northeastern and Appalachian Forest Seep Group (G189)

Association: Golden-saxifrage Forested Seep (CEGL006193)

      - **Association:** Skunk Cabbage - Jewelweed Seep (CEGL006567)
- **Formation:** Temperate and Boreal Freshwater Wet Meadow and Marsh (2.C.5)
- **Division:** Eastern North American Freshwater Wet Meadow, Riparian, and Marsh (D030)
  - **Macrogroup:** Atlantic and Gulf Coastal Plain Freshwater Tidal Marsh (M066)
    - **Group:** Atlantic and Gulf Coastal Plain Freshwater Tidal Marsh Group (G110)
      - **Association:** Atlantic Coast Wild Rice Tidal Marsh (CEGL004202)
      - **Association:** Broadleaf Pond-lily Tidal Marsh (CEGL004472)
  - **Macrogroup:** Eastern North American Wet Meadow and Marsh (M069)
    - **Group:** Eastern North American Wet Meadow Group (G112)
      - **Association**: Central Appalachian Cutgrass Marsh (CEGL006461)
      - **Association:** Mixed Forb Marsh (CEGL006446)
      - **Association:** Steeplebush / Reed Canarygrass Successional Wet Meadow (CEGL006571)
    - **Group:** Eastern North American Freshwater Marsh Group (G125)
      - **Association:** Eastern Cattail Marsh (CEGL006153)
  - **Macrogroup:** Northern and Central Tall Shrub Wetland (M160)
    - **Group:** Northern and Central Shrub Swamp Group (G167)
      - **Association:** Alluvial Alder Swamp (CEGL006414)
      - **Association:** Northeastern Buttonbush Shrub Swamp (CEGL006069)
  - **Macrogroup:** Eastern North American Ruderal Wet Meadow and Marsh (M303)
    - **Group:** Northern and Central Ruderal Wet Meadow and Marsh Group (G556)
      - **Association:** Eastern Reed Marsh (CEGL004141)
      - **Association:** Purple Loosestrife Wetland (CEGL006403)
- **Formation:** Salt Marsh (2.C.6)
- **Division:** Temperate and Boreal Atlantic Coastal Salt Marsh (D034)
  - **Macrogroup:** Eastern North American Atlantic Salt Marsh (M079)
    - **Group:** North American Atlantic Brackish Tidal Marsh Group (G120)
      - **Association:** Cattail Brackish Tidal Marsh (CEGL004201)

Class / Subclass: Aquatic Vegetation (5) / Freshwater Aquatic Vegetation (5.B)
- **Formation:** Freshwater Aquatic Vegetation (5.B.1)
- **Division:** North American Freshwater Freshwater Aquatic Vegetation (D049)
  - **Macrogroup:** Eastern North American Freshwater Aquatic Vegetation (M108)
    - **Group:** Eastern North American Freshwater Aquatic Vegetation Group (G114)
      - **Association:** Duckweed Pond (CEGL005451)
      - **Association:** Open Water Marsh with Mixed Submergents / Emergents (CEGL006196)

Table 6. Plot, accuracy assessment, and map class statistics for vegetation and land cover classes at Saratoga National Historical Park, in order of Tables 4 and 5 (see bottom of table for explanation of table headers).

USNVC Association (USNVC code)	n (Classific. Plots)[a]	n (Reference Observ. Points)[b]	n (AA Destination Points)[c]	n (AA Points Visited)[d]	n (AA Reference Data Values)[e]	Map Version[f]	Map Statistics		
							n (polygons)[g]	Area (hectares)[h]	Predicted Area (hectares)[i]
USNVC ASSOCIATIONS									
Red Oak - Heath Woodland / Rocky Summit (CEGL006134)	1	0	1	1	0	Final	1	0.08	0.00
						Prelim.	1	1.31	
Red-cedar Rocky Summit (CEGL006002)	9	2	5	3	2	Final	7	5.21	0.32
						Prelim.	7	5.45	
Dry, Rich Oak - Hickory Forest (CEGL006301)	6	0	10	6	9	Final	20	59.00	69.58
						Prelim.	18	54.74	
Northeastern Dry Oak-Hickory Forest (CEGL006336)	3	0	2	2	10	Final	8	10.68	16.80
						Prelim.	2	3.32	
Black Locust Successional Forest (CEGL007279)	1	0	0	0	0	Final	2	4.67	N/A
						Prelim.	0	0.00	
Early-Successional Aspen – Birch Woodland (CEGL006303)	0	0	1	1	1	Final	1	0.42	2.61
						Prelim.	1	1.17	
Eastern White Pine Successional Forest (CEGL007944)	0	0	0	0	1	Final	2	2.92	10.89
						Prelim.	0	0.00	
Northeastern Modified Successional Forest (CEGL006599)	0	0	2	1	7	Final	7	6.36	29.52
						Prelim.	2	5.70	
Northeastern Oak - Red Maple Successional Forest (CEGL006506)	1	0	36	16	3	Final	48	53.55	4.44
						Prelim.	63	72.05	
Norway Maple Forest (CEGL006407)	1	0	0	0	2	Final	2	2.79	8.31
						Prelim.	0	0.00	
Successional Tree-of-Heaven Forest (CEGL007191)	1	0	0	0	0	Final	1	4.78	N/A
						Prelim.	0	0.00	
Hardwood Plantation (CEGL006613)	0	0	18	14	12	Final	29	6.93	6.41
						Prelim.	31	7.29	
Mixed Pine Conifer Plantation (CEGL006313)	1	0	8	6	3	Final	23	9.99	2.68
						Prelim.	25	11.55	
Norway Spruce Plantation (CEGL007167)	1	1	3	3	6	Final	7	3.23	11.47
						Prelim.	4	2.12	
Red Pine Plantation (CEGL007177)	0	0	4	2	2	Final	3	2.88	2.98
						Prelim.	3	2.98	

Table 6. Plot, accuracy assessment, and map class statistics for vegetation and land cover classes at Saratoga National Historical Park (continued) (see bottom of table for explanation of table headers).

USNVC Association (USNVC code)	n (Classific. Plots)[a]	n (Reference Observ. Points)[b]	n (AA Destination Points)[c]	n (AA Points Visited)[d]	n (AA Reference Data Values)[e]	Map Version[f]	Map Statistics		
							n (polygons)[g]	Area (hectares)[h]	Predicted Area (hectares)[i]
White Pine Plantation (CEGL007178)	3	1	9	7	8	Final	12	11.38	12.77
						Prelim.	12	11.96	
Central Appalachian Hemlock - Chestnut Oak Forest (CEGL006923)	5	0	2	2	11	Final	13	28.13	18.08
						Prelim.	2	12.78	
Hemlock -Beech - Oak Forest (CEGL006088)	6	1	7	6	17	Final	24	62.48	56.98
						Prelim.	14	49.58	
Hemlock - Northern Hardwood Forest (CEGL006109)	4	0	6	6	7	Final	8	25.45	60.75
						Prelim.	8	18.93	
Hemlock / White Pine - Red Oak – Mixed Hardwood Forest (CEGL006566)	8	0	20	20	6	Final	7	22.28	12.14
						Prelim.	11	53.52	
High Allegheny Rich Red Oak-Sugar Maple Forest (CEGL006125)	15	3	25	27	17	Final	19	69.77	37.69
						Prelim.	16	86.17	
Mesic Sugar Maple – Ash – Oak – Hickory Forest (CEGL006046)	1	0	0	0	6	Final	4	1.32	8.46
						Prelim.	0	0.00	
Red Oak - Northern Hardwood Forest (CEGL006173)	7	0	24	27	11	Final	11	57.43	58.05
						Prelim.	11	67.13	
Semi-rich Northern Hardwood Forest (CEGL006211)	3	0	4	4	6	Final	9	32.35	26.80
						Prelim.	4	21.20	
Sugar Maple-Ash-Basswood Northern Rich Mesic Forest (CEGL005008)	1	0	0	0	2	Final	2	2.69	0.60
						Prelim.	0	0.00	
White Pine - Hemlock Dry-Mesic Coniferous Forest (CEGL006328)	1	0	0	0	2	Final	3	2.11	2.85
						Prelim.	0	0.00	
Hemlock - Hardwood Swamp (CEGL006226)	1	1	4	4	0	Final	1	0.83	0.00
						Prelim.	4	2.50	
Red Maple - Blackgum Basin Swamp (CEGL006014)	4	0	3	3	4	Final	6	4.26	4.20
						Prelim.	3	3.71	
Red Maple / Tussock Sedge Wooded Marsh (CEGL006119)	6	0	6	2	6	Final	23	15.50	7.40
						Prelim.	20	15.86	
Southern New England / N. Piedmont Red Maple Seepage Swamp (CEGL006406)	13	2	11	8	9	Final	30	24.41	38.87
						Prelim.	29	23.97	
Northeastern Pin Oak - Swamp White Oak Forest (CEGL006240)	1	0	1	1	1	Final	1	0.17	0.17
						Prelim.	1	0.17	

Table 6. Plot, accuracy assessment, and map class statistics for vegetation and land cover classes at Saratoga National Historical Park (continued) (see bottom of table for explanation of table headers).

USNVC Association (USNVC code)	n (Classific. Plots)[a]	n (Reference Observ. Points)[b]	n (AA Destination Points)[c]	n (AA Points Visited)[d]	n (AA Reference Data Values)[e]	Map Version[f]	Map Statistics		
							n (polygons)[g]	Area (hectares)[h]	Predicted Area (hectares)[i]
Northeastern Old Field (CEGL006107)	5	0	8	6	5	Final	25	40.78	34.86
						Prelim.	24	40.35	
Northeastern Successional Shrubland (CEGL006451)	2	0	9	6	3	Final	10	4.14	2.93
						Prelim.	12	4.63	
Eastern Woodland Vernal Pool (CEGL006453)	7	4	10	8	11	Final	41	4.61	22.41
						Prelim.	36	4.15	
Northern Riverside Rock Outcrop (CEGL006284)	2	1	3	3	3	Final	3	0.05	0.05
						Prelim.	3	0.05	
Golden-saxifrage Forested Seep (CEGL006193)	0	0	0	0	1	Final	1	0.12	0.53
						Prelim.	0	0.00	
Skunk Cabbage - Jewelweed Seep (CEGL006567)	1	0	1	0	1	Final	3	0.71	4.16
						Prelim.	1	0.07	
Atlantic Coast Wild Rice Tidal Marsh (CEGL004202)	2	0	4	0	0	Final	4	1.07	0.00
						Prelim.	4	1.07	
Broadleaf Pond-lily Tidal Marsh (CEGL004472)	6	0	5	3	3	Final	6	3.10	2.67
						Prelim.	5	2.67	
Central Appalachian Cutgrass Marsh (CEGL006461)	1	0	0	0	1	Final	1	0.33	0.19
						Prelim.	0	0.00	
Mixed Forb Marsh (CEGL006446)	0	1	0	0	0	Final	1	0.02	N/A
						Prelim.	0	0.00	
Steeplebush / Reed Canarygrass Successional Wet Meadow (CEGL006571)	1	0	1	1	1	Final	1	0.17	0.17
						Prelim.	1	0.17	
Eastern Cattail Marsh (CEGL006153)	1	0	5	2	0	Final	12	1.49	0.00
						Prelim.	20	2.58	
Alluvial Alder Swamp (CEGL006414)	2	0	7	4	0	Final	12	1.50	0.00
						Prelim.	18	2.48	
Northeastern Buttonbush Shrub Swamp (CEGL006069)	1	0	1	1	1	Final	3	0.58	4.34
						Prelim.	1	0.20	
Eastern Reed Marsh (CEGL004141)	1	0	1	1	2	Final	2	0.35	0.84
						Prelim.	1	0.31	
Purple Loosestrife Wetland (CEGL006403)	3	0	6	4	5	Final	7	0.85	6.71
						Prelim.	6	0.73	

Table 6. Plot, accuracy assessment, and map class statistics for vegetation and land cover classes at Saratoga National Historical Park (continued) (see bottom of table for explanation of table headers).

USNVC Association (USNVC code)	n (Classific. Plots)[a]	n (Reference Observ. Points)[b]	n (AA Destination Points)[c]	n (AA Points Visited)[d]	n (AA Reference Data Values)[e]	Map Version[f]	Map Statistics		
							n (polygons)[g]	Area (hectares)[h]	Predicted Area (hectares)[i]
Cattail Brackish Tidal Marsh (CEGL004201)	3	0	2	1	3	Final	9	0.90	2.32
						Prelim.	2	0.19	
Duckweed Pond (CEGL005451)	3	0	1	2	2	Final	13	1.50	0.92
						Prelim.	14	1.88	
Open Water Marsh with Mixed Submergents / Emergents (CEGL006196)	1	0	5	2	2	Final	5	6.34	6.34
						Prelim.	5	6.34	
USNVC CLASS SUBTOTALS	**146**	**17**	**281**	**216**	**215**	**Final**	**493**	**603.05**	
						Prelim.	**445**	**602.66**	
ANDERSON LEVEL I and LEVEL II CLASSES									
1. Urban or Built-up Land	0	0	0	0	0	Final	202	7.43	N/A
						Prelim.	202	7.43	
11. Residential	0	0	0	0	0	Final	8	13.90	N/A
						Prelim.	13	9.56	
14. Transportation, Communications, and Utilities	1	0	0	0	1	Final	226	52.55	N/A
						Prelim.	239	56.76	
17. Other Urban or Built Up Land	0	0	0	0	0	Final	194	83.76	N/A
						Prelim.	191	83.76	
22. Orchards, Groves, Vineyards, and Nurseries	0	0	0	0	0	Final	10	1.07	N/A
						Prelim.	10	1.07	
5. Water	0	0	2	0	0	Final	21	0.89	N/A
						Prelim.	21	0.89	
51. Streams and Canals	0	1	0	0	0	Final	19	54.39	N/A
						Prelim.	18	54.35	
53. Reservoirs	0	0	0	0	0	Final	6	4.39	N/A
						Prelim.	8	4.66	
62. Nonforested Wetland	0	0	2	0	0	Final	2	0.17	N/A
						Prelim.	2	0.17	
ANDERSON CLASS SUBTOTALS	1	1	4	0	1	**Final**	**688**	**218.54**	
						Prelim.	**688**	**218.54**	
GRAND TOTALS	**147**	**18**[j]	**285**	**216**	**216**	**Final**	**1181**	**821.20**	
						Prelim.	**1133**	**821.59**	

[a] number of vegetation classification plots assigned to class

[b] number of reference observation points assigned to class

[c] number of accuracy assessment (AA) destination points assigned to map class

[d] number of accuracy assessment (AA) destination points in map class visited (number of accuracy assessment points with sample data label assigned to the map class)

[e] number of accuracy assessment (AA) destination with a reference data value assigned to the map class (number of occasions during AA the class was observed in the field)

[f] version of map to which the map class statistics (area, polygons) apply (prelim. = revised preliminary vegetation map (pre-accuracy assessment); Final = 2014 revised map)

[g] number of polygons labeled as the map class

[h] Total area (in hectares) labeled as the map class.

[i] Estimated area on ground to be assigned to map class, accounting for mapping errors (see Lea and Curtis 2010).

[j] An additional three reference observation points were recorded in Crum Elbow Marsh.

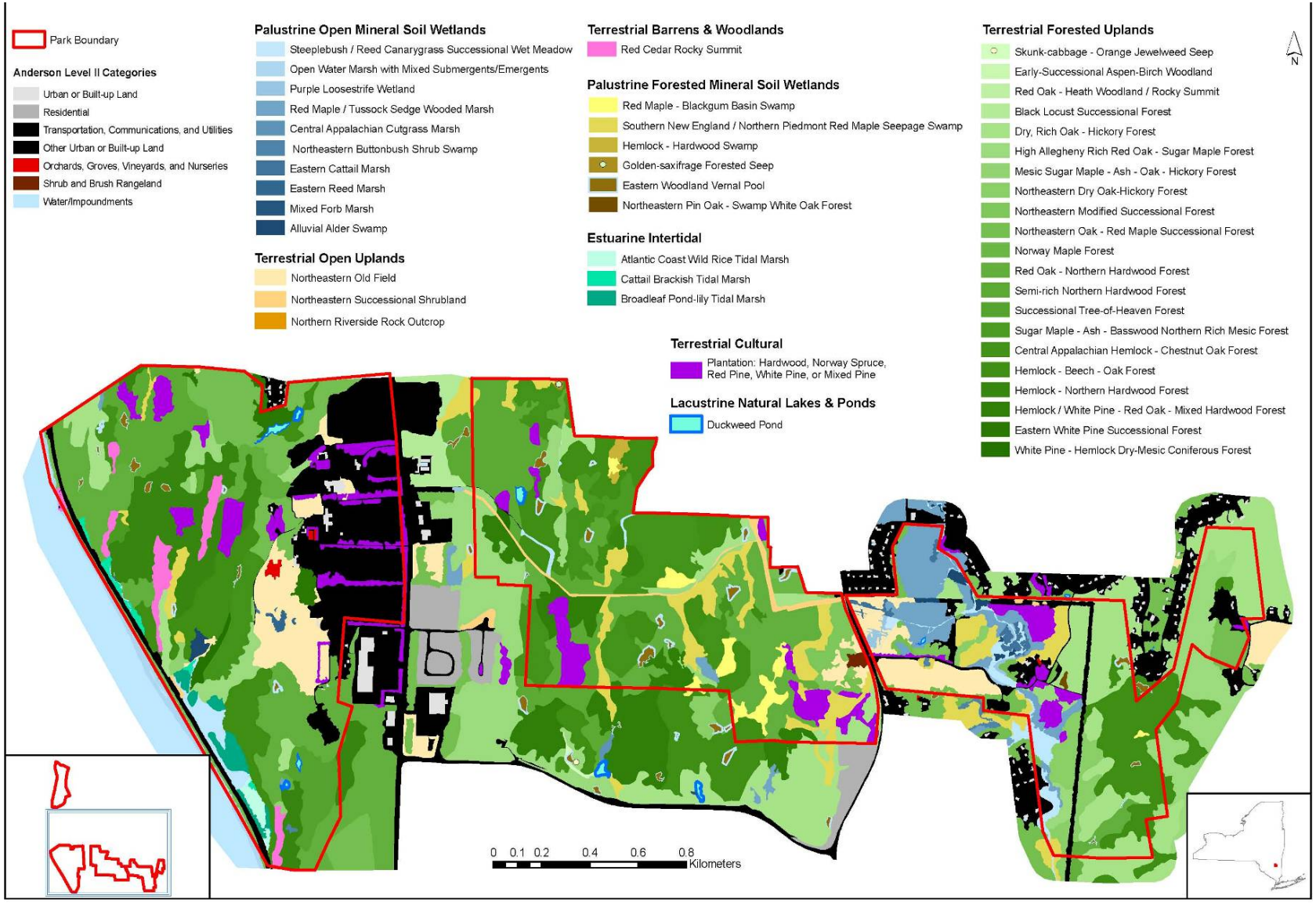

Figure 11. Final vegetation map (post-AA) showing the distribution of USNVC associations and Anderson Level I and II categories within Home of Franklin D. Roosevelt NHS and Val-Kill.

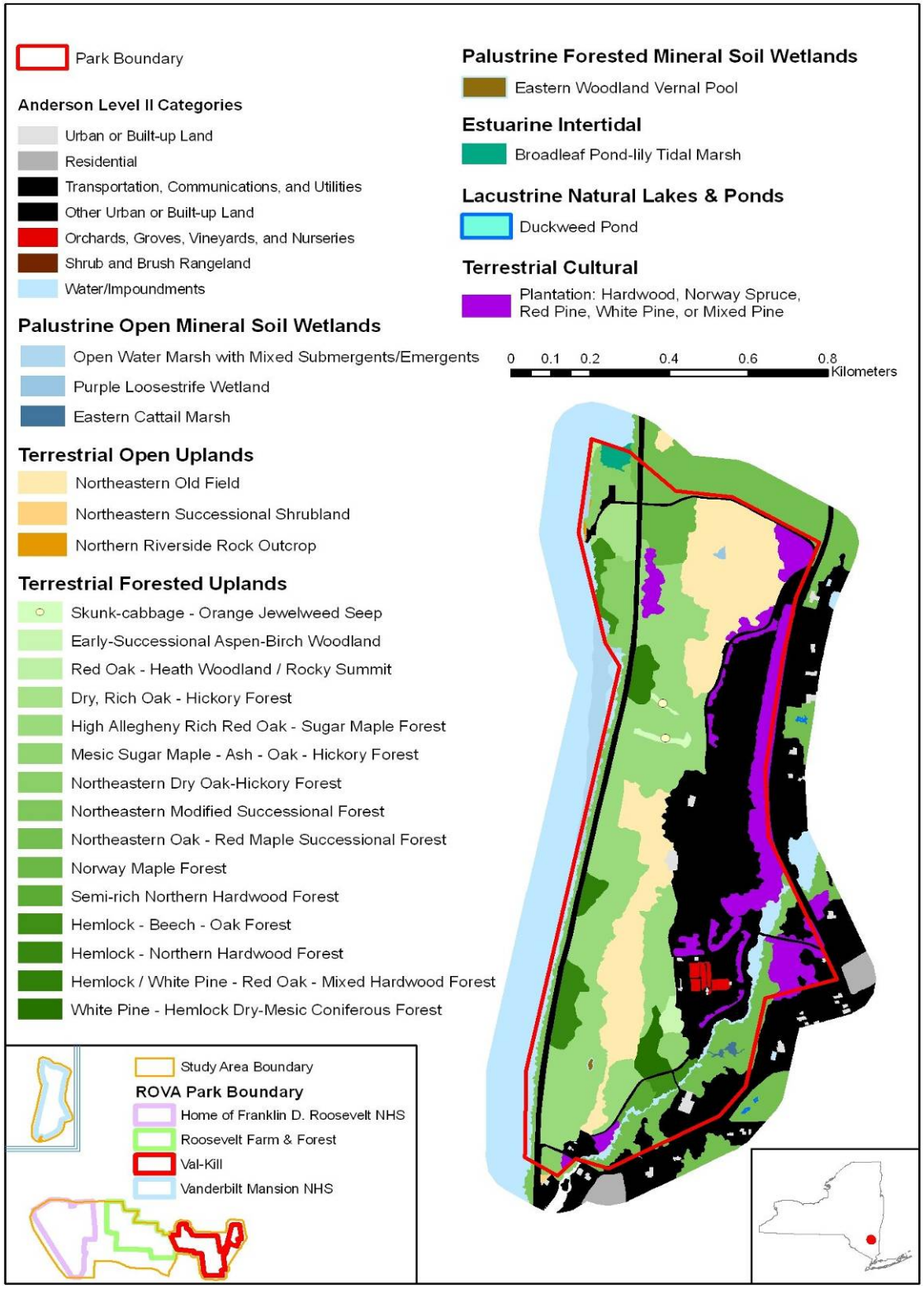

Figure 12. Final vegetation map (post-AA) showing the distribution of USNVC associations and Anderson Level I and II categories within Vanderbilt Mansion NHS.

Including nine map classes represented as Anderson Level I or Level II map classes, a total of 1,181 polygons covering 821.2 hectares were represented in the final map.

Positional Accuracy Assessment

The horizontal positional accuracy of the photomosaic is 2.85 meters (9.3 ft), which meets the Class 2 National Map Accuracy Standard (FGDC 1998b). A copy of the spreadsheet containing the x and y coordinates for each ground control point and the accuracy calculation formula is stored in the Northeast Temperate Network archive.

Thematic Accuracy Assessment

The point estimate for overall accuracies for the pooled USNVC portions of both revised preliminary maps (with map classes from both preliminary maps weighted by unit and combined as described in the Methods section) are 39.3% at the association level, 56.4% at the alliance level, 79.8% at the group level, 80.2% at the macrogroup level, 91.6% at the division and formation levels, and 94.1% at the subclass and class levels. Table 7 summarizes the increases in thematic accuracy with a decrease in thematic resolution at ROVA.

The final vegetation association map presumably has higher thematic accuracy than what is reported below for the revised preliminary (pre-accuracy assessment) vegetation association maps. However, the accuracy results of the uncorrected maps (HVV and RFF) remain a conservative and best estimate of sites that were not visited during the AA.

Table 7. Numbers of thematic units (vegetation classes) and overall thematic accuracies Roosevelt-Vanderbilt National Historic Sites' revised preliminary vegetation map at various levels of the USNVC hierarchy.

USNVC LEVEL	NUMBER OF UNITS AT ROVA*	POINT ESTIMATE OF OVERALL ACCURACY
Association	50 (42)	39.3%
Alliance	43 (35)	56.4%
Group	19 (17)	79.8%
Macrogroup	13	80.2%
Division/Formation	8	91.6%
Subclass/Class	3	94.1%

* number of units classified in the preliminary vegetation maps, and where different, number of units encountered during accuracy assessment in parentheses

Contingency tables C-1 through C-12 in Appendix C present individual map class user's and producer's accuracies at the above levels of the USNVC for the unified- ROVA revised preliminary vegetation map. These tables also are included in Excel spreadsheet format as part of the final digital products for this project . The tables provide insight into the advantages and cautions of applying the map at different levels of thematic resolution.

Computation of the *Kappa* index (Foody 1992), as recommended by the 1994 protocols (ESRI et al. 1994), assesses overall accuracy from the sample contingency table, rather than the population contingency table. Therefore, this computation does not account for the stratified design. For this reason, this unbalanced version of the *Kappa* index is unsuitable for reporting overall accuracy of the final ROVA map. However, when compared with overall accuracy as calculated from the sample contingency table (i.e., as computed for a simple random, rather than NPS stratified random design), the index does provide a measure of accounting for increases in

mapping difficulty imposed by more classes by taking into account the increased influence of chance on map accuracy for smaller numbers of classes. In the case of ROVA, the overall accuracy estimate as computed by the sample contingency table (i.e., as if all AA observations were drawn as a single simple random, rather than stratified, sample) is 45.1% and the corresponding *Kappa* index is 42.9 %.

Project Deliverables

Final products of the vegetation mapping project are presented in Table 8. All products were delivered to the NPS by NYNHP with this report.

Table 8. Summary of products resulting from the vegetation classification and mapping at Roosevelt-Vanderbilt National Historical Sites.

Product	**FGCD-compliant spatial metadata**
Aerial photographs, including flight line map and photoindex	Yes
Photomosaic digital format	Yes
Vegetation classification plot sampling data in the PLOTS 2.0 Database	Yes
GPS coordinates of vegetation classification plots	Yes
Thematic AA data in the PLOTS 2.0 Database	Yes
Contingency tables showing individual map class user's and producer's accuracies in digital spreadsheet format	Not applicable
GPS coordinates of thematic AA sampling points	Yes
Digital photographs of all classification plots and AA points acquired in the field	Not applicable
Final map of vegetation associations as paper copy and in digital format	Yes
Wetland map as paper and in digital format	Yes
Final report in digital format	Not applicable

Discussion

The ROVA Vegetation Inventory should provide an effective context for interpreting the vegetation resources and a baseline for future research. This project provides the most detailed study to date of the distribution and diversity of vegetation at ROVA. As with previous studies in the region, vegetation inventory within ROVA demonstrates the exceptional floristic diversity of the Hudson River corridor, adjacent uplands, and managed lands. This section provides a discussion of the significant floristic resources and plant communities; project limitations; possibilities for improving the classification and map accuracy; and the study's implications for natural resource management, interpretive goals, and future research.

Vegetation Classification and Characterization

The diversity of vegetation associations within ROVA is a result of several factors, including variable topographic features, ecological processes, and land use history. The diversity and distribution of vegetation associations are primarily a result of the following four factors: (1) the geologic history of the region, especially the effect of glaciation; (2) the location along the Hudson River within a temperate climate; (3) the diverse topography that includes moderately steep slopes, rolling hills, and basin wetlands; and (4) the setting within a suburban landscape with associated historical and ongoing land use practices.

Globally Rare Associations

ROVA supports several vegetation associations with biodiversity significance at the state and global level. While there are no large examples of globally rare associations within ROVA, there are small patches of several USNVC associations that are considered rare by NatureServe, they include: (1) Red-cedar Rocky Summit (CEGL006002), (2) Central Appalachian Hemlock - Chestnut Oak Forest (CEGL006923); (3) Red Maple Blackgum Basin Swamp (CEGL006014), and (4) Eastern Woodland Vernal Pool (CEGL006453) (Table 9) (Appendix F).

Table 9. NatureServe's subnational (state) and global conservation ranks[a] for USNVC rare associations within Roosevelt-Vanderbilt National Historic Sites.

USNVC Association	Global Rank	Subnational Rank (for New York)	Park unit(s) where present[b]
Red-cedar Rocky Summit (CEL006002)	Imperiled to Vulnerable (G2G3)	Vulnerable (S3)	HOFR
Central Appalachian Hemlock - Chestnut Oak Forest (CEGL006923)	Vulnerable (G3)	Apparently Secure (S4)	HOFR, RFF, VK
Red Maple Blackgum Basin Swamp (CEGL006014)	Not Ranked (GNR)	Imperiled (S2)	RFF, VK
Eastern Woodland Vernal Pool (CEGL006453)	Not Ranked (GNR)	Vulnerable (S3)	HOFR, RFF, VM,VK

For further explanation of global and subnational ranks, see: http://www.natureserve.org/explorer/ranking.htm

[b] RFF (Roosevelt Farm and Forest), HOFR (Home of Franklin D. Roosevelt NHS, excluding Roosevelt Farm and Forest), VM (Vanderbilt Mansion NHS) and VK (Val-Kill; Eleanor Roosevelt NHS).

State Significant Occurrences of Natural Communities

Five NY Natural Heritage ecological communities within ROVA are considered significant occurrences from a statewide perspective (Table 10). They are: (1) oak-tulip tree forest at Vanderbilt Mansion NHS; (2) hemlock-northern hardwood forest at Roosevelt Farm and Forest; (3) red-cedar rocky summit at Home of Franklin D. Roosevelt NHS (excluding Roosevelt Farm and Forest); (4) vernal pool at both Val-Kill and Roosevelt Farm and Forest; (5) and freshwater tidal marsh at Home of Franklin D. Roosevelt NHS (excluding Roosevelt Farm and Forest). These natural communities and their equivalent USNVC associations are described briefly below.

Table 10. State and global conservation ranks for New York statewide significant occurrences within Roosevelt-Vanderbilt National Historic Sites.

New York Natural Community type	USNVC Association (local name)	Global Rank	Subnational Rank (for New York)	Park unit(s) where present[a]
Red-cedar rocky summit	Red-cedar Rocky Summit (CEL006002)	Imperiled to Vulnerable (G2G3)	Vulnerable (S3)	HOFR
Hemlock-northern hardwood forest	Central Appalachian Hemlock - Chestnut Oak Forest (CEGL006923)	Vulnerable (G3)	Apparently Secure (S4)	RFF
Hemlock-northern hardwood forest	Hemlock - Beech - Oak Forest (CEGL006088)	Apparently Secure to Secure (G4G5)	Apparently Secure (S4)	RFF
Hemlock-northern hardwood forest	Hemlock - Northern Hardwood Forest (CEGL006109)	Apparently Secure (S4)	Apparently Secure (S4)	RFF
Hemlock-northern hardwood forest	Hemlock / White Pine - Red Oak - Mixed Hardwood Forest (CEGL006566)	Apparently Secure (G4)	Apparently Secure (S4)	RFF
Oak-tulip tree forest	High Allegheny Rich Red Oak - Sugar Maple Forest (CEGL006125)	Apparently Secure (G4?)	Imperiled (S2)	VM
Hemlock-northern hardwood forest	White Pine - Hemlock Dry-Mesic Coniferous Forest (CEGL006328)	Secure (G5)	Apparently Secure (S4)	RFF
Vernal pool	Eastern Woodland Vernal Pool (CEGL006453)	Not Ranked (GNR)	Vulnerable (S3)	RFF, VK
Freshwater tidal marsh	Atlantic Coast Wild Rice Tidal Marsh (CEGL004202)	Apparently Secure (G4)	Imperiled (S2)	HOFR
Freshwater tidal marsh	Broadleaf Pond-lily Tidal Marsh (CEGL004472)	Vulnerable to Apparently Secure (G3G4)	Imperiled (S2)	HOFR

[a] Refers to where the association occurs with significance occurrence only. Codes are: RFF (Roosevelt Farm and Forest), HOFR (Home of Franklin D. Roosevelt NHS, excluding Roosevelt Farm and Forest), VM (Vanderbilt Mansion NHS) and VK (Val-Kill; Eleanor Roosevelt NHS).

Although the oak-tulip tree forest community is found throughout all park units at ROVA, a small, moderately diverse, 52 acre (21 ha) stand, equivalent to the USNVC association High

Allegheny Rich Red Oak - Sugar Maple Forest (CEGL006125), established on the west-facing slope on the east side of the Hudson River at Vanderbilt Mansion NHS, is of particular note (Table 10). This forest was determined to be a statewide significant occurrence for this community type. The northern portion of this forest stand may be considered old-growth (it contains approximately two dozen very large trees with diameters around one meter (range 80-146 cm) that are very mature and possibly old growth. The forest stand is almost completely surrounded by either cultural communities or very disturbed natural communities. The integrity of this stand could be enhanced by restoration of the disturbed natural communities which currently serve as a buffer for the mature forest stand.

The hemlock-northern hardwood forest represents the most common NY Natural Heritage community type within ROVA. It is comprised of the following five USNVC associations: (1) Hemlock / White Pine - Red Oak - Mixed Hardwood Forest (CEGL006566); (2) Hemlock - Northern Hardwood Forest (CEGL006109); (3) Central Appalachian Hemlock - Chestnut Oak Forest (CEGL006923); (4) White Pine - Hemlock Dry-Mesic Coniferous Forest (CEGL006328); and (5) Hemlock - Beech - Oak Forest (CEGL006088). A particularly good example of this NY Natural Heritage community type for the state occurs within Roosevelt Farm and Forest (Table 10). The 183 acre (71 ha) forest is generally in excellent condition, with very little evidence of exotic plants or the hemlock woolly adelgid (*Adelges tsugae*), a small aphid-like insect that damages hemlock trees within ecosystems in eastern North America (Evans 2002). This forest also has good species diversity and species regeneration within the natural community. The forest stand is surrounded by Semi-rich Northern Hardwood Forest (CEGL006211), Mesic Sugar Maple - Ash - Oak -Hickory Forest (CEGL006046), and Red Oak-Northern Hardwood Forest (CEGL006173).

A small, 10.6 acre (4.3 ha), diverse red-cedar rocky summit natural community located at Home of Franklin D. Roosevelt NHS (excluding Roosevelt Farm and Forest) was determined to be a significant occurrence for this community type (Table 10). The stand supports a few invasive plant species, however this heat stress-maintained red-cedar rocky summit has excellent species diversity and is in good condition. The majority of the community is located within a roadless area of about 400 acres (161ha) and is well connected to the surrounding natural communities. Roads, residential areas, and railroads fragment similar forests in the distant landscape. The red-cedar rocky summit located at Home of Franklin D. Roosevelt NHS (excluding Roosevelt Farm and Forest) is composed of at least one USNVC association: Red-cedar Rocky Summit (CEGL006002). Maintenance of this occurrence may require management measures that slow invasion of open areas by woody vegetation (e.g., burning, goat grazing, mechanical removal of invading saplings, etc.).

Although the vernal pool community (equivalent to Eastern Woodland Vernal Pool - CEGL006453) is present in all ROVA units, the vernal pool complexes within and adjacent to Roosevelt Farm and Forest and Eleanor Roosevelt NHS were determined to be significant occurrences (Table 10).

The good quality complex associated with RFF was located using aerial photographs and surveyed in the spring and summer of 2007. The vernal pools are embedded within a 334 acre (136 ha) landscape characterized by NY Natural Heritage Natural Community hemlock-northern hardwood forest with small inclusions of oak-tulip tree forest, Appalachian oak-hickory forest,

and red maple-hardwood swamp. This occurrence is comprised of 23 vernal pools of varying size totaling 7.05 acres (2.85 ha). The major portions of these vernal pools are in excellent condition, with good floristic diversity and an intact forested buffer. However, the southernmost pools are in close proximity to a major road, which may decrease their ecological integrity due to altered hydrology. It is recommended that these pools be surveyed for obligate vernal pool fauna during early spring.

The vernal pool complex (equivalent to Eastern Woodland Vernal Pool - CEGL006453) associated with Eleanor Roosevelt NHS was determined to be a significant occurrence of this community (Table 10). The complex was surveyed for fauna in 2006 and supported breeding obligate salamander species (Hayes 2006). Six vernal pools totaling 1.62 acres (0.66 ha) are situated within a semi-natural landscape comprised of hemlock-northern hardwood forest, Appalachian oak-hickory forest, and red maple-hardwood swamp. This vernal pool complex occurs in a landscape with suburban development on most sides. It is recommended that further ecological surveys be conducted within these vernal pools to document plant species, condition, and biotic and abiotic characteristics.

A small, 2.7 acre (1.1 ha) freshwater tidal marsh located within Home of Franklin D. Roosevelt NHS (excluding Roosevelt Farm and Forest) was determined to be a significant occurrence for this community type (Table 10). This marsh, created at least in part from the construction of the railroad embankment along the eastern shore of the Hudson River, is characterized by excellent species and physiognomic diversity. It is surrounded by a landscape in moderate condition with moderate disturbance buffering capabilities; daily tidal flushing occurs through a railroad bridge near the center of the marsh. The marsh shows a strong mosaic varying from open water near the inlet, to small regions of mudflats, and to patches dominated by yellow pond-lily (*Nuphar lutea* ssp. *advena*). This freshwater tidal marsh is comprised of two USNVC associations: (1) Broadleaf Pond-lily Tidal Marsh (CEGL004472) and (2) Atlantic Coast Wild Rice Tidal Marsh (CEGL004202). Some marsh areas that currently do not receive tidal flushing from the Hudson River because of structural barriers might benefit from hydrologic restoration measures.

Accuracy Assessment

The largest source of thematic accuracy error was the difficulty in distinguishing between USNVC types with very similar aerial photography signatures. Several of the deciduous forest associations were misclassified as other deciduous forest associations. For example, the High Allegheny Rich Red Oak - Sugar Maple Forest (CEGL006125) map class represented a large number of misclassifications of other associations, with 17 of 27 observations found to be another association, including ten observations that were found in the field to be the Northeastern Dry Oak - Hickory Forest (CEGL006336), three observations that were found to be the Red Oak - Northern Hardwood Forest (CEGL006173), and two observations dominated by the invasive species Norway maple that were classified in the field as Norway Maple Forest (CEGL006407). High Allegheny Rich Red Oak - Sugar Maple Forest (CEGL006125) is a rich USNVC association, which presents favorable conditions for invasive species such as Norway maple to invade stands occurring near human development.

For the Red Oak - Northern Hardwood Forest (CEGL006173) map class, 19 of 27 observations proved to be other associations, including a total of 12 from among the similar Mesic Sugar Maple – Oak - Ash – Hickory Forest (CEGL006046), High Allegheny Rich Red Oak - Sugar Maple Forest (CEGL006125), Semi-rich Northern Hardwood Forest (CEGL006211), and Sugar

Maple - Ash - Basswood Northern Rich Mesic Forest (CEGL005008) associations. All of these deciduous forest types are very difficult to distinguish from one another using aerial photograph signatures. Additionally, the similarity of these forests to one another on the ground may have caused reference data labeling errors.

Several tidal wetland associations were difficult to distinguish from non-tidal wetlands and resulted in errors in thematic accuracy. For example, Cattail Brackish Tidal Marsh (CEGL004201) was misclassified as Eastern Cattail Marsh (CEGL006153) and Alluvial Alder Swamp (CEGL006414) due to difficulties in determining whether these wetlands that are separated by barriers were influenced by river tides. In addition, it was difficult to delineate these wetlands on early spring aerial photographs since vegetation from these wetlands does not emerge above open water until late spring/early summer.

The overall size of the Red-cedar Rocky Summit (CEGL006002) natural community was actually smaller than originally mapped due in part to difficulties in distinguishing elevation on aerial photographs. Hemlock - northern hardwood forest associations occur immediately downslope from this association and were labeled incorrectly as Red-cedar Rocky Summit. In addition, the shade from hemlock-northern hardwood forest canopies presents further difficulty in distinguishing summits from the adjacent, down-slope steep slopes.

At Roosevelt Farm and Forest, the main source of mapping error resulted from distinguishing among hemlock-northern hardwood forest associations on aerial photographs. Five hemlock-northern hardwood forest associations, which are distinguished from one another by dominant species, mesic versus xeric environmental settings, and topographical affinities, were ultimately identified within this park unit. Observation data collected during AA sampling showed that, for example, the Hemlock – Beech - Oak Forest (CEGL006088) was misclassified in the preliminary map as the Hemlock / White Pine - Red Oak - Mixed Hardwood Forest (CEGL006566) at least 11 times. In some cases, a polygon was mapped as one prevalent association, but the AA point randomly fell into a small, unmapped included association. In most of these cases, if the embedded association met the minimum mapping size and its signature was discernible on aerial photography, then polygons representing the two types were mapped separately on the revised map. Several large hemlock-northern hardwood polygons were found to have embedded associations that were often slightly wetter or drier depending on slight changes in elevation that were undetectable on aerial photograph signatures.

Due to the inverse correlation between thematic resolution and thematic accuracy (i.e., thematic accuracy improves at thematically coarser levels, Table 7), use of the map can be tailored to the management question at hand . Map users should consult the project contingency tables (Appendix C or digital spreadsheet versions) to assess appropriate thematic levels for an intended use.

The map accuracy as calculated from the revised preliminary maps provides a conservative estimate for the map accuracy of the final map. Although individual map class and overall accuracies of the final map presumably increased as a result of relabeling polygons to match thematic AA observations, the exact amount of improvement is uncertain. The individual observations made during the AA often encompassed a much smaller area than an entire

polygon. Errors can remain since polygons cannot be assumed to be internally homogeneous as to vegetation type unless they are observed in their entirety (Lea and Curtis 2010).

While an AA of the final map that assesses individual classes for accuracy, as specified by NPS protocols, can be time-consuming, a map validation that assesses overall map accuracy but stops short of the intensity needed for a precise estimate of individual classes could assess whether overall accuracy has been improved by the post-AA relabeling and, if so, by how much. The NPS validation process (http://science.nature.nps.gov/im/inventory/veg/docs/Veg_Inv_12step_Guidance_v1.1.pdf) recommends that 30-50 such random observations can suffice as an overall measure of project accuracy; field work for this more limited sample size could be made by park or network staff within a few days to one week's time, and the results, while unlikely to assess individual map class issues well, would be likely to help answer the question of how much the post-AA map relabeling improved the overall map accuracy of the final map. This validation could be limited more to sets of map classes that had higher rates of internal mapping errors and/or were more edited between the preliminary and final maps.

New validation or AA efforts might better define conceptual boundaries between vegetation types and lead to a more reliable, revised field key. It may be that examination of similar individual types reveals that they are better "lumped". Light or otherwise insufficient classification plot sampling tends to emphasize difference between sample units and leads to splitting, whereas more intensive sampling may reveal a continuum between individual sample units and encourage lumping.

Wetland Maps

NYNHP also produced wetland maps for ROVA. The polygon shapefiles with vegetation associations were cross-walked and labeled to Systems (Cowardin et al. 1979) and Subsystems following the Ecological Communities of New York State (Edinger et al. 2002). Figures 13 and 14 depict the palustrine, estuarine, and lacustrine associations within ROVA. A comparison of these wetland association maps with National Wetland Inventory maps is recommended. Furthermore, these wetland maps are not intended to replace existing federal and state regulatory wetland maps.

Natural Resource Concerns

Non-Native Species

The PLOTS database associated with this project contains information on the presence and absence of non-native invasive plant species encountered during classification and AA field work. These data will be very useful as a baseline from which to prioritize management actions and evaluate changes in the future. In addition, the data could be used to model the types of environments susceptible to non-native/weedy species invasion.

Wildlife Habitat

Although this inventory did not emphasize sampling of detailed wildlife habitat or structural parameters, the delineation of physiognomic classes should aid in analyses of broad patterns in

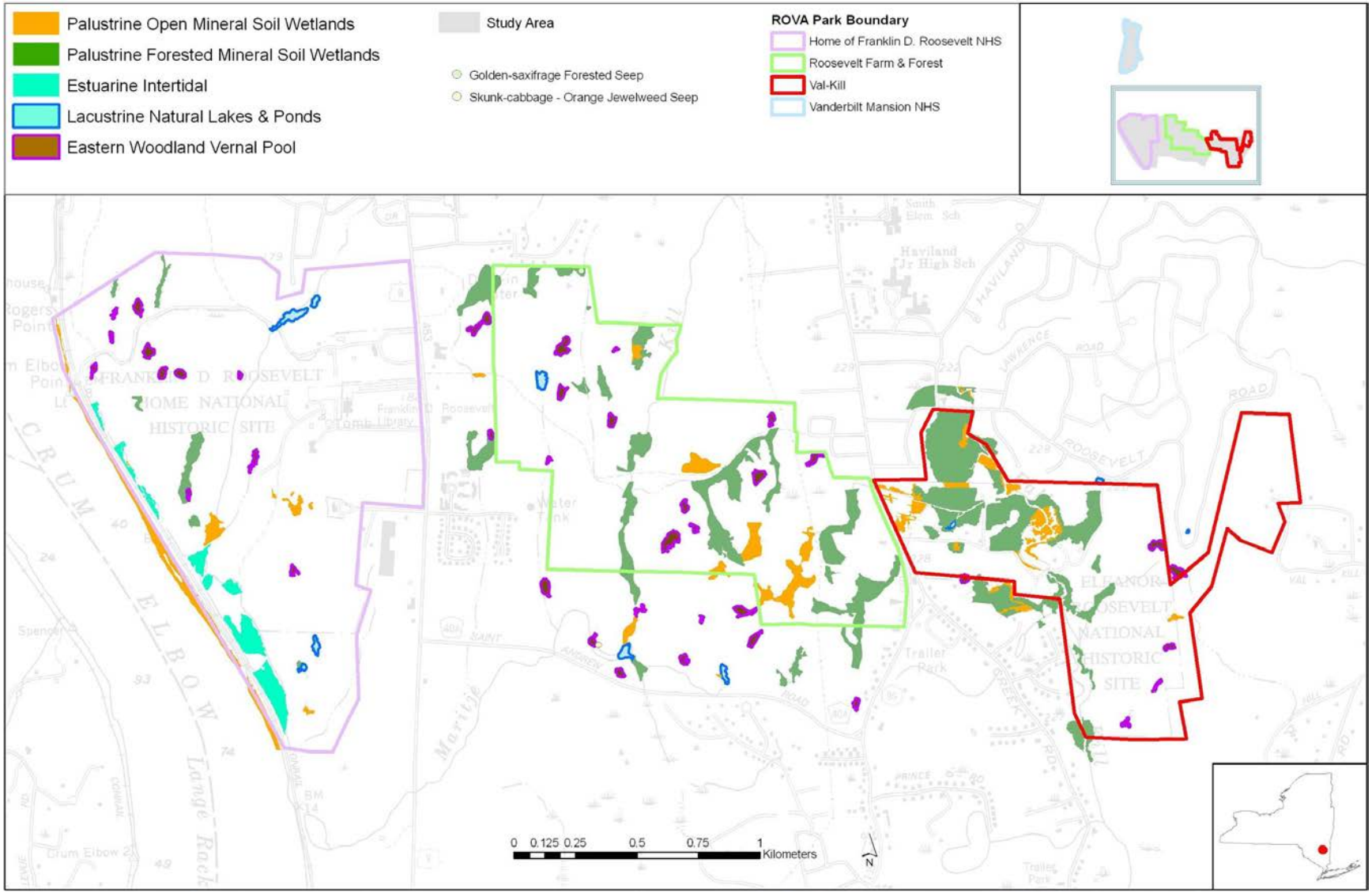

Figure 13. Open and forested wetlands within Home of Franklin D. Roosevelt NHS and Val-Kill.

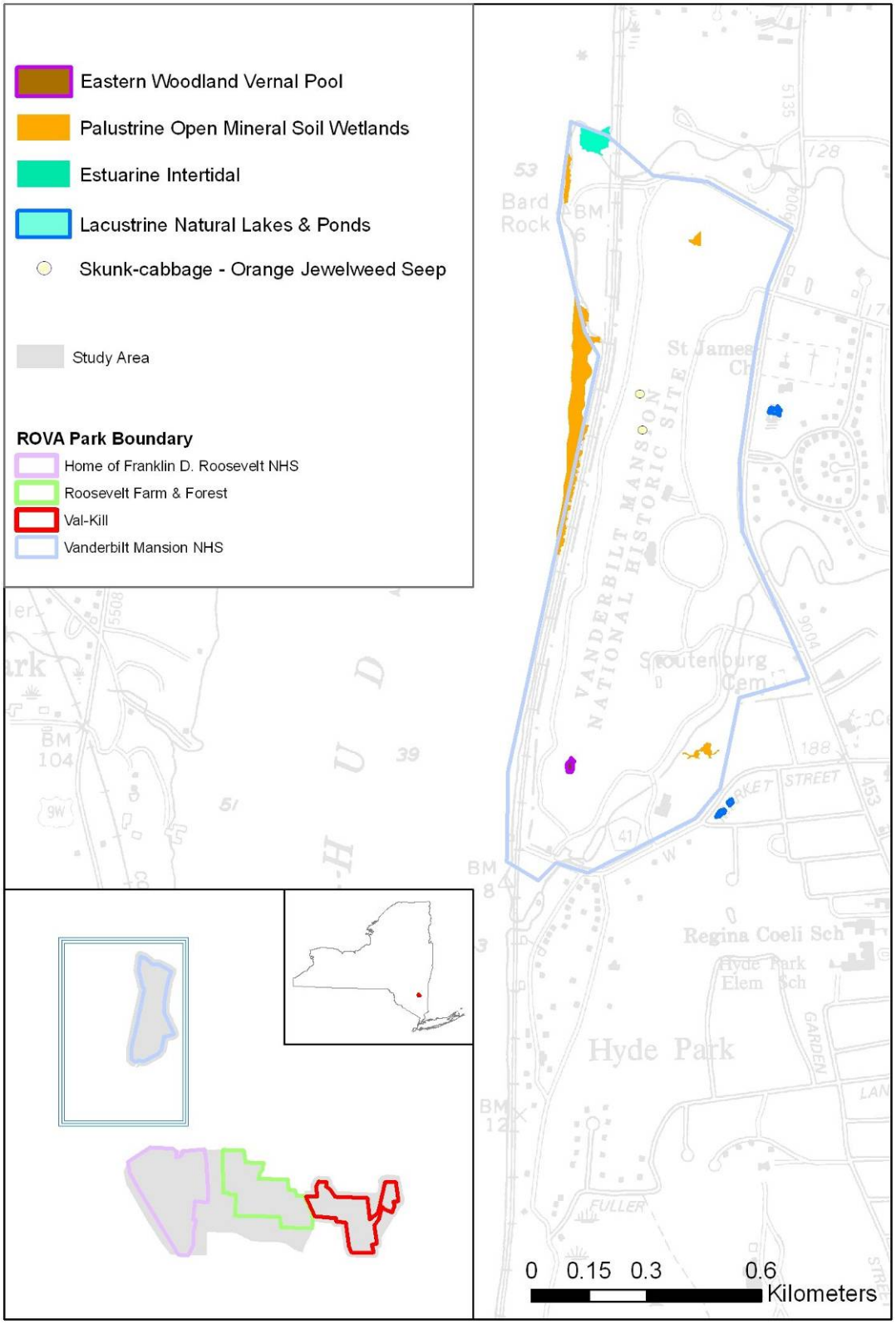

Figure 14. Open and forested wetlands within Vanderbilt Mansion NHS.

vegetation structural types for use in wildlife monitoring. Vertebrate wildlife are known to respond foremost to vegetation structure and broad physiognomic classes, and this project should inform modeling and mapping efforts for wildlife habitat/use.

Natural Resource Interpretation

This inventory project illustrates the diverse vegetation mosaic that has become established along the Hudson River. It thereby provides a valuable resource for ROVA interpretive staff to educate visitors about plant communities and the diverse ecological processes affecting their development and change. Within ROVA the vegetation pattern is structured by several physical and biological factors interacting in time and space. Climate (precipitation and temperature) influences vegetation in the entire inventory area and region. Topography, geology, soils, and precipitation events interact to influence the chemical composition and amount of surface- and groundwater that feeds seeps, wetlands, and streams in the park.

Even within this small-sized landscape, vegetation dynamics are caused by variation in climate and a variety of natural and human disturbance types. Natural pest and pathogens undoubtedly augment the vegetation mosaics resulting from environmental complexity and influences like drought and fire. The compact ROVA landscape is a unique place to contemplate past and continued environmental changes; this vegetation inventory project provides an important benchmark for evaluating these and similar processes of environmental change in the Lower Hudson River drainage.

The forested areas of ROVA provide a characteristic regional setting for studying natural and human-caused disturbance dynamics and their implications for native plant and animal diversity. The post-logging succession in particular may be an important interpretive resource; interpretive walks through native and secondary forest stands might provide an ideal showcase to illustrate and communicate 20th century forestry approaches and their outcomes. ROVA, in general, provides an opportunity to interpret the regional climatic, disturbance, and human history of the Hudson River.

As stated above, this study provides an in-depth resource for interpretive staff to develop communication programs that describe the complex vegetation mosaic within ROVA and the adjacent Hudson River floodplain. In particular, the key to the associations (Appendix E) and the vegetation association descriptions (Appendix F) provide valuable tools to effectively communicate both vegetation classification and distribution patterns. This inventory will also serve as a valuable resource for individuals wanting to quickly gain a comprehensive introduction to the vegetation of ROVA and vicinity.

Research Opportunities

The vegetation map and database provide opportunities for research on vegetation-environment relations. The spatial data can be overlaid with the geology and soils mapping to provide additional environmental descriptors for each classification plot location. Ordination techniques relating plot data to environmental data could be applied to pursue vegetation-environment relations. In addition, species richness data could be analyzed for patterns related to vegetation association, elevation, hydrology, disturbance, and other variables. The map data are also useful as a guide for rare plant surveys as well as for wildlife habitat modeling or wildlife habitat structural analyses, fire modeling, and prioritizing invasive exotic species management areas.

Complex interactions between environmental data and the mapped vegetation could be examined and yield important information about vegetation composition, structure, and function and how these elements are affected by elevation, soil, slope aspect, hydrology, and disturbance.

In addition, the dynamics of the various forest canopy structures in ROVA could be explored. Research evaluating the habitat these forests provide for native plant and vertebrate diversity could investigate the current microclimate, understory plant diversity, and wildlife habitat values (e.g., land bird, small mammal, and invertebrate diversity). For example, secondary forests could be prioritized for long-term research in forest succession to document the rate and magnitude of change over time. A subset of these forests might also be the focus for restoration efforts to explore the prospects for increasing heterogeneity or to alter current trends of succession through the introduction of prescribed fire or mechanical treatments.

Literature Cited

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

Avery, T.E. 1978. Forester's Guide to Aerial Photo Interpretation. U.S. Department of Agriculture, U.S. Forest Service. Agriculture Handbook 308. United States Government Printing Office, Washington, DC.

Bailey, R. Map: Ecoregions of North America. [revised]. 1997. USDA Forest Service in cooperation with The Nature Conservancy and the U.S. Geological Survey. Washington, DC.

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

Cadwell, D. H. 1989. Lower Hudson Sheet. In *Surficial Geologic Map of New York*. Scale 1:250,000. New York State Museum Map and Chart Series 40, edited by D. H. Cadwell, and others, The University of the State of New York, Albany, New York.

Caldwell, J., P. Lombard and W. Gawley. 2006. Freshwater vital-signs monitoring plan for National Parks in the Northeast Temperate Network (NETN), phase III; Water –quality monitoring protocols in lakes, ponds, and streams. USGS, Augusta, ME.

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

Congalton, R. G. and K. Green. 2009. Assessing the accuracy of remotely sensed data: principles and practices, 2nd ed. CRC Press, Boca Raton, FL.

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

Czaplewski, R. L. 2003. Accuracy assessment of maps of forest condition: statistical design and methodological considerations. Pages 115 to 140 in Wulder, M. A. and S. E. Franklin, editors. Remote Sensing of Forest Environments: Concepts and Case Studies. Kluwer Academic Publishers, Boston, MA.

Dutton, B. E. April 1998a. Vascular plant survey of Eleanor Roosevelt National Historic Site. National Park Service unpublished document.

Dutton, B. E. April 1998b. Vascular plant survey of Franklin D. Roosevelt National Historic Site. National Park Service unpublished document.

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

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

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

[ESRI] Environmental Systems Research Institute, Inc. 1992-2000. ArcView 3.2. Environmental Systems Research Institute, Inc., Redlands, CA.

[ESRI] Environmental Systems Research Institute, Inc. 1999-2006. ArcMap 9.2. Environmental Systems Research Institute, Inc., Redlands, CA.

Evans, R.A. 2002. Hemlock ecosystems and hemlock woolly adelgid at Delaware Water Gap National Recreation Area.

[FGDC] Federal Geographic Data Committee. 1997. Vegetation Subcommittee. Vegetation Classification Standard. FGDC-STD-005. Federal Geographic Data Committee, U.S. Geological Survey, Reston, VA.

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

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

[FGDC] Federal Geographic Data Committee. 2008. Vegetation Subcommittee. National Vegetation Classification Standard, Version 2. FGDC-STD-005-2008. Federal Geographic Data Committee, U.S. Geological Survey, Reston, VA.

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

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

Glenn, S. D. 1998. Vascular plant survey of Vanderbilt Mansion National Historic Site from 1995-1997.

Haines, A. 2011. *Flora Novae Angliae*: a manual for the identification of native and naturalized higher vascular plants of New England. Yale University Press, New Haven, CT.

Hayes, D. 2006. Salamander monitoring summary of Eleanor Roosevelt National Historic Site (Val-Kill). National Park Service, Hyde Park, NY.

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

Klemens, M.W., Cook, R.P., and Hayes, D.J. 1992. Herpetofauna of Roosevelt-Vanderbilt National Historic Sites Hyde Park, New York, with emphasis on Blanding's turtle (Emydoidea blandingii). Boston: United States National Park Service, North Atlantic Region, Technical Report NPS/NAROSS/NRTR-92/08, 34 pp.

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

Lea, C. 2011. Vegetation classification guidelines: National Park Service Vegetation Inventory, version 2.0. Natural Resource Report NPS/NRPC/NRR—2011/374. National Park Service, Fort Collins, CO.

Lea, C. and A.C. Curtis. 2010. Thematic accuracy assessment procedures: National Park Service Vegetation Inventory, version 2.0. Natural Resource Report NPS/2010/204. National Park Service, Fort Collins, CO.

Lewis, A. 1983. Vegetation resource inventory for the Home of Franklin D. Roosevelt National Forest. Boston, MA: Office of Scientific Studies, North Atlantic Region, National Park Service, Department of the Interior, Boston, MA, 1983. 83-4.

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

McCune, B. and M. J. Mefford 2007. PC-ORD: Multivariate Analysis of Ecological Data, Version 5.10. MjM Software Design, Gleneden Beach, OR.

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

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

National Park Service. 1997. Water resource management plan of Roosevelt-Vanderbilt National Historic Site. U.S. Dept. of the Interior, National Park Service, Northeast Region, Boston, MA.

National Park Service (NPS). 1999. Natural Resource Challenge: The National Park Service's action plan for preserving natural resources. http://www.nature.nps.gov/challenge/assets/actionplan/NatRes2.pdf> Last accessed 16 December 2013.

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

NatureServe. 2009. International Ecological Classification Standard: terrestrial ecological classifications. NatureServe Central Databases. Arlington, VA. U.S.A. Data current as of 17 March 2009.

NatureServe. 2013. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. (Accessed: December 31, 2013).

[NYNHP] New York Natural Heritage Program, New York State Department of Environmental Conservation, 2013. Ecological Community Information. Accessed online January 2014 at: http://www.dec.ny.gov/animals/29384.html

[NYNHP] New York Natural Heritage Program. 2004-2008. Biotics database. New York State Department of Environmental Conservation. Albany, NY.

Pandullo Quirk Associates. 1979. Natural resources inventory at Eleanor Roosevelt National Historic Site, Hyde Park, New York. Overview report. National Park Service, Boston, MA.

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

Rudnicky, J. L. 1985. National resource inventory of the Vanderbilt National Historic Site. Office of Scientific Studies, North Atlantic Region, National Park Service, United States Department of the Interior, Boston, MA.

Schmidt, R. E. 1995. Fishes of the Roosevelt-Vanderbilt National Historic Site, Hyde Park, New York, Final report. Roosevelt-Vanderbilt National Historic Site, NY: National Park Service.

Steadman, D. W. 1991. Field survey of small mammals of Roosevelt-Vanderbilt National Historic Site, Hyde Park, New York. Biological State Museum Albany, NY.

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

[USDA NRCS] U.S. Department of Agriculture, Natural Resources Conservation Service. 2004a. Soil survey of Dutchess County, New York. http://soildatamart.nrcs.usda.gov/Manuscripts/NY027/0/Dutchess.pdf

[USDA NRCS] U.S. Department of Agriculture, Natural Resources Conservation Service. 2004b. The PLANTS database, Version 3.5 (http://plants.usda.gov). Data compiled from various sources by Mark W. Skinner. National Plant Data Center, Baton Rouge, LA.

[USDI NPS] U.S. Department of the Interior, National Park Service. 1997. Baseline water quality data inventory and analysis, Roosevelt-Vanderbilt National Historic Site. Water Resources Division. Technical Report NPS/NRWRD/NRTR-95/64. Washington, DC.

[USDI NPS] U.S. Department of the Interior, National Park Service. 2013 Northeast Temperate Network Website.. Accessed online in September 2013 at: http://science.nature.nps.gov/im/units/netn/.

[USGS] U.S. Geological Survey. 1994. USGS digital orthophoto quadrangles. United States Geological Survey, Sioux Falls, SD.

[USGS] U.S. Geological Survey. 2004. Tools for creation of formal metadata, a compiler for formal metadata. Retrieved June 2004 from http://geology.usgs.gov/tools/metadata/tools/doc/mp.html.

Appendix A: Roosevelt - Vanderbilt National Historic Sites - Photomosaic Key Attributes

Table A-1. Roosevelt - Vanderbilt National Historic Sites - photomosaic key attributes

Photomosaic attributes	**Metadata**
Title of metadata record:	Roosevelt-Vanderbilt Mansion NHS Color Infrared Orthorectified Photomosaic – Leaf-on (ERDAS IMAGINE 8.7 .img and MrSID formats)
Publication date of mosaic (from metadata):	September 22, 2004
Date aerial photography was acquired:	May 12, 2004
Vendor that provided aerial photography:	William Frament, USDA Forest Service (Northeastern Area State and Private Forestry, Durham, NH)
Scale of photography:	1:8,000
Type of photography:	Color infrared, stereo pairs
Number of air photos in mosaic:	47
Archive location of aerial photographs, camera calibration certificate, and shapefile of photo centers:	USGS Earth Resources Observation and Science (EROS) Center, Sioux Falls, SD
Scanning specifications:	600 dpi
Horizontal positional accuracy of mosaics:	2.85 meters, meets Class 2 National Map Accuracy Standard
Number of ground control points upon which estimated accuracy is based:	35
Method of calculating positional accuracy:	Root mean square error
Archive location of mosaics and metadata:	USGS Earth Resources Observation and Science (EROS) Center, Sioux Falls, SD
Format(s) of archived mosaics:	.img (uncompressed) and MrSID (20:1 compression)

Appendix B: NY Natural Heritage Vegetation Plot Form and Hand-Held DataBase (HHDB) Screen Shots

COMMUNITY FORM 3: QUANTITATIVE COMMUNITY CHARACTERIZATION revised May 10, 2001

NY Natural Heritage Program

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

A. IDENTIFIERS / LOCATION (GENERAL EOR INFORMATION)

1. Survey site name:_____

2. Quad code(s):_____

3. Quad name(s): _____

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

6. Directions to this transect:_____

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

10. Surveyors:_____

B. ENVIRONMENTAL DESCRIPTION

11. **Community name** _____

12. National Association_____

13. Transect/observation point #

14. Image annotation #

15. Elevation:

16. Topographic position:
__Interfluve __Toeslope
__High slope __Low level
__High level __Channel wall
__Midslope __Channel bed
__Backslope __Basin floor
__Step in slope __Other:
__Lowslope

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

18. Slope degrees:_____

19. Slope aspect:_____

20. Parent material/bedrock:

21. Soil profile description: note depth, texture, and color of each horizon. Note significant changes such as depth to mottling, depth to water table, root penetration depth

22. Organic horizon depth:_____

23. Organic horizon type: Mor:__ Mull:___

24. Average pH of mineral soil:_____

25. Soil moisture regime:
__Extremely dry __Very dry
__Dry __Well drained
__Somewhat moist __Moist
__Somewhat wet __Wet
__Permanently inundated __Very wet
__Periodically inundated
Soil pore salinity_____ppt. (optional)

26.Soil drainage:
__Rapidly drained
__Well drained
__Moderately well drained
__Somewhat poorly drained
__Poorly drained
__Very poorly drained

27. Hydrologic Regime of plot (adapted from Cowardin 1979):
__Semipermanently flooded __Intermittently flooded
__Seasonally flooded __Permanently flooded
__Saturated __Tidally flooded
__Temporarily flooded __Unknown
__Never Inundated

Optional fields below
pH of water_____
Flood depth_____
Tidal range_____

28. Stoniness:
__Stone free <0.1%
__Moderately stony 0.1-1%
__Stony 3-15%
__Very stony 15-50%
__Exceedingly stony 50-90%
__Stone piles >90%

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

30. Average organic soil texture:
__muck
__peat

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

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

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

33. Plot representativeness:_____

Figure B-1. Front page of classification plot field form used at ROVA.

C. VEGETATION

Community name:_____

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

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

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

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

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

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

Figure B-2. Back page of classification plot field form used at ROVA.

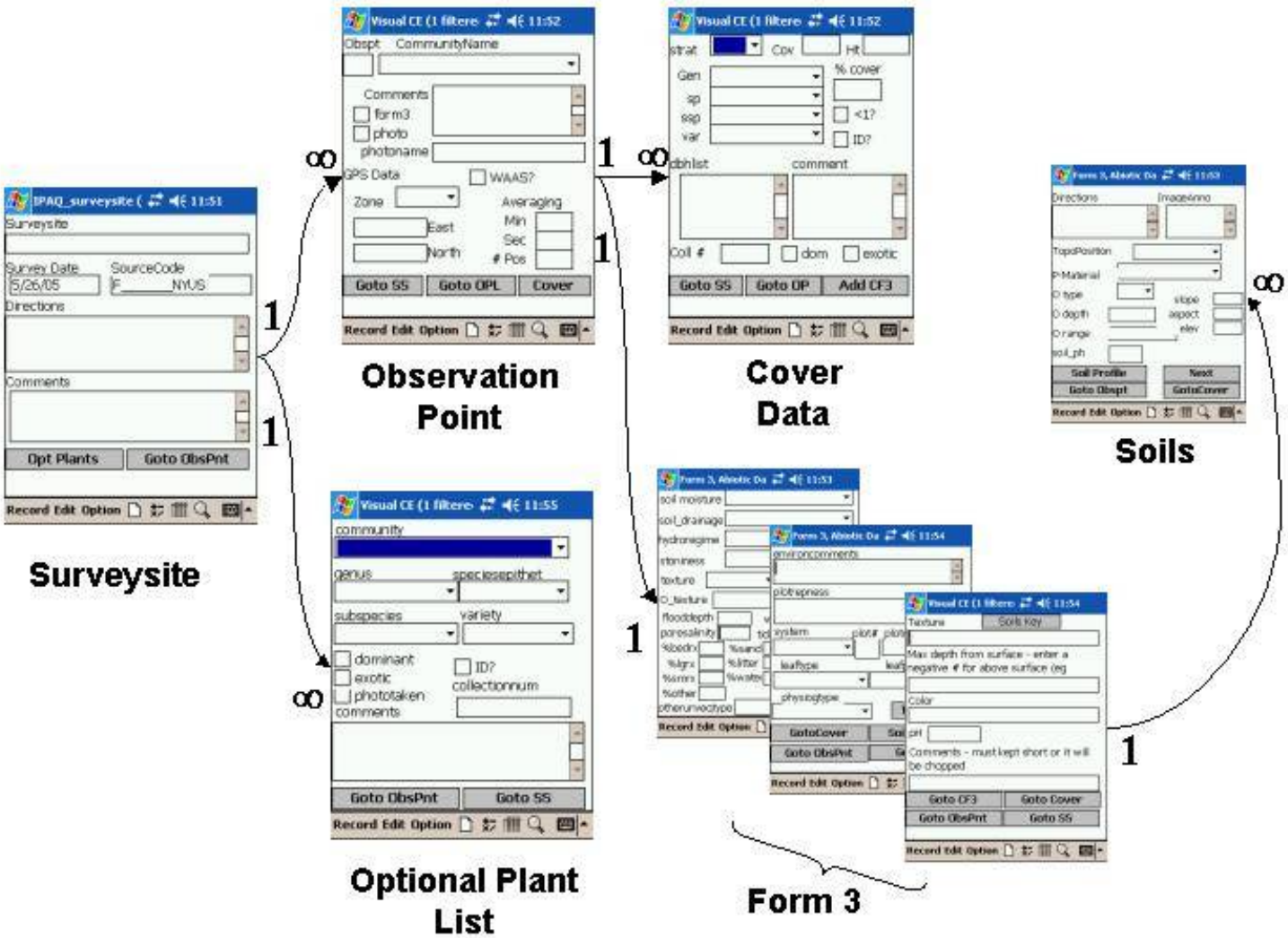

Figure B-3. Screen shots of NY Natural Heritage Hand-Held DataBase (HHDB). Vegetation plot data and accuracy assessment point data were digitally collected in the field using this software.

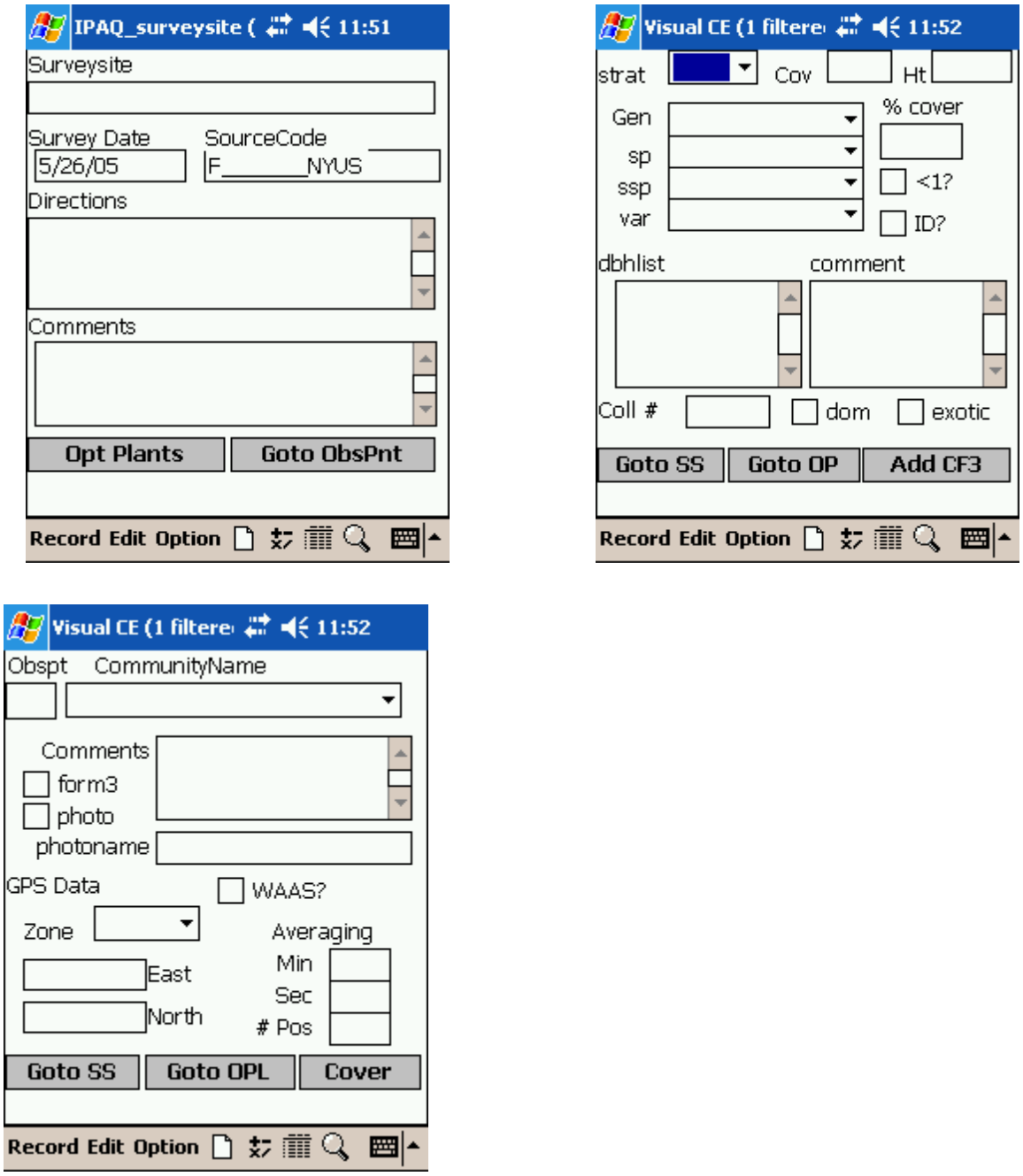

Figure B-4. Screen shots of NY Natural Heritage Hand-Held DataBase (HHDB). Survey site information, plot and point spatial data, and vegetation cover data were digitally collected in the field using this software.

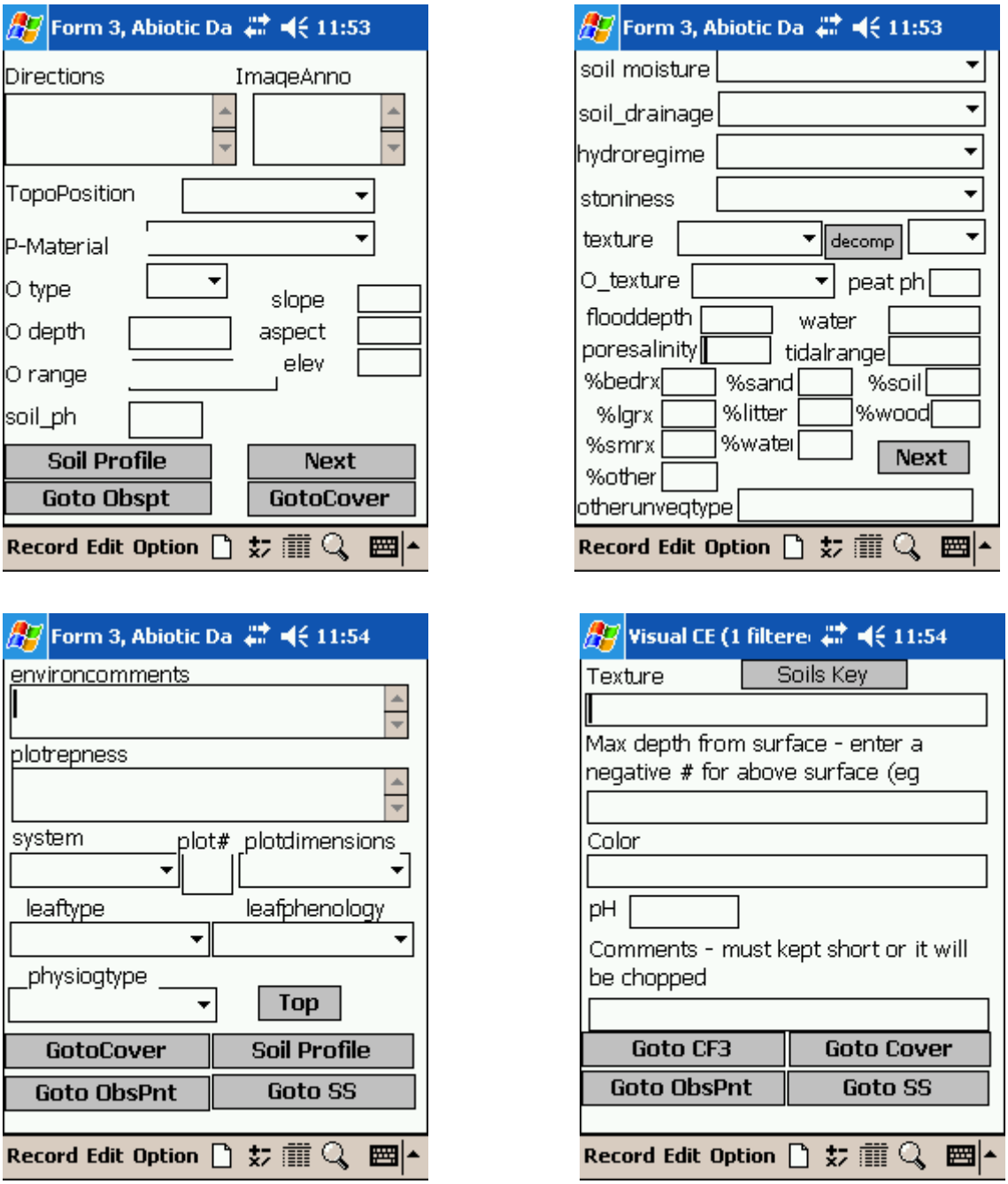

Figure B-5. Screen shots of NY Natural Heritage Hand-Held DataBase (HHDB). Data on the physical characteristics and soils for plots were digitally collected in the field using this software

Appendix C. Thematic Accuracy Assessment Contingency Tables

This appendix displays sample and population contingency tables (see Lea and Curtis (2010) for more explanation) for the thematic accuracy assessment at ROVA at the USNVC levels of association, alliance, group, macrogroup, division (1:1 with USNVC formation at ROVA) and subclass (1:1 with USNVC class at ROVA). Tables that represent the intermediate step of weighting the association level sample counts in order to account for polygon stratification (described in text) are not included in this appendix, but are included in project accuracy assessment spreadsheets (part of associated data).

Table C-1. Sample (raw counts) contingency table at USNVC Association Level, Roosevelt-Vanderbilt National Historic Sites.

This is the sample contingency table for ROVA at the USNVC Association level. These are raw counts that have not been weighted for the polygon level stratification (see project report). For definitions of sample and population contingency tables, see NPS guidelines (Lea and Curtis 2010)	Red Oak – Heath Woodland / Rocky Summit (CEGL006134)	Red Cedar Rocky Summit (CEGL006002)	Dry, Rich Oak - Hickory Forest (CEGL006301)	Northeastern Dry Oak - Hickory Forest (CEGL006336)	Early-Successional Woodland/Forest (CEGL006303)	Eastern White Pine Successional Forest (CEGL007944)	Northeastern Modified Successional Forest (CEGL006599)	Northeastern Oak - Red Maple Successional Forest (CEGL006506)	Norway Maple Forest (CEGL006407)	Hardwood Plantation (CEGL006613)	Mixed Pine Conifer Plantation (CEGL006313)	Norway Spruce Plantation (CEGL007167)	Red Pine Plantation (CEGL007177)	White Pine Plantation (CEGL007178)	Central Appalachian Hemlock - Chestnut Oak Forest (CEGL006923)	Hemlock - Beech - Oak Forest (CEGL006088)	Hemlock – Northern Hardwood Forest (CEGL006109)	Hemlock / White Pine – Red Oak - Mixed Hardwood Forest (CEGL006566)	High Allegheny Rich Red Oak – Sugar Maple Forest (CEGL006125)	Mesic Sugar Maple – Oak - Ash – Hickory Forest (CEGL006046)	Red Oak - Northern Hardwood Forest (CEGL006173)	Semi-rich Northern Hardwood Forest (CEGL006211)	Sugar Maple – Ash – Basswood Northern Rich Mesic Forest (CEGL005008)	White Pine - Hemlock Dry-Mesic Coniferous Forest (CEGL006328)	Hemlock – Hardwood Swamp (CEGL006226)	Red Maple – Blackgum Basin Swamp (CEGL006014)	Red Maple / Tussock Sedge Wooded Marsh (CEGL006119)	Southern New England Red Maple Seepage Swamp (CEGL006406)	Northeastern Pin Oak - Swamp White Oak Forest (CEGL006240)	Northeastern Old Field (CEGL006107)	Northeastern Successional Shrubland (CEGL006451)	Eastern Woodland Vernal Pool (CEGL006453)	Northern Riverside Rock Outcrop (CEGL006284)	Golden–saxifrage Forested Seep (CEGL006193)	Skunk Cabbage – Orange Jewelweed Seep (CEGL006567)	Broadleaf Pond-lily Tidal Marsh (CEGL004472)	Central Appalachian Cutgrass Marsh (CEGL006461)	Steeplebush / Reed Canarygrass Successional Wet Meadow (CEGL006571)	Eastern Cattail Marsh (CEGL006153)	Eastern Reed Marsh (CEGL004141)	Purple Loosestrife Wetland (CEGL006403)	Alluvial Alder Swamp (CEGL006414)	Northeastern Buttonbush Shrub Swamp (CEGL006069)	Cattail Brackish Tidal Marsh (CEGL004201)	Duckweed Pond (CEGL005451)	Open Water Marsh with Mixed Submergents/Emergents (CEGL006196)	Unvegetated (Paved Road)	ROW TOTAL (n_{i+})
Red Oak – Heath Woodland / Rocky Summit (CEGL006134)				1																																															1
Red Cedar Rocky Summit (CEGL006002)		2																		1																															3
Dry, Rich Oak - Hickory Forest (CEGL006301)			3																3																															6
Northeastern Dry Oak - Hickory Forest (CEGL006336)			1	1																																														2
Early-Successional Woodland/Forest (CEGL006303)							1																																											1
Eastern White Pine Successional Forest (CEGL007944)																																																		0
Northeastern Modified Successional Forest (CEGL006599)			1																																															1
Northeastern Oak - Red Maple Successional Forest (CEGL006506)				1		1	4	3				1			1	3			1				1																											16
Norway Maple Forest (CEGL006407)																																																		0
Hardwood Plantation (CEGL006613)										12	1			1																																				14
Mixed Pine Conifer Plantation (CEGL006313)											2	2		1												1																									6
Norway Spruce Plantation (CEGL007167)												3																																						3
Red Pine Plantation (CEGL007177)													2																																					2
White Pine Plantation (CEGL007178)														6	1																																			7
Central Appalachian Hemlock - Chestnut Oak Forest (CEGL006923)																2																																		2
Hemlock - Beech - Oak Forest (CEGL006088)															2		3																			1														6
Hemlock – Northern Hardwood Forest (CEGL006109)															1		2	2																											1					6
Hemlock / White Pine – Red Oak – Mixed Hardwood Forest (CEGL006566)															3	11	1	4																				1												20
High Allegheny Rich Red Oak – Sugar Maple Forest (CEGL006125)			1	7	1				2										10	1	3					1												1											27
Mesic Sugar Maple – Oak - Ash – Hickory Forest (CEGL006046)																				1																														0
Red Oak - Northern Hardwood Forest (CEGL006173)			2												1				3	4	8	3	2							1						3													27
Semi-rich Northern Hardwood Forest (CEGL006211)			1														1					2																												4
Sugar Maple – Ash – Basswood Northern Rich Mesic Forest (CEGL005008)																																																		0
White Pine - Hemlock Dry-Mesic Coniferous Forest (CEGL006328)																																																		0
Hemlock – Hardwood Swamp (CEGL006226)															1	1												1								1														4
Red Maple – Blackgum Basin Swamp (CEGL006014)																													2	1																				3
Red Maple / Tussock Sedge Wooded Marsh (CEGL006119)																														1	1																			2
Southern New England Red Maple Seepage Swamp (CEGL006406)															1																7																			8
Northeastern Pin Oak - Swamp White Oak Forest (CEGL006240)																																1																		1
Northeastern Old Field (CEGL006107)																																	4	1																6
Northeastern Successional Shrubland (CEGL006451)							2																										1	2															1	6
Eastern Woodland Vernal Pool (CEGL006453)																													1						6												1			8
Northern Riverside Rock Outcrop (CEGL006284)																																				3														3
Golden–saxifrage Forested Seep (CEGL006193)																																																		0
Skunk Cabbage – Orange Jewelweed Seep (CEGL006567)																																																		0
Broadleaf Pond-lily Tidal Marsh (CEGL004472)																																						3												3
Central Appalachian Cutgrass Marsh (CEGL006461)																																																		0
Steeplebush / Reed Canarygrass Successional Wet Meadow (CEGL006571)																																								1										1
Eastern Cattail Marsh (CEGL006153)																																										1						1		2
Eastern Reed Marsh (CEGL004141)																																											1							1
Purple Loosestrife Wetland (CEGL006403)																																												4						4
Alluvial Alder Swamp (CEGL006414)																														2										1						1				4
Northeastern Buttonbush Shrub Swamp (CEGL006069)																															1																			1
Cattail Brackish Tidal Marsh (CEGL004201)																																															1			1
Duckweed Pond (CEGL005451)																														1																	1			2
Open Water Marsh with Mixed Submergents/Emergents (CEGL006196)																																																2		2
Unvegetated (Paved Road)																																																	1	0
COLUMN TOTAL (n_{+j})	0	2	9	10	1	1	7	3	2	12	3	6	2	8	11	17	7	6	17	6	11	6	2	2	0	4	6	9	1	5	3	11	3	1	1	3	1	1	0	2	5	0	1	3	2	2	1	216

Table C-2. Population contingency table, with point estimates of map class user's and producer's accuracies at USNVC Association Level, Roosevelt-Vanderbilt National Historic Sites.

This is the population contingency table for ROVA at the USNVC Association level. The point estimate for overall accuracy at this level is 39.3%. For definitions of sample and population contingency tables, see NPS guidelines (Lea and Curtis 2010)	Red Oak – Heath Woodland / Rocky Summit (CEGL006134)	Red Cedar Rocky Summit (CEGL006002)	Dry, Rich Oak - Hickory Forest (CEGL006301)	Northeastern Dry Oak - Hickory Forest (CEGL006336)	Early-Successional Woodland/Forest (CEGL006303)	Eastern White Pine Successional Forest (CEGL007944)	Northeastern Modified Successional Forest (CEGL006599)	Northeastern Oak - Red Maple Successional Forest (CEGL006506)	Norway Maple Forest (CEGL006407)	Hardwood Plantation (CEGL006613)	Mixed Pine Conifer Plantation (CEGL006313)	Norway Spruce Plantation (CEGL007167)	Red Pine Plantation (CEGL007177)	White Pine Plantation (CEGL007178)	Central Appalachian Hemlock - Chestnut Oak Forest (CEGL006923)	Hemlock - Beech - Oak Forest (CEGL006088)	Hemlock – Northern Hardwood Forest (CEGL006109)	Hemlock / White Pine – Red Oak – Mixed Hardwood Forest (CEGL006566)	High Allegheny Rich Red Oak – Sugar Maple Forest (CEGL006125)	Mesic Sugar Maple – Oak - Ash – Hickory Forest (CEGL006046)	Red Oak - Northern Hardwood Forest (CEGL006173)	Semi-rich Northern Hardwood Forest (CEGL006211)	Sugar Maple – Ash – Basswood Northern Rich Mesic Forest (CEGL005008)	White Pine - Hemlock Dry-Mesic Coniferous Forest (CEGL006328)	Hemlock – Hardwood Swamp (CEGL006226)	Red Maple – Blackgum Basin Swamp (CEGL006014)	Red Maple / Tussock Sedge Wooded Marsh (CEGL006119)	Southern New England Red Maple Seepage Swamp (CEGL006406)	Northeastern Pin Oak - Swamp White Oak Forest (CEGL006240)	Northeastern Old Field (CEGL006107)	Northeastern Successional Shrubland (CEGL006451)	Eastern Woodland Vernal Pool (CEGL006453)	Northern Riverside Rock Outcrop (CEGL006284)	Golden–saxifrage Forested Seep (CEGL006193)	Skunk Cabbage – Orange Jewelweed Seep (CEGL006567)	Broadleaf Pond-lily Tidal Marsh (CEGL004472)	Central Appalachian Cutgrass Marsh (CEGL006461)	Steeplebush / Reed Canarygrass Successional Wet Meadow (CEGL006571)	Eastern Cattail Marsh (CEGL006153)	Eastern Reed Marsh (CEGL004141)	Purple Loosestrife Wetland (CEGL006403)	Alluvial Alder Swamp (CEGL006414)	Northeastern Buttonbush Shrub Swamp (CEGL006069)	Cattail Brackish Tidal Marsh (CEGL004201)	Duckweed Pond (CEGL005451)	Open Water Marsh with Mixed Submergents/Emergents (CEGL006196)	Unvegetated (Paved Road)	USERS' ACCURACY ($P_{J=X\|I=X}$)
Red Oak – Heath Woodland / Rocky Summit (CEGL006134)	0.0000	0.0000	0.0000	0.0022	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0%
Red Cedar Rocky Summit (CEGL006002)	0.0000	0.0005	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0085	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	5.9%
Dry, Rich Oak - Hickory Forest (CEGL006301)	0.0000	0.0000	0.0888	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0021	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	97.7%
Northeastern Dry Oak - Hickory Forest (CEGL006336)	0.0000	0.0000	0.0048	0.0008	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	13.8%
Early-Successional Woodland/Forest (CEGL006303)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0019	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0%
Eastern White Pine Successional Forest (CEGL007944)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	N/A
Northeastern Modified Successional Forest (CEGL006599)	0.0000	0.0000	0.0095	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0%
Northeastern Oak - Red Maple Successional Forest (CEGL006506)	0.0000	0.0000	0.0000	0.0097	0.0000	0.0181	0.0461	0.0074	0.0000	0.0000	0.0000	0.0016	0.0000	0.0000	0.0002	0.0098	0.0000	0.0000	0.0208	0.0000	0.0000	0.0061	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	6.2%
Norway Maple Forest (CEGL006407)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	N/A
Hardwood Plantation (CEGL006613)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0106	0.0003	0.0000	0.0000	0.0012	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	87.9%
Mixed Pine Conifer Plantation (CEGL006313)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0042	0.0140	0.0000	0.0006	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0004	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	21.7%
Norway Spruce Plantation (CEGL007167)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0035	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0%
Red Pine Plantation (CEGL007177)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0049	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0%
White Pine Plantation (CEGL007178)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0194	0.0005	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	97.6%
Central Appalachian Hemlock - Chestnut Oak Forest (CEGL006923)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0212	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0%
Hemlock - Beech - Oak Forest (CEGL006088)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0066	0.0000	0.0741	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0018	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0%
Hemlock – Northern Hardwood Forest (CEGL006109)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0007	0.0000	0.0160	0.0076	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0072	0.0000	0.0000	0.0000	0.0000	50.7%
Hemlock / White Pine – Red Oak – Mixed Hardwood Forest (CEGL006566)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0111	0.0632	0.0011	0.0126	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0009	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	14.1%
High Allegheny Rich Red Oak – Sugar Maple Forest (CEGL006125)	0.0000	0.0000	0.0034	0.0153	0.0043	0.0000	0.0000	0.0000	0.0138	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0358	0.0043	0.0549	0.0000	0.0000	0.0043	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0069	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	25.0%
Mesic Sugar Maple – Oak - Ash – Hickory Forest (CEGL006046)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	N/A
Red Oak - Northern Hardwood Forest (CEGL006173)	0.0000	0.0000	0.0061	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0057	0.0000	0.0000	0.0000	0.0039	0.0012	0.0416	0.0161	0.0010	0.0000	0.0000	0.0000	0.0057	0.0000	0.0000	0.0000	0.0000	0.0302	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	37.3%
Semi-rich Northern Hardwood Forest (CEGL006211)	0.0000	0.0000	0.0030	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0098	0.0000	0.0000	0.0000	0.0000	0.0223	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	63.4%
Sugar Maple – Ash – Basswood Northern Rich Mesic Forest (CEGL005008)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	N/A
White Pine - Hemlock Dry-Mesic Coniferous Forest (CEGL006328)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	N/A
Hemlock – Hardwood Swamp (CEGL006226)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0013	0.0004	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0017	0.0000	0.0000	0.0000	0.0000	0.0000	0.0008	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0%
Red Maple – Blackgum Basin Swamp (CEGL006014)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0039	0.0022	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	63.9%
Red Maple / Tussock Sedge Wooded Marsh (CEGL006119)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0006	0.0257	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	2.4%
Southern New England Red Maple Seepage Swamp (CEGL006406)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0040	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0359	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	90.1%
Northeastern Pin Oak - Swamp White Oak Forest (CEGL006240)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0%
Northeastern Old Field (CEGL006107)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0571	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0099	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	85.2%
Northeastern Successional Shrubland (CEGL006451)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0010	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0008	0.0049	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0011	63.2%
Eastern Woodland Vernal Pool (CEGL006453)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0013	0.0000	0.0000	0.0000	0.0000	0.0000	0.0045	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0011	0.0000	0.0000	64.9%
Northern Riverside Rock Outcrop (CEGL006284)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0%
Golden–saxifrage Forested Seep (CEGL006193)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	N/A
Skunk Cabbage – Orange Jewelweed Seep (CEGL006567)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	N/A
Broadleaf Pond-lily Tidal Marsh (CEGL004472)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0044	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0%
Central Appalachian Cutgrass Marsh (CEGL006461)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	N/A
Steeplebush / Reed Canarygrass Successional Wet Meadow (CEGL006571)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0%
Eastern Cattail Marsh (CEGL006153)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0009	0.0000	0.0000	0.0000	0.0034	0.0000	0.0000	0.0000	0.0%
Eastern Reed Marsh (CEGL004141)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0005	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0%
Purple Loosestrife Wetland (CEGL006403)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0012	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0%
Alluvial Alder Swamp (CEGL006414)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0010	0.0027	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000	0.0000	0.0%
Northeastern Buttonbush Shrub Swamp (CEGL006069)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0%
Cattail Brackish Tidal Marsh (CEGL004201)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0003	0.0000	0.0000	0.0000	100.0%
Duckweed Pond (CEGL005451)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0027	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0004	0.0000	0.0000	13.1%
Open Water Marsh with Mixed Submergents/Emergents (CEGL006196)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0105	0.0000	100.0%
Unvegetated (Paved Road)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	N/A
PRODUCERS' ACCURACY ($P_{i=Y\|J=Y}$)	N/A	100.0%	76.8%	2.7%	0.0%	0.0%	0.0%	100.0%	0.0%	100.0%	93.3%	18.4%	100.0%	91.4%	0.0%	0.0%	15.8%	62.4%	57.2%	0.0%	43.1%	50.1%	0.0%	0.0%	N/A	56.5%	5.2%	55.5%	100.0%	98.6%	99.8%	12.0%	100.0%	0.0%	0.0%	100.0%	0.0%	100.0%	N/A	36.5%	10.9%	N/A	0.0%	8.0%	26.7%	100.0%	0.0%	

Table C-3. Sample (raw counts) contingency table at USNVC Alliance Level, Roosevelt-Vanderbilt National Historic Sites..

This is the sample contingency table for ROVA at the USNVC Alliance level. These are raw counts that have not been weighted for the polygon level stratification (see project report). For definitions of sample and population contingency tables, see NPS guidelines (Lea and Curtis 2010)	Northern Red Oak - Chestnut Oak Woodland Alliance	Eastern Red-cedar Woodland Alliance	(Pignut Hickory, Shagbark Hickory) - White Ash - (White Oak, Northern Red Oak) Forest Alliance	White Oak - (Northern Red Oak, Hickory species) Forest Alliance	Quaking Aspen Woodland Alliance	Eastern White Pine Forest Alliance	Black Cherry - Red Maple - Canadian Serviceberry - Oak species Forest Alliance	Northern Red Oak - (Sugar Maple) Forest Alliance	Sugar Maple - Yellow Birch - (American Beech) Forest Alliance	Alliance undefined	Eastern White Pine Planted Forest Alliance	Norway Spruce Planted Forest Alliance	Red Pine Planted Forest Alliance	Eastern Hemlock - Tuliptree Forest Alliance	Eastern Hemlock - Yellow Birch Forest Alliance	Sugar Maple - White Ash - American Basswood Forest Alliance	Eastern White Pine - Eastern Hemlock Forest Alliance	Eastern Hemlock Saturated Forest Alliance	Red Maple - Blackgum Saturated Forest Alliance	Red Maple Seasonally Flooded Woodland Alliance	Red Maple - Green Ash Saturated Forest Alliance	Pin Oak - (Swamp White Oak) Seasonally Flooded Forest Alliance	Orchard Grass - Common Sheep Sorrel Herbaceous Alliance	Roughleaf Dogwood Shrubland Alliance	Non-tidal Mudflat Seasonally/Temporarily Flooded Sparsely Vegetated Alliance	Big Bluestem - (Indiangrass) Herbaceous Alliance	American Golden-saxifrage Saturated Herbaceous Alliance	Skunk-cabbage - Yellow Marsh-marigold Saturated Herbaceous Alliance	Yellow Pond-lily Tidal Herbaceous Alliance	Rice Cutgrass - Fowl Mannagrass Seasonally Flooded Herbaceous Alliance	(White Meadowsweet, Steeplebush) - Blackberry species Seasonally Flooded Shrubland Alliance	(Narrowleaf Cattail, Broadleaf Cattail) (Clubrush species) Semipermanently Flooded Herbaceous Alliance	Common Reed Semipermanently Flooded Herbaceous Alliance	Purple Loosestrife Herbaceous Alliance	Hazel Alder Temporarily Flooded Shrubland Alliance	Common Buttonbush Semipermanently Flooded Shrubland Alliance	(Narrowleaf Cattail, Southern Cattail) Tidal Herbaceous Alliance	Duckweed species Permanently Flooded Herbaceous Alliance	American Eel-grass Permanently Flooded Temperate Herbaceous Alliance	Unvegetated (Paved Road)	ROW TOTAL (n_{i+})
Northern Red Oak - Chestnut Oak Woodland Alliance				1																																						1
Eastern Red-cedar Woodland Alliance		2						1																																		3
(Pignut Hickory, Shagbark Hickory) - White Ash - (White Oak, Northern Red Oak) Forest Alliance			3					3																																		6
White Oak - (Northern Red Oak, Hickory species) Forest Alliance			1	1																																						2
Quaking Aspen Woodland Alliance							1																																			1
Eastern White Pine Forest Alliance																																										0
Black Cherry - Red Maple - Canadian Serviceberry - Oak species Forest Alliance			1																																							1
Northern Red Oak - (Sugar Maple) Forest Alliance			3	8	1	1	4	33	2			1		2	3	6	1			1				3			1														70
Sugar Maple - Yellow Birch - (American Beech) Forest Alliance																																										0
Alliance undefined										12	2																															14
Eastern White Pine Planted Forest Alliance											9	2		1			1																									13
Norway Spruce Planted Forest Alliance												3																														3
Red Pine Planted Forest Alliance													2																													2
Eastern Hemlock - Tuliptree Forest Alliance														7	14														1													22
Eastern Hemlock - Yellow Birch Forest Alliance														5	5									1														1				12
Sugar Maple - White Ash - American Basswood Forest Alliance			1												1	2																										4
Eastern White Pine - Eastern Hemlock Forest Alliance																																										0
Eastern Hemlock Saturated Forest Alliance														1	1				1					1																		4
Red Maple - Blackgum Saturated Forest Alliance																			2	1																						3
Red Maple Seasonally Flooded Woodland Alliance																				1	1																					2
Red Maple - Green Ash Saturated Forest Alliance														1							7																					8
Pin Oak - (Swamp White Oak) Seasonally Flooded Forest Alliance																						1																				1
Orchard Grass - Common Sheep Sorrel Herbaceous Alliance																							4	1													1					6
Roughleaf Dogwood Shrubland Alliance							2																1	2																	1	6
Non-tidal Mudflat Seasonally/Temporarily Flooded Sparsely Vegetated Alliance														1					1						6														1			8
Big Bluestem - (Indiangrass) Herbaceous Alliance																										3																3
American Golden-saxifrage Saturated Herbaceous Alliance																																										0
Skunk-cabbage - Yellow Marsh-marigold Saturated Herbaceous Alliance																																										0
Yellow Pond-lily Tidal Herbaceous Alliance																													3													3
Rice Cutgrass - Fowl Mannagrass Seasonally Flooded Herbaceous Alliance																																										0
(White Meadowsweet, Steeplebush) - Blackberry species Seasonally Flooded Shrubland Alliance																																										1
(Narrowleaf Cattail, Broadleaf Cattail) - (Clubrush species) Semipermanently Flooded Herbaceous Alliance																																										2
Common Reed Semipermanently Flooded Herbaceous Alliance																																										1
Purple Loosestrife Herbaceous Alliance																																										4
Hazel Alder Temporarily Flooded Shrubland Alliance																				2																						4
Common Buttonbush Semipermanently Flooded Shrubland Alliance																					1																					1
(Narrowleaf Cattail, Southern Cattail) Tidal Herbaceous Alliance																																										1
Duckweed species Permanently Flooded Herbaceous Alliance																				1																						2
American Eel-grass Permanently Flooded Temperate Herbaceous Alliance																																										2
Unvegetated (Paved Road)																																										0
COLUMN TOTAL (n_{+j})	0	2	9	10	1	1	7	37	2	12	11	6	2	17	24	8	2	0	4	6	9	1	5	3	11	3	1	1	3	1	1	0	2	5	0	1	3	2	2	1	216

Table C-4. Population contingency table, with point estimates of map class user's and producer's accuracies at USNVC Alliance Level, Roosevelt-Vanderbilt National Historic Sites.

This is the population contingency table for ROVA at the USNVC Alliance level. The point estimate for overall accuracy at this level is 56.4%. For definitions of sample and population contingency tables, see NPS guidelines (Lea and Curtis 2010)	Northern Red Oak - Chestnut Oak Woodland Alliance	Eastern Red-cedar Woodland Alliance	(Pignut Hickory, Shagbark Hickory) - White Ash - (White Oak, Northern Red Oak) Forest Alliance	White Oak - (Northern Red Oak, Hickory species) Forest Alliance	Quaking Aspen Woodland Alliance	Eastern White Pine Forest Alliance	Black Cherry - Red Maple - Canadian Serviceberry - Oak species Forest Alliance	Northern Red Oak - (Sugar Maple) Forest Alliance	Sugar Maple - Yellow Birch - (American Beech) Forest Alliance	Alliance undefined	Eastern White Pine Planted Forest Alliance	Norway Spruce Planted Forest Alliance	Red Pine Planted Forest Alliance	Eastern Hemlock - Tuliptree Forest Alliance	Eastern Hemlock - Yellow Birch Forest Alliance	Sugar Maple - White Ash - American Basswood Forest Alliance	Eastern White Pine - Eastern Hemlock Forest Alliance	Eastern Hemlock Saturated Forest Alliance	Red Maple - Blackgum Saturated Forest Alliance	Red Maple Seasonally Flooded Woodland Alliance	Red Maple - Green Ash Saturated Forest Alliance	Pin Oak - (Swamp White Oak) Seasonally Flooded Forest Alliance	Orchard Grass - Common Sheep Sorrel Herbaceous Alliance	Roughleaf Dogwood Shrubland Alliance	Non-tidal Mudflat Seasonally/Temporarily Flooded Sparsely Vegetated Alliance	Big Bluestem - (Indiangrass) Herbaceous Alliance	American Golden-saxifrage Saturated Herbaceous Alliance	Skunk-cabbage - Yellow Marsh-marigold Saturated Herbaceous Alliance	Yellow Pond-lily Tidal Herbaceous Alliance	Rice Cutgrass - Fowl Mannagrass Seasonally Flooded Herbaceous Alliance	(White Meadowsweet, Steeplebush) - Blackberry species Seasonally Flooded Shrubland Alliance	(Narrowleaf Cattail, Broadleaf Cattail) - (Clubrush species) Semipermanently Flooded Herbaceous Alliance	Common Reed Semipermanently Flooded Herbaceous Alliance	Purple Loosestrife Herbaceous Alliance	Hazel Alder Temporarily Flooded Shrubland Alliance	Common Buttonbush Semipermanently Flooded Shrubland Alliance	(Narrowleaf Cattail, Southern Cattail) Tidal Herbaceous Alliance	Duckweed species Permanently Flooded Herbaceous Alliance	American Eel-grass Permanently Flooded Temperate Herbaceous Alliance	Unvegetated (Paved Road)	USERS' ACCURACY ($P_{i=x\|j=x}$)
Northern Red Oak - Chestnut Oak Woodland Alliance	0.0000	0.0000	0.0000	0.0022	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0%
Eastern Red-cedar Woodland Alliance	0.0000	0.0005	0.0000	0.0000	0.0000	0.0000	0.0000	0.0085	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	5.9%
(Pignut Hickory, Shagbark Hickory) - White Ash - (White Oak, Northern Red Oak) Forest Alliance	0.0000	0.0000	0.0888	0.0000	0.0000	0.0000	0.0000	0.0021	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	97.7%
White Oak - (Northern Red Oak, Hickory species) Forest Alliance	0.0000	0.0000	0.0048	0.0008	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	13.8%
Quaking Aspen Woodland Alliance	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0019	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0%
Eastern White Pine Forest Alliance	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	N/A
Black Cherry - Red Maple - Canadian Serviceberry - Oak species Forest Alliance	0.0000	0.0000	0.0095	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0%
Northern Red Oak - (Sugar Maple) Forest Alliance	0.0000	0.0000	0.0095	0.0250	0.0043	0.0181	0.0461	0.1698	0.0138	0.0000	0.0000	0.0016	0.0000	0.0059	0.0098	0.0232	0.0043	0.0000	0.0000	0.0057	0.0000	0.0000	0.0000	0.0000	0.0302	0.0000	0.0000	0.0069	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	45.4%
Sugar Maple - Yellow Birch - (American Beech) Forest Alliance	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	N/A
Alliance undefined	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0106	0.0015	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	87.9%
Eastern White Pine Planted Forest Alliance	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0242	0.0140	0.0000	0.0005	0.0000	0.0000	0.0004	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	62.0%
Norway Spruce Planted Forest Alliance	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0035	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0%
Red Pine Planted Forest Alliance	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0049	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0%
Eastern Hemlock - Tuliptree Forest Alliance	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0237	0.0855	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0009	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	21.5%
Eastern Hemlock - Yellow Birch Forest Alliance	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0148	0.0900	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0018	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0072	0.0000	0.0000	0.0000	0.0000	79.1%
Sugar Maple - White Ash - American Basswood Forest Alliance	0.0000	0.0000	0.0030	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0098	0.0223	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	63.4%
Eastern White Pine - Eastern Hemlock Forest Alliance	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	N/A
Eastern Hemlock Saturated Forest Alliance	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0013	0.0004	0.0000	0.0000	0.0000	0.0017	0.0000	0.0000	0.0000	0.0000	0.0000	0.0008	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0%
Red Maple - Blackgum Saturated Forest Alliance	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0039	0.0022	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	63.9%
Red Maple Seasonally Flooded Woodland Alliance	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0006	0.0257	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	2.4%
Red Maple - Green Ash Saturated Forest Alliance	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0040	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0359	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	90.1%
Pin Oak - (Swamp White Oak) Seasonally Flooded Forest Alliance	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0%
Orchard Grass - Common Sheep Sorrel Herbaceous Alliance	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0571	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0099	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	85.2%
Roughleaf Dogwood Shrubland Alliance	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0010	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0008	0.0049	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0011	63.2%
Non-tidal Mudflat Seasonally/Temporarily Flooded Sparsely Vegetated Alliance	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0013	0.0000	0.0000	0.0000	0.0000	0.0000	0.0045	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0011	0.0000	0.0000	64.9%
Big Bluestem - (Indiangrass) Herbaceous Alliance	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0%
American Golden-saxifrage Saturated Herbaceous Alliance	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	N/A
Skunk-cabbage - Yellow Marsh-marigold Saturated Herbaceous Alliance	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	N/A
Yellow Pond-lily Tidal Herbaceous Alliance	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0044	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0%
Rice Cutgrass - Fowl Mannagrass Seasonally Flooded Herbaceous Alliance	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	N/A
(White Meadowsweet, Steeplebush) - Blackberry species Seasonally Flooded Shrubland Alliance	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0%
(Narrowleaf Cattail, Broadleaf Cattail) - (Clubrush species) Semipermanently Flooded Herbaceous Alliance	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0009	0.0000	0.0000	0.0000	0.0034	0.0000	0.0000	0.0000	0.0%
Common Reed Semipermanently Flooded Herbaceous Alliance	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0005	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0%
Purple Loosestrife Herbaceous Alliance	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0012	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0%
Hazel Alder Temporarily Flooded Shrubland Alliance	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0010	0.0027	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000	0.0000	0.0%
Common Buttonbush Semipermanently Flooded Shrubland Alliance	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0%
(Narrowleaf Cattail, Southern Cattail) Tidal Herbaceous Alliance	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0003	0.0000	0.0000	0.0000	100.0%
Duckweed species Permanently Flooded Herbaceous Alliance	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0027	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0004	0.0000	0.0000	13.1%
American Eel-grass Permanently Flooded Temperate Herbaceous Alliance	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0105	0.0000	100.0%
Unvegetated (Paved Road)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	N/A
PRODUCERS' ACCURACY ($P_{i=Y\|J=Y}$)	N/A	100.0%	76.8%	2.7%	0.0%	0.0%	0.0%	94.1%	0.0%	100.0%	94.3%	18.4%	100.0%	47.2%	46.0%	49.0%	0.0%	N/A	56.5%	5.2%	55.5%	100.0%	98.6%	99.8%	12.0%	100.0%	0.0%	0.0%	100.0%	0.0%	100.0%	N/A	36.5%	10.9%	N/A	0.0%	8.0%	26.7%	100.0%	0.0%	

Table C-5. Sample (raw counts) contingency table at USNVC Group Level, Roosevelt-Vanderbilt National Historic Sites.

This is the sample contingency table for ROVA at the USNVC Group level. The counts have not been weighted for stratification (as have been those at the Association level). For definitions of sample and population contingency tables, see NPS guidelines (Lea and Curtis 2010)	Appalachian Oak - Chestnut Forest Group	Chinkapin Oak – Ash – Red-cedar Alkaline Forest Group	Northeastern and North-Central Oak - Hickory Forest Group	Northern and Central Hardwood and Conifer Ruderal Forest Group	Northern and Central Conifer and Hardwood Plantation Group	Northern Hardwood – Hemlock - White Pine Forest Group	Northern and Central Conifer and Hardwood Acidic Swamp Group	Central Flatwoods and Pond Forest Group	Northern and Central Ruderal Meadow and Shrubland Group	Eastern North American Lake Flat and Beach Group	Eastern North American River Shoreline Group	Northeastern and Appalachian Forest Seep Group	Atlantic and Gulf Coastal Plain Freshwater Tidal Marsh Group	Eastern North American Wet Meadow Group	Eastern North American Freshwater Marsh Group	Northern and Central Ruderal Wet Meadow and Marsh Group	Northern and Central Shrub Swamp Group	North American Atlantic Brackish Tidal Marsh	Eastern North American Freshwater Aquatic Vegetation Group	Unvegetated (Paved Road)	ROW TOTAL (n_{i+})
Appalachian Oak - Chestnut Forest Group			1																		1
Chinkapin Oak – Ash – Red-cedar Alkaline Forest Group		2				1															3
Northeastern and North-Central Oak - Hickory Forest Group			5			3															8
Northern and Central Hardwood and Conifer Ruderal Forest Group			2	9	1	6															18
Northern and Central Conifer and Hardwood Plantation Group					30	2															32
Northern Hardwood – Hemlock - White Pine Forest Group			11	3		70	1			4		2					1				92
Northern and Central Conifer and Hardwood Acidic Swamp Group						3	13			1											17
Central Flatwoods and Pond Forest Group								1													1
Northern and Central Ruderal Meadow and Shrubland Group				2					8							1				1	12
Eastern North American Lake Flat and Beach Group							1			6									1		8
Eastern North American River Shoreline Group											3										3
Northeastern and Appalachian Forest Seep Group																					0
Atlantic and Gulf Coastal Plain Freshwater Tidal Marsh Group													3								3
Eastern North American Wet Meadow Group														1							1
Eastern North American Freshwater Marsh Group																1		1			2
Northern and Central Ruderal Wet Meadow and Marsh Group																5					5
Northern and Central Shrub Swamp Group							3							1				1			5
North American Atlantic Brackish Tidal Marsh																		1			1
Eastern North American Freshwater Aquatic Vegetation Group							1												3		4
Unvegetated (Paved Road)																					0
COLUMN TOTAL (n_{+j})	0	2	19	14	31	85	19	1	8	11	3	2	3	2	0	7	1	3	4	1	216

Table C-6. Population contingency table, with point estimates of map class user's and producer's accuracies at USNVC Group Level, Roosevelt-Vanderbilt National Historic Sites

This is the population contingency table for ROVA at the USNVC Group level. The point estimate for overall accuracy at this level is 79.8%. For definitions of sample and population contingency tables, see NPS guidelines (Lea and Curtis 2010)	Appalachian Oak - Chestnut Forest Group	Chinkapin Oak – Ash – Red-cedar Alkaline Forest Group	Northeastern and North-Central Oak - Hickory Forest Group	Northern and Central Hardwood and Conifer Ruderal Forest Group	Northern and Central Conifer and Hardwood Plantation Group	Northern Hardwood – Hemlock - White Pine Forest Group	Northern and Central Conifer and Hardwood Acidic Swamp Group	Central Flatwoods and Pond Forest Group	Northern and Central Ruderal Meadow and Shrubland Group	Eastern North American Lake Flat and Beach Group	Eastern North American River Shoreline Group	Northeastern and Appalachian Forest Seep Group	Atlantic and Gulf Coastal Plain Freshwater Tidal Marsh Group	Eastern North American Wet Meadow Group	Eastern North American Freshwater Marsh Group	Northern and Central Ruderal Wet Meadow and Marsh Group	Northern and Central Shrub Swamp Group	North American Atlantic Brackish Tidal Marsh	Eastern North American Freshwater Aquatic Vegetation Group	Unvegetated (Paved Road)	USERS' ACCURACY ($P_{i=X|i=X}$)
Appalachian Oak - Chestnut Forest Group	0.0000	0.0000	0.0022	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0%
Chinkapin Oak – Ash – Red-cedar Alkaline Forest Group	0.0000	0.0005	0.0000	0.0000	0.0000	0.0085	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	5.9%
Northeastern and North-Central Oak - Hickory Forest Group	0.0000	0.0000	0.0943	0.0000	0.0000	0.0021	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	97.8%
Northern and Central Hardwood and Conifer Ruderal Forest Group	0.0000	0.0000	0.0191	0.0736	0.0016	0.0369	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	56.1%
Northern and Central Conifer and Hardwood Plantation Group	0.0000	0.0000	0.0000	0.0000	0.0588	0.0009	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	98.5%
Northern Hardwood – Hemlock - White Pine Forest Group	0.0000	0.0000	0.0279	0.0181	0.0000	0.4151	0.0057	0.0000	0.0000	0.0320	0.0000	0.0078	0.0000	0.0000	0.0000	0.0000	0.0072	0.0000	0.0000	0.0000	80.8%
Northern and Central Conifer and Hardwood Acidic Swamp Group	0.0000	0.0000	0.0000	0.0000	0.0000	0.0056	0.0701	0.0000	0.0000	0.0008	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	91.7%
Central Flatwoods and Pond Forest Group	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0%
Northern and Central Ruderal Meadow and Shrubland Group	0.0000	0.0000	0.0000	0.0010	0.0000	0.0000	0.0000	0.0000	0.0628	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0099	0.0000	0.0000	0.0000	0.0011	84.0%
Eastern North American Lake Flat and Beach Group	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0013	0.0000	0.0000	0.0045	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0011	0.0000	64.9%
Eastern North American River Shoreline Group	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0%
Northeastern and Appalachian Forest Seep Group	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	N/A
Atlantic and Gulf Coastal Plain Freshwater Tidal Marsh Group	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0044	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0%
Eastern North American Wet Meadow Group	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0%
Eastern North American Freshwater Marsh Group	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0009	0.0000	0.0034	0.0000	0.0000	0.0%
Northern and Central Ruderal Wet Meadow and Marsh Group	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0017	0.0000	0.0000	0.0000	0.0000	100.0%
Northern and Central Shrub Swamp Group	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0040	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0003	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000	0.0%
North American Atlantic Brackish Tidal Marsh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0003	0.0000	0.0000	100.0%
Eastern North American Freshwater Aquatic Vegetation Group	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0027	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0109	0.0000	80.2%
Unvegetated (Paved Road)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	N/A
PRODUCERS' ACCURACY ($P_{i=Y|j=Y}$)	N/A	100.0%	65.7%	79.4%	97.4%	88.5%	83.6%	100.0%	100.0%	12.0%	100.0%	0.0%	100.0%	47.5%	N/A	13.8%	0.0%	8.0%	90.7%	0.0%	

Table C-7. Sample (raw counts) contingency table at USNVC Macrogroup Level, Roosevelt-Vanderbilt National Historic Sites.

This is the sample contingency table for ROVA at the USNVC Macrogroup level. The counts have not been weighted for stratification (as have been those at the Association level). For definitions of sample and population contingency tables, see NPS guidelines (Lea and Curtis 2010)	Central Oak-Hardwood and Pine Forest	Eastern North American Ruderal Forest and Plantation	Northern Mesic Hardwood and Conifer Forest	Northern and Central Swamp Forest	Eastern Northern American Ruderal Grassland and Shrubland	Eastern North American Beach, Shoreline, and Flat	Appalachian, Interior Plateau, and Prairie Fen	Atlantic and Gulf Coastal Plain Freshwater Tidal Marsh	Eastern North American Wet Meadow and Marsh	Eastern North American Ruderal Wet Meadow and Marsh	Northern and Central Tall Shrub Wetland	Eastern North American Atlantic Salt Marsh	Eastern North American Freshwater Aquatic Vegetation	Unvegetated (Paved Road)	ROW TOTAL (n_{i+})
Central Oak-Hardwood and Pine Forest	8		4												12
Eastern North American Ruderal Forest and Plantation	2	40	8												50
Northern Mesic Hardwood and Conifer Forest	11	3	70	1		4	2				1				92
Northern and Central Swamp Forest			3	14		1									18
Eastern Northern American Ruderal Grassland and Shrubland		2			8					1				1	12
Eastern North American Beach, Shoreline, and Flat				1		9							1		11
Appalachian, Interior Plateau, and Prairie Fen															0
Atlantic and Gulf Coastal Plain Freshwater Tidal Marsh								3							3
Eastern North American Wet Meadow and Marsh									1	1		1			3
Eastern North American Ruderal Wet Meadow and Marsh										5					5
Northern and Central Tall Shrub Wetland				3					1			1			5
Eastern North American Atlantic Salt Marsh												1			1
Eastern North American Freshwater Aquatic Vegetation				1									3		4
Unvegetated (Paved Road)															0
COLUMN TOTAL (n_{+j})	21	45	85	20	8	14	2	3	2	7	1	3	4	1	216

Table C-8. Population contingency table, with point estimates of map class user's and producer's accuracies at USNVC Macrogroup Level, Roosevelt-Vanderbilt National Historic Sites

This is the population contingency table for ROVA at the USNVC Group level. The point estimate for overall accuracy at this level is 80.2%. For definitions of sample and population contingency tables, see NPS guidelines (Lea and Curtis 2010)	Central Oak-Hardwood and Pine Forest	Eastern North American Ruderal Forest and Plantation	Northern Mesic Hardwood and Conifer Forest	Northern and Central Swamp Forest	Eastern Northern American Ruderal Grassland and Shrubland	Eastern North American Beach, Shoreline, and Flat	Appalachian, Interior Plateau, and Prairie Fen	Atlantic and Gulf Coastal Plain Freshwater Tidal Marsh	Eastern North American Wet Meadow and Marsh	Eastern North American Ruderal Wet Meadow and Marsh	Northern and Central Tall Shrub Wetland	Eastern North American Atlantic Salt Marsh	Eastern North American Freshwater Aquatic Vegetation	Unvegetated (Paved Road)	USERS' ACCURACY ($P_{i=X|i=x}$)
Central Oak-Hardwood and Pine Forest	0.0970	0.0000	0.0106	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	90.1%
Eastern North American Ruderal Forest and Plantation	0.0191	0.1339	0.0377	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	70.2%
Northern Mesic Hardwood and Conifer Forest	0.0279	0.0181	0.4151	0.0057	0.0000	0.0320	0.0078	0.0000	0.0000	0.0000	0.0072	0.0000	0.0000	0.0000	80.8%
Northern and Central Swamp Forest	0.0000	0.0000	0.0056	0.0704	0.0000	0.0008	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	91.7%
Eastern Northern American Ruderal Grassland and Shrubland	0.0000	0.0010	0.0000	0.0000	0.0628	0.0000	0.0000	0.0000	0.0000	0.0099	0.0000	0.0000	0.0000	0.0011	84.0%
Eastern North American Beach, Shoreline, and Flat	0.0000	0.0000	0.0000	0.0013	0.0000	0.0046	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0011	0.0000	65.3%
Appalachian, Interior Plateau, and Prairie Fen	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	N/A
Atlantic and Gulf Coastal Plain Freshwater Tidal Marsh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0044	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0%
Eastern North American Wet Meadow and Marsh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0003	0.0009	0.0000	0.0034	0.0000	0.0000	6.3%
Eastern North American Ruderal Wet Meadow and Marsh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0017	0.0000	0.0000	0.0000	0.0000	100.0%
Northern and Central Tall Shrub Wetland	0.0000	0.0000	0.0000	0.0040	0.0000	0.0000	0.0000	0.0000	0.0003	0.0000	0.0000	0.0001	0.0000	0.0000	0.0%
Eastern North American Atlantic Salt Marsh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0003	0.0000	0.0000	100.0%
Eastern North American Freshwater Aquatic Vegetation	0.0000	0.0000	0.0000	0.0027	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0109	0.0000	80.2%
Unvegetated (Paved Road)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	N/A
PRODUCERS' ACCURACY ($P_{i=Y|j=Y}$)	67.4%	87.5%	88.5%	83.7%	100.0%	12.2%	0.0%	100.0%	47.5%	13.8%	0.0%	8.0%	90.7%	0.0%	

Table C-9. Sample (raw counts) contingency table at USNVC Division Level, Roosevelt-Vanderbilt National Historic Sites.

This is the sample contingency table for ROVA at the USNVC Division level. The counts have not been weighted for stratification (as have been those at the Association level). The Divison and Formation levels are 1:1 at ROVA. For definitions of sample and population contingency tables, see NPS guidelines (Lea and Curtis 2010)	Eastern North American Cool Temperate Forest	Eastern North American Flooded and Swamp Forest	Eastern North American Grassland, Meadow, and Shrubland	Eastern North American Dune and Coastal Grassland and Shrubland	North American Bog and Fen	Eastern North American Freshwater Wet Meadow, Riparian, and Marsh	Temperate and Boreal Atlantic Coastal Salt Marsh	North American Freshwater Aquatic Vegetation	Unvegetated (Paved Road)	ROW TOTAL (n_{i+})
Eastern North American Cool Temperate Forest	146	1		4	2	1				154
Eastern North American Flooded and Swamp Forest	3	14		1						18
Eastern North American Grassland, Meadow, and Shrubland	2		8			1			1	12
Eastern North American Dune and Coastal Grassland and Shrubland		1		9				1		11
North American Bog and Fen										0
Eastern North American Freshwater Wet Meadow, Riparian, and Marsh		3				11	2			16
Temperate and Boreal Atlantic Coastal Salt Marsh							1			1
North American Freshwater Aquatic Vegetation		1						3		4
Unvegetated (Paved Road)										0
COLUMN TOTAL (n_{+j})	151	20	8	14	2	13	3	4	1	216

Table C-10. Population contingency table, with point estimates of map class user's and producer's accuracies at USNVC Division Level, Roosevelt-Vanderbilt National Historic Sites.

This is the population contingency table for ROVA at the USNVC Division level. The point estimate for overall accuracy at this level is 91.6%. The Division and Formation levels are 1:1 at ROVA. For definitions of sample and population contingency tables, see NPS guidelines (Lea and Curtis 2010)	Eastern North American Cool Temperate Forest	Eastern North American Flooded and Swamp Forest	Eastern North American Grassland, Meadow, and Shrubland	Eastern North American Dune and Coastal Grassland and Shrubland	North American Bog and Fen	Eastern North American Freshwater Wet Meadow, Riparian, and Marsh	Temperate and Boreal Atlantic Coastal Salt Marsh	North American Freshwater Aquatic Vegetation	Unvegetated (Paved Road)	USERS' ACCURACY ($P_{j=x|i=x}$)
Eastern North American Cool Temperate Forest	0.7595	0.0057	0.0000	0.0320	0.0078	0.0072	0.0000	0.0000	0.0000	93.5%
Eastern North American Flooded and Swamp Forest	0.0056	0.0704	0.0000	0.0008	0.0000	0.0000	0.0000	0.0000	0.0000	91.7%
Eastern North American Grassland, Meadow, and Shrubland	0.0010	0.0000	0.0628	0.0000	0.0000	0.0099	0.0000	0.0000	0.0011	84.0%
Eastern North American Dune and Coastal Grassland and Shrubland	0.0000	0.0013	0.0000	0.0046	0.0000	0.0000	0.0000	0.0011	0.0000	65.3%
North American Bog and Fen	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	N/A
Eastern North American Freshwater Wet Meadow, Riparian, and Marsh	0.0000	0.0040	0.0000	0.0000	0.0000	0.0077	0.0036	0.0000	0.0000	50.4%
Temperate and Boreal Atlantic Coastal Salt Marsh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0003	0.0000	0.0000	100.0%
North American Freshwater Aquatic Vegetation	0.0000	0.0027	0.0000	0.0000	0.0000	0.0000	0.0000	0.0109	0.0000	80.2%
Unvegetated (Paved Road)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	N/A
PRODUCERS' ACCURACY ($P_{i=Y|J=Y}$)	99.1%	83.7%	100.0%	12.2%	0.0%	30.9%	8.0%	90.7%	0.0%	

Table C-11. Sample (raw counts) contingency table at USNVC Subclass Level, Roosevelt-Vanderbilt National Historic Sites.

This is the sample contingency table for ROVA at the USNVC Subclass level. The counts have not been weighted for stratification (as have been those at the association level). The Subclass and Class levels are 1:1 at ROVA. For definitions of sample and population contingency tables, see NPS guidelines (Lea and Curtis 2010)	Eastern North American Cool Temperate Forest	Eastern North American Grassland, Meadow, and Shrubland	North American Freshwater Aquatic Vegetation	Unvegetated (Paved Road)	ROW TOTAL (n_{i+})
Eastern North American Cool Temperate Forest	164	8			172
Eastern North American Grassland, Meadow, and Shrubland	6	33	1	1	41
North American Freshwater Aquatic Vegetation	1		3		4
Unvegetated (Paved Road)					0
COLUMN TOTAL (n_{+j})	171	41	4	1	217

Table C-12. Population contingency table, with point estimates of map class user's and producer's accuracies at USNVC Subclass Level, Roosevelt-Vanderbilt National Historic Sites.

This is the population contingency table for SARA at the USNVC Subclass level. The point estimate for overall accuracy at this level is 94.1%. The Subclass and Class levels are 1:1 at ROVA. For definitions of sample and population contingency tables, see NPS guidelines (Lea and Curtis 2010)	Central Oak-Hardwood and Pine Forest	Eastern Northern American Ruderal Grassland and Shrubland	Eastern North American Freshwater Aquatic Vegetation	Unvegetated (Paved Road)	USERS' ACCURACY ($P_{J=x\|i=x}$)
Central Oak-Hardwood and Pine Forest	0.8413	0.0478	0.0000	0.0000	94.6%
Eastern Northern American Ruderal Grassland and Shrubland	0.0062	0.0888	0.0011	0.0011	91.3%
Eastern North American Freshwater Aquatic Vegetation	0.0027	0.0000	0.0109	0.0000	80.2%
Unvegetated (Paved Road)	0.0000	0.0000	0.0000	0.0000	N/A
PRODUCERS' ACCURACY ($P_{i=Y\|J=Y}$)	98.9%	65.0%	90.7%	0.0%	

Appendix D: Plant Species Observed in Roosevelt - Vanderbilt National Historic Sites during Vegetation Plot and Thematic Accuracy Assessment Sampling

Nomenclature follows the PLANTS 3.5 Database developed by the Natural Resource Conservation Service in cooperation with the Biota of North America Program (USDA - NRCS 2004, with updates from the on-line PLANTS database: http://plants.usda.gov), as accessed on September 9, 2013. For this report, some common names listed in the PLANTS database were changed to reflect the common names typically used by ecologists and resource managers in this region. The common and scientific names of plants observed during the vegetation plot and thematic accuracy assessment sampling are listed below. Species not sampled within classification or AA plots but were observed during vegetation plot sampling are included in the following table without an assignment to the PLOT Species (PS) and/or AA Species (AA) fields. Species with an asterisk (*) following the scientific name are exotic/introduced taxa as determined by project ecologists or as described within the USDA-NRCS PLANTS Database (2013) or by Haines (2011). The nativity of species denoted by a plus sign (+) cannot be determined from the listed names (e.g., a species name that represents both native and non-native infraspecific varieties or subspecies).

Table D-1. List of plant species observed during Vegetation Inventory of Roosevelt - Vanderbilt National Historic Sites.

Family	Scientific Name	Common Name
Aceraceae	*Acer pensylvanicum*	striped maple [AA, PS]
	*Acer platanoides**	Norway maple [AA, PS]
	Acer rubrum	red maple [AA, PS]
	Acer saccharinum	silver maple [PS]
	Acer saccharum	sugar maple [AA, PS]
	Acer spicatum	mountain maple
Alismataceae	*Alisma subcordatum*	American water plantain [AA]
	Sagittaria latifolia	broadleaf arrowhead [PS]
Amblystegiaceae	*Calliergon* sp.	calliergon moss [AA]
Anacardiaceae	*Rhus glabra*	smooth sumac [AA]
	Rhus hirta	staghorn sumac [PS]
	Toxicodendron radicans	eastern poison ivy [AA, PS]
Apiaceae	*Angelica atropurpurea*	purplestem angelica [PS]
	*Anthriscus sylvestris**	wild chervil [AA]
	Cicuta maculata var. *maculata*	spotted water hemlock [PS]
	*Daucus carota**	Queen Anne's lace [PS]
	Osmorhiza claytonii	Clayton's sweetroot [AA, PS]
	Osmorhiza longistylis	longstyle sweetroot [AA]
	Sium suave	hemlock waterparsnip [AA, PS]
	Zizia aurea	golden zizia [AA]

Table D-1. List of plant species observed during Vegetation Inventory of Roosevelt - Vanderbilt National Historic Sites (continued).

Family	**Scientific Name**	**Common Name**
Apocynaceae	*Apocynum cannabinum*	Indianhemp [AA, PS]
Aquifoliaceae	*Ilex verticillata*	common winterberry [AA, PS]
Araceae	*Arisaema triphyllum*	Jack in the pulpit [AA, PS]
	Peltandra virginica	green arrow arum [AA, PS]
	Symplocarpus foetidus	skunk cabbage [AA, PS]
Araliaceae	*Aralia nudicaulis*	wild sarsaparilla [AA, PS]
Aristolochiaceae	*Asarum canadense*	Canadian wildginger [AA, PS]
Asclepiadaceae	*Asclepias incarnata*	swamp milkweed [AA]
	Asclepias syriaca	common milkweed [PS]
	*Cynanchum vincetoxicum**	white swallow-wort [AA, PS]
Aspleniaceae	*Asplenium platyneuron*	ebony spleenwort [AA, PS]
	Asplenium rhizophyllum	walking fern [PS]
Asteraceae	*Achillea millefolium**	common yarrow [AA, PS]
	Ageratina altissima	white snakeroot [AA, PS]
	Antennaria plantaginifolia	woman's tobacco [AA, PS]
	*Artemisia vulgaris**	common wormwood [AA]
	Aster sp.	aster
	Bidens sp.	beggarticks [PS]
	Bidens cernua	nodding beggartick [AA, PS]
	Bidens connata	purplestem beggarticks [AA, PS]
	Bidens frondosa	devil's beggartick [AA, PS]
	Centaurea sp.*	knapweed [PS]
	*Centaurea biebersteinii**	spotted knapweed [AA, PS]
	Erechtites hieraciifolia	American burnweed [AA, PS]
	Erigeron annuus	eastern daisy fleabane [AA]
	Erigeron pulchellus	robin's plantain [PS]
	Eupatorium sp.	thoroughwort [PS]
	Eutrochium maculatum var. *maculatum*	spotted joepyeweed [AA, PS]
	Eupatorium perfoliatum	common boneset [AA, PS]
	Eurybia divaricata	white wood aster [AA, PS]
	Eurybia macrophylla	bigleaf aster [AA, PS]
	Euthamia graminifolia	flat-top goldentop [AA, PS]
	Helianthus divaricatus	woodland sunflower [PS]
	Mikania scandens	climbing hempvine [PS]
	Prenanthes alba	white rattlesnakeroot
	Prenanthes trifoliolata	gall of the earth [AA, PS]
	Pseudognaphalium obtusifolium var. *obtusifolium*	rabbittobacco [AA]
	Rudbeckia hirta+	blackeyed Susan [PS]
	Rudbeckia laciniata	cutleaf coneflower [PS]
	Senecio sp.	ragwort [PS]

Table D-1. List of plant species observed during Vegetation Inventory of Roosevelt - Vanderbilt National Historic Sites (continued).

Family	**Scientific Name**	**Common Name**
Asteraceae (cont.)	*Solidago* sp.	goldenrod [PS]
	Solidago bicolor	white goldenrod [AA, PS]
	Solidago caesia	wreath goldenrod [AA, PS]
	Solidago canadensis	Canada goldenrod [AA, PS]
	Solidago flexicaulis	zigzag goldenrod [PS]
	Solidago gigantea	giant goldenrod [AA]
	Solidago juncea	early goldenrod [AA, PS]
	Solidago latissimifolia	Elliott's goldenrod [PS]
	Solidago nemoralis	gray goldenrod [PS]
	Solidago puberula	downy goldenrod [PS]
	Solidago rugosa	wrinkleleaf goldenrod [AA, PS]
	Symphyotrichum sp.	aster [AA, PS]
	Symphyotrichum lateriflorum	calico aster [AA, PS]
	Symphyotrichum novae-angliae	New England aster [PS]
	Symphyotrichum patens var. *patens*	late purple aster [PS]
	Symphyotrichum pilosum var. *pilosum*	hairy white oldfield aster [PS]
	Symphyotrichum puniceum	purplestem aster [PS]
	*Taraxacum officinale**	common dandelion [AA]
	Vernonia noveboracensis	New York ironweed [PS]
Balsaminaceae	*Impatiens capensis*	jewelweed [AA, PS]
Berberidaceae	*Berberis thunbergii**	Japanese barberry [AA, PS]
	Caulophyllum thalictroides	blue cohosh [AA, PS]
Betulaceae	*Alnus incana*	gray alder [PS]
	Alnus incana ssp. *rugosa*	speckled alder [AA, PS]
	Alnus serrulata	hazel alder [AA]
	Betula alleghaniensis	yellow birch [PS]
	Betula lenta	sweet birch [AA, PS]
	Betula papyrifera	paper birch [PS]
	Betula populifolia	gray birch [AA, PS]
	Carpinus caroliniana	American hornbeam [AA, PS]
	Corylus sp.	hazelnut [PS]
	Corylus americana	American hazelnut [AA, PS]
	Corylus cornuta	beaked hazelnut [PS]
	Ostrya virginiana	hophornbeam [AA, PS]
Bignoniaceae	*Catalpa speciosa**	northern catalpa [AA, PS]
Blechnaceae	*Woodwardia virginica*	Virginia chainfern [AA]
Boraginaceae	*Hackelia virginiana*	beggarslice [AA]
Brachytheciaceae	*Brachythecium salebrosum*	brachythecium moss [PS]
Brassicaceae	*Alliaria petiolata**	garlic mustard [AA, PS]
	Arabis glabra	tower rockcress [AA, PS]

Table D1. List of plant species observed during Vegetation Inventory of Roosevelt - Vanderbilt National Historic Sites (continued).

Family	**Scientific Name**	**Common Name**
Brassicaceae (cont.)	*Arabis lyrata*	lyrate rockcress [AA, PS]
	*Cardamine impatiens**	narrowleaf bittercress [AA]
	*Lepidium campestre**	field pepperweed [PS]
Cactaceae	*Opuntia humifusa*	devil's-tongue [PS]
Callitrichaceae	*Callitriche* sp.	water-starwort [PS]
	Callitriche palustris	vernal water-starwort [AA]
Campanulaceae	*Campanula rotundifolia*	bluebell bellflower [PS]
	Lobelia cardinalis	cardinalflower [PS]
Caprifoliaceae	*Diervilla lonicera*	northern bush honeysuckle [PS]
	Lonicera sp.	honeysuckle [PS]
	Lonicera hirsuta	hairy honeysuckle [PS]
	*Lonicera morrowii**	Morrow's honeysuckle [PS]
	*Lonicera tatarica**	Tatarian honeysuckle [AA, PS]
	Sambucus nigra ssp. *canadensis*	common elderberry [AA, PS]
	Sambucus racemosa	red elderberry [PS]
	Viburnum acerifolium	mapleleaf viburnum [AA, PS]
	Viburnum dentatum	southern arrowwood [AA, PS]
	Viburnum lentago	nannyberry [PS]
	Viburnum nudum var. *cassinoides*	withe-rod [AA]
	Viburnum rafinesquianum	downy arrowwood [AA, PS]
Caryophyllaceae	*Dianthus armeria**	Deptford pink [PS]
	Paronychia canadensis	smooth forked nailwort [PS]
	*Saponaria officinalis**	bouncingbet [AA]
	*Silene antirrhina**	sleepy silene [AA]
Celastraceae	*Celastrus orbiculatus**	oriental bittersweet [AA, PS]
	*Euonymus alata**	winged burning bush [AA, PS]
Chenopodiaceae	*Chenopodium* sp.	goosefoot [AA]
Cladoniaceae	*Cladonia* sp.	cup lichen [PS]
Climaciaceae	*Climacium dendroides*	tree climacium moss [AA, PS]
Clusiaceae	*Hypericum* sp.	St. Johnswort [PS]
	*Hypericum perforatum**	common St. Johnswort [PS]
	Hypericum punctatum	spotted St. Johnswort [PS]
	Triadenum virginicum	Virginia marsh St. Johnswort [PS]
Cornaceae	*Cornus alternifolia*	alternateleaf dogwood [AA]
	Cornus amomum	silky dogwood [AA, PS]
	Cornus florida	flowering dogwood [AA, PS]
	Cornus racemosa	gray dogwood [AA, PS]
Cucurbitaceae	*Echinocystis lobata*	wild cucumber [AA]
Cupressaceae	*Juniperus virginiana*	eastern red-cedar [AA, PS]

Table D1. List of plant species observed during Vegetation Inventory of Roosevelt - Vanderbilt National Historic Sites (continued).

Family	Scientific Name	Common Name
Cupressaceae (cont.)	*Thuja occidentalis*	arborvitae, northern white cedar [AA, PS]
Cuscutaceae	*Cuscuta* sp.	dodder [PS]
	Cuscuta gronovii	scaldweed [AA, PS]
Cyperaceae	*Carex* sp.	sedge [AA, PS]
	Carex amphibola	eastern narrowleaf sedge [AA, PS]
	Carex blanda	eastern woodland sedge [PS]
	Carex bromoides	bromelike sedge [AA, PS]
	Carex brunnescens	brownish sedge [PS]
	Carex comosa	longhair sedge [AA]
	Carex crinita	fringed sedge [AA]
	Carex debilis	white edge sedge [PS]
	Carex echinata	star sedge [PS]
	Carex glaucodea	blue sedge [AA]
	Carex gracillima	graceful sedge [AA, PS]
	Carex granularis	limestone meadow sedge [AA]
	Carex gynandra	nodding sedge [PS]
	Carex intumescens	greater bladder sedge [AA, PS]
	Carex lacustris	hairy sedge [PS]
	Carex laxiflora	broad looseflower sedge [AA]
	Carex lupulina	hop sedge [AA, PS]
	Carex lurida	shallow sedge [AA, PS]
	Carex pensylvanica	Pennsylvania sedge [AA, PS]
	Carex plantaginea	plantainleaf sedge [PS]
	Carex platyphylla	broadleaf sedge [AA]
	Carex scoparia	broom sedge [AA, PS]
	Carex stipata	owlfruit sedge [PS]
	Carex stricta	upright sedge [AA, PS]
	Carex swanii	Swan's sedge [AA, PS]
	Carex tribuloides	blunt broom sedge [PS]
	Carex trisperma	threeseeded sedge [AA, PS]
	Carex vulpinoidea	fox sedge [AA, PS]
	Cyperus squarrosus	bearded flatsedge [PS]
	Dulichium arundinaceum	threeway sedge [PS]
	Scirpus sp.	bulrush [PS]
	Scirpus atrovirens	green bulrush [AA, PS]
	Scirpus cyperinus	woolgrass [AA, PS]
Dennstaedtiaceae	*Dennstaedtia punctilobula*	eastern hayscented fern [AA, PS]

Table D1. List of plant species observed during Vegetation Inventory of Roosevelt - Vanderbilt National Historic Sites (continued).

Family	Scientific Name	Common Name
Dennstaedtiaceae (cont.)	*Pteridium aquilinum*	western brackenfern [AA, PS]
Dicranaceae	*Dicranum scoparium*	dicranum moss [PS]
Dioscoreaceae	*Dioscorea villosa*	wild yam [AA, PS]
Dryopteridaceae	*Athyrium filix-femina*	common ladyfern [AA, PS]
	Cystopteris bulbifera	bulblet bladderfern [PS]
	Dryopteris sp.	woodfern [PS]
	Dryopteris carthusiana	spinulose woodfern [PS]
	Dryopteris clintoniana	Clinton's woodfern [PS]
	Dryopteris cristata	crested woodfern [AA, PS]
	Dryopteris intermedia	intermediate woodfern [AA, PS]
	Dryopteris marginalis	marginal woodfern [AA, PS]
	Onoclea sensibilis	sensitive fern [AA, PS]
	Polystichum acrostichoides	Christmas fern [AA, PS]
Equisetaceae	*Equisetum* sp.	horsetail [PS]
	Equisetum arvense	field horsetail [AA]
	Equisetum fluviatile	water horsetail [PS]
	Equisetum palustre	marsh horsetail [AA]
Ericaceae	*Gaultheria procumbens*	eastern teaberry [PS]
	Gaylussacia baccata	black huckleberry [AA]
	Rhododendron viscosum	swamp azalea [AA, PS]
	Vaccinium angustifolium	lowbush blueberry [AA, PS]
	Vaccinium corymbosum	highbush blueberry [AA, PS]
	Vaccinium pallidum	Blue Ridge blueberry [AA, PS]
	Vaccinium stamineum	deerberry [AA]
Euphorbiaceae	*Euphorbia cyparissias**	cypress spurge [PS]
Fabaceae	*Amorpha fruticosa**	desert false indigo [AA, PS]
	Amphicarpaea bracteata	American hogpeanut [AA, PS]
	Apios americana	groundnut [PS]
	Desmodium sp.	ticktrefoil [PS]
	Desmodium cuspidatum	largebract ticktrefoil [PS]
	Desmodium glutinosum	pointedleaf ticktrefoil [PS]
	Desmodium laevigatum	smooth ticktrefoil [PS]
	Desmodium nudiflorum	nakedflower ticktrefoil [AA, PS]
	*Lotus corniculatus**	birdfoot deervetch [PS]
	*Robinia pseudoacacia**	black locust [AA, PS]
	Trifolium sp.*	clover [PS]
	*Trifolium arvense**	rabbitfoot clover [AA, PS]
	*Trifolium pratense**	red clover [AA, PS]
Fagaceae	*Castanea dentata*	American chestnut [PS]
	Fagus grandifolia	American beech [AA, PS]
	Quercus sp.	oak [AA, PS]

Table D1. List of plant species observed during Vegetation Inventory of Roosevelt - Vanderbilt National Historic Sites (continued).

Family	**Scientific Name**	**Common Name**
Fagaceae (cont.)	*Quercus alba*	white oak [AA, PS]
	Quercus bicolor	swamp white oak [AA, PS]
	Quercus coccinea	scarlet oak [AA, PS]
	Quercus macrocarpa	bur oak [AA]
	Quercus palustris	pin oak [PS]
	Quercus prinus	chestnut oak [AA, PS]
	Quercus rubra	northern red oak [AA, PS]
	Quercus velutina	black oak [AA, PS]
Fumariaceae	*Adlumia fungosa*	Allegheny vine [PS]
	Corydalis sempervirens	rock harlequin [PS]
	Fumaria officinalis	drug fumitory [AA]
Gentianaceae	*Bartonia virginica*	yellow screwstem [PS]
	Gentiana andrewsii	closed bottle gentian [PS]
Geraniaceae	*Geranium maculatum*	spotted geranium [AA, PS]
	Geranium robertianum	Robert geranium [AA, PS]
Grossulariaceae	*Ribes* sp.	currant [PS]
	Ribes americanum	American black currant [PS]
	Ribes cynosbati	eastern prickly gooseberry [AA]
	Ribes glandulosum	skunk currant [PS]
Hamamelidaceae	*Hamamelis virginiana*	American witchhazel [AA, PS]
Hydrocharitaceae	*Vallisneria americana*	American eelgrass [AA, PS]
Hypnaceae	*Hypnum imponens*	hypnum moss [PS]
Iridaceae	*Iris versicolor*	harlequin blueflag [AA, PS]
Juglandaceae	*Carya* sp.	hickory [AA, PS]
	Carya alba	mockernut hickory [AA, PS]
	Carya cordiformis	bitternut hickory [AA, PS]
	Carya glabra	pignut hickory [AA, PS]
	Carya ovalis	red hickory [AA]
	Carya ovata	shagbark hickory [AA, PS]
	Juglans nigra	black walnut [AA]
Juncaceae	*Juncus effusus*	common rush [AA, PS]
	Juncus tenuis	poverty rush [AA]
Lamiaceae	*Clinopodium vulgare**	wild basil [PS]
	Collinsonia canadensis	richweed [AA, PS]
	*Leonurus cardiaca**	common motherwort [PS]
	Lycopus americanus	American water horehound [PS]
	Lycopus uniflorus	northern bugleweed [AA, PS]
	*Origanum vulgare**	oregano [AA]
	Prunella vulgaris+	common selfheal [PS]
	Pycnanthemum tenuifolium	narrowleaf mountainmint [PS]
	Scutellaria sp.	skullcap [PS]
	Scutellaria lateriflora	blue skullcap [PS]

Table D1. List of plant species observed during Vegetation Inventory of Roosevelt - Vanderbilt National Historic Sites (continued).

Family	Scientific Name	Common Name
Lamiaceae (cont.)	*Trichostema dichotomum*	forked bluecurls [AA, PS]
Lauraceae	*Lindera benzoin*	northern spicebush [AA, PS]
	Sassafras albidum	sassafras [AA, PS]
Lemnaceae	*Lemna minor*	common duckweed [AA, PS]
	Wolffia brasiliensis	Brazilian watermeal [AA, PS]
Leucobryaceae	*Leucobryum glaucum*	leucobryum moss [AA, PS]
Liliaceae	*Allium tricoccum*	wild leek [AA, PS]
	Maianthemum canadense	Canada mayflower [AA, PS]
	Maianthemum racemosum	feathery false lily of the valley [AA, PS]
	Medeola virginiana	Indian cucumber [PS]
	Polygonatum biflorum	smooth Solomon's seal [AA, PS]
	Polygonatum pubescens	hairy Solomon's seal [AA, PS]
	Trillium erectum	red trillium [PS]
	Uvularia perfoliata	perfoliate bellwort [AA]
	Uvularia sessilifolia	sessileleaf bellwort [AA, PS]
	Veratrum viride	green false hellebore [PS]
Lycopodiaceae	*Lycopodium obscurum*	rare clubmoss [AA]
Lythraceae	*Lythrum salicaria**	purple loosestrife [AA, PS]
Magnoliaceae	*Liriodendron tulipifera*	tuliptree [AA, PS]
	*Magnolia tripetala**	umbrella-tree [AA, PS]
Monotropaceae	*Monotropa uniflora*	Indianpipe [AA, PS]
Myricaceae	*Comptonia peregrina*	sweet fern [AA]
Nymphaeaceae	*Nuphar lutea* ssp. *advena*	yellow pond-lily [AA, PS]
Nyssaceae	*Nyssa sylvatica*	blackgum [AA, PS]
Oleaceae	*Fraxinus* sp.	ash [PS]
	Fraxinus americana	white ash [AA, PS]
	Fraxinus nigra	black ash [PS]
	Fraxinus pennsylvanica	green ash [AA, PS]
	*Ligustrum vulgare**	European privet [AA]
Onagraceae	*Circaea lutetiana*	broadleaf enchanter's nightshade [AA, PS]
	Epilobium sp.	willowherb [PS]
	Epilobium coloratum	purpleleaf willowherb [PS]
	Epilobium palustre	marsh willowherb [PS]
	Ludwigia palustris	marsh seedbox [AA, PS]
Ophioglossaceae	*Botrychium virginianum*	rattlesnake fern [AA, PS]
Orchidaceae	*Cypripedium acaule*	moccasin flower [PS]
	*Epipactis helleborine**	broadleaf helleborine [AA, PS]
	Goodyera pubescens	downy rattlesnake plantain [AA, PS]
	Platanthera sp.	fringed orchid [PS]
	Spiranthes cernua	nodding ladies'-tresses [PS]
Orobanchaceae	*Conopholis americana*	American squawroot [AA, PS]

Table D1. List of plant species observed during Vegetation Inventory of Roosevelt - Vanderbilt National Historic Sites (continued).

Family	**Scientific Name**	**Common Name**
Orobanchaceae (cont.)	*Epifagus virginiana*	beechdrops [PS]
Osmundaceae	*Osmunda cinnamomea*	cinnamon fern [AA, PS]
	Osmunda claytoniana	interrupted fern [AA, PS]
	Osmunda regalis	royal fern [AA, PS]
Oxalidaceae	*Oxalis* sp.	Woodsorrel [PS]
	*Oxalis corniculata**	creeping woodsorrel [PS]
	Oxalis stricta	common yellow oxalis [AA, PS]
Papaveraceae	*Sanguinaria canadensis*	bloodroot [AA, PS]
Pinaceae	*Larix laricina*	tamarack [AA, PS]
	*Picea abies**	Norway spruce [AA, PS]
	Picea glauca	white spruce [AA]
	Pinus resinosa	red pine [AA]
	Pinus rigida	pitch pine [PS]
	Pinus strobus	eastern white pine [AA, PS]
	*Pinus sylvestris**	Scotch pine [AA]
	Tsuga canadensis	eastern hemlock [AA, PS]
Plantaginaceae	*Plantago lanceolata**	narrowleaf plantain [AA, PS]
	*Plantago major**	common plantain [AA]
Platanaceae	*Platanus occidentalis*	American sycamore [AA, PS]
Poaceae	*Agrostis* sp.	bentgrass [PS]
	*Agrostis stolonifera**	creeping bentgrass [PS]
	Andropogon gerardii	big bluestem [AA]
	*Anthoxanthum odoratum**	sweet vernalgrass [AA, PS]
	*Avena fatua**	wild oat [PS]
	Brachyelytrum erectum	bearded shorthusk [PS]
	*Bromus inermis**	smooth brome [AA, PS]
	Calamagrostis canadensis	bluejoint
	Cinna arundinacea	sweet woodreed [AA, PS]
	Cinna latifolia	drooping woodreed [PS]
	*Dactylis glomerata**	orchardgrass [AA, PS]
	Danthonia spicata	poverty oatgrass [AA, PS]
	Deschampsia flexuosa	wavy hairgrass [AA, PS]
	Dichanthelium clandestinum	deertongue [AA, PS]
	Dichanthelium depauperatum	starved panicgrass [PS]
	Dichanthelium latifolium	broadleaf rosette grass [PS]
	*Digitaria sanguinalis**	hairy crabgrass [AA]
	*Elymus repens**	quackgrass [PS]
	*Festuca rubra**	red fescue [PS]
	Glyceria canadensis	rattlesnake mannagrass [PS]
	Glyceria melicaria	melic mannagrass [AA]
	Glyceria striata	fowl mannagrass [AA, PS]

Table D1. List of plant species observed during Vegetation Inventory of Roosevelt - Vanderbilt National Historic Sites (continued).

Family	Scientific Name	Common Name
Poaceae (cont.)	*Leersia oryzoides*	rice cutgrass [AA]
	Leersia virginica	whitegrass [PS]
	*Microstegium vimineum**	Nepalese browntop, Japanese stiltgrass [AA, PS]
	Panicum dichotomiflorum	fall panicgrass [AA]
	Phalaris arundinacea	reed canarygrass
	*Phleum pratense**	Timothy [PS]
	*Phragmites australis**	common reed [AA, PS]
	Piptatherum racemosum	blackseed ricegrass [AA]
	Poa sp.	bluegrass [PS]
	Poa alsodes	grove bluegrass [PS]
	*Poa annua**	annual bluegrass [PS]
	*Poa compressa**	Canada bluegrass [AA, PS]
	*Poa pratensis**	Kentucky bluegrass [AA, PS]
	Schizachyrium scoparium	little bluestem [AA, PS]
	Tridens flavus	purpletop tridens [AA, PS]
	Zizania aquatica	annual wildrice [PS]
Polemoniaceae	*Phlox subulata*	moss phlox [PS]
Polygalaceae	*Polygala sanguinea*	purple milkwort [PS]
Polygonaceae	*Polygonum* sp.	knotweed [PS]
	Polygonum amphibium var. *emersum*	longroot smartweed [AA, PS]
	Polygonum arifolium	halberdleaf tearthumb [AA, PS]
	*Polygonum aviculare**	prostrate knotweed [AA]
	Polygonum cilinode	fringed black bindweed [PS]
	*Polygonum cuspidatum**	Japanese knotweed [PS]
	Polygonum hydropiperoides	swamp smartweed [AA, PS]
	*Polygonum persicaria**	spotted ladysthumb [AA, PS]
	Polygonum sagittatum	arrowleaf tearthumb [AA, PS]
	Polygonum virginianum	jumpseed [AA, PS]
	*Rumex acetosella**	common sheep sorrel [AA, PS]
Polypodiaceae	*Polypodium* sp.	polypody [PS]
	Polypodium virginianum	rock polypody [AA, PS]
Polytrichaceae	*Atrichum angustatum*	atrichum moss [AA, PS]
	Polytrichum commune	polytrichum moss [AA]
	Polytrichum juniperinum	juniper polytrichum moss [AA, PS]
Pontederiaceae	*Pontederia cordata*	pickerelweed [PS]
Primulaceae	*Lysimachia nummularia**	creeping jenny [AA, PS]
	Lysimachia quadrifolia	whorled yellow loosestrife [AA, PS]
	Trientalis borealis	starflower [PS]
Pteridaceae	*Adiantum pedatum*	northern maidenhair [AA, PS]
Pyrolaceae	*Chimaphila maculata*	striped prince's pine [AA, PS]

Table D1. List of plant species observed during Vegetation Inventory of Roosevelt - Vanderbilt National Historic Sites (continued).

Family	**Scientific Name**	**Common Name**
Ranunculaceae	*Actaea pachypoda*	white baneberry [PS]
	Aquilegia canadensis	red columbine [PS]
	Coptis trifolia	threeleaf goldthread [AA, PS]
	Hepatica nobilis var. *obtusa*	roundlobe hepatica [AA, PS]
	Ranunculus sp.	buttercup [AA]
	*Ranunculus acris**	tall buttercup [PS]
	*Ranunculus parviflorus**	smallflower buttercup [AA]
	Thalictrum dioicum	early meadow-rue [AA, PS]
	Thalictrum pubescens	king of the meadow [AA]
	Thalictrum thalictroides	rue anemone [AA, PS]
Rhamnaceae	*Frangula alnus**	glossy buckthorn [AA]
	*Rhamnus cathartica**	common buckthorn [AA, PS]
Rosaceae	*Amelanchier* sp.	serviceberry [AA, PS]
	Amelanchier arborea	common serviceberry [AA, PS]
	Crataegus sp.	hawthorn [PS]
	Fragaria virginiana	Virginia strawberry [AA, PS]
	Geum aleppicum	yellow avens [PS]
	Geum canadense	white avens [AA, PS]
	Geum virginianum	cream avens [PS]
	Photinia melanocarpa	black chokeberry [AA]
	Physocarpus opulifolius	common ninebark [AA, PS]
	Potentilla sp.	cinquefoil [PS]
	Potentilla canadensis	dwarf cinquefoil [AA, PS]
	*Potentilla recta**	sulphur cinquefoil [PS]
	Potentilla simplex	common cinquefoil [AA, PS]
	Prunus sp.	plum [PS]
	*Prunus avium**	sweet cherry [PS]
	Prunus pensylvanica	pin cherry [PS]
	Prunus serotina	black cherry [AA, PS]
	Prunus virginiana	chokecherry [PS]
	Rosa carolina	Carolina rose [AA, PS]
	*Rosa multiflora**	multiflora rose [AA, PS]
	Rosa palustris	swamp rose [AA, PS]
	Rosa virginiana	Virginia rose [PS]
	Rubus allegheniensis	Allegheny blackberry [AA, PS]
	Rubus flagellaris	northern dewberry [AA, PS]
	Rubus hispidus	bristly dewberry [AA, PS]
	Rubus idaeus	American red raspberry [PS]
	Rubus occidentalis	black raspberry [AA, PS]
	Rubus pubescens	dwarf red blackberry [PS]
	Spiraea alba var. *latifolia*	white meadowsweet [AA, PS]

Table D1. List of plant species observed during Vegetation Inventory of Roosevelt - Vanderbilt National Historic Sites (continued).

Family	Scientific Name	Common Name
Rubiaceae	*Cephalanthus occidentalis*	common buttonbush [AA, PS]
	Galium sp.	bedstraw [AA, PS]
	Galium circaezans	licorice bedstraw [AA, PS]
	*Galium mollugo**	false baby's breath [AA, PS]
	Galium palustre	common marsh bedstraw [AA, PS]
	Galium tinctorium	stiff marsh bedstraw [PS]
	Mitchella repens	partridgeberry [AA, PS]
Rutaceae	*Zanthoxylum americanum*	common pricklyash [AA]
Salicaceae	*Populus deltoides*	eastern cottonwood [AA, PS]
	Populus grandidentata	bigtooth aspen [PS]
	Populus heterophylla	swamp cottonwood [PS]
	Populus tremuloides	quaking aspen [AA]
	Salix sp.	willow [AA]
	Salix lucida	shining willow [PS]
	Salix nigra	black willow [PS]
	Salix x *sepulcralis**	weeping willow
Saxifragaceae	*Chrysosplenium americanum*	American golden saxifrage
	Mitella diphylla	twoleaf miterwort [PS]
	Saxifraga virginiensis	early saxifrage [PS]
Scrophulariaceae	*Aureolaria virginica*	downy yellow false foxglove [AA, PS]
	Chelone glabra	white turtlehead [PS]
	*Linaria vulgaris**	butter and eggs [AA, PS]
	Melampyrum lineare	narrowleaf cowwheat [AA, PS]
	Mimulus alatus	sharpwing monkeyflower [PS]
	Mimulus ringens	Allegheny monkeyflower [AA]
	Penstemon digitalis	talus slope penstemon [AA, PS]
	Veronica sp. +	speedwell [PS]
Simaroubaceae	*Ailanthus altissima**	tree of heaven [AA, PS]
Smilacaceae	*Smilax glauca*	cat greenbrier [AA]
	Smilax rotundifolia	roundleaf greenbrier [AA, PS]
	Smilax tamnoides	bristly greenbrier [PS]
Solanaceae	*Physalis alkekengi**	strawberry groundcherry [AA]
	Physalis heterophylla	clammy groundcherry [PS]
	*Solanum carolinense**	Carolina horsenettle [AA, PS]
	*Solanum nigrum**	black nightshade [PS]
	Solanum ptychanthum	West Indian nightshade
Sparganiaceae	*Sparganium* sp.	bur-reed [AA, PS]
	Sparganium americanum	American bur-reed [AA]
	Sparganium eurycarpum	broadfruit bur-reed [PS]
Sphagnaceae	*Sphagnum* sp.	sphagnum [AA, PS]
Staphyleaceae	*Staphylea trifolia*	American bladdernut [AA, PS]

Table D1. List of plant species observed during Vegetation Inventory of Roosevelt - Vanderbilt National Historic Sites (continued).

Family	**Scientific Name**	**Common Name**
Thelypteridaceae	*Thelypteris noveboracensis*	New York fern [AA, PS]
	Thelypteris palustris	eastern marsh fern [AA, PS]
Thuidiaceae	*Thuidium delicatulum*	delicate thuidium moss [PS]
Thymelaeaceae	*Dirca palustris*	eastern leatherwood [AA]
Tiliaceae	*Tilia americana*	American basswood [AA, PS]
Trapaceae	*Trapa natans**	water chestnut [AA]
Typhaceae	*Typha angustifolia*	narrowleaf cattail [AA, PS]
	Typha latifolia	broadleaf cattail [AA, PS]
Ulmaceae	*Celtis occidentalis*	common hackberry [AA, PS]
	Ulmus americana	American elm [AA, PS]
Urticaceae	*Boehmeria cylindrica*	smallspike false nettle [AA, PS]
	Laportea canadensis	Canadian woodnettle [AA, PS]
	Pilea pumila	Canadian clearweed [AA, PS]
	Urtica dioica+	stinging nettle [PS]
Verbenaceae	*Phryma leptostachya*	American lopseed [AA, PS]
Violaceae	*Viola* sp.	violet [AA, PS]
	Viola conspersa	American dog violet [PS]
	Viola cucullata	marsh blue violet [AA]
	Viola rotundifolia	roundleaf yellow violet
Vitaceae	*Parthenocissus quinquefolia*	Virginia creeper [AA, PS]
	Vitis sp.	grape [AA, PS]
	Vitis aestivalis	summer grape [AA, PS]
	Vitis labrusca	fox grape [PS]

Appendix E: Dichotomous Field Keys to Vegetation Associations at Roosevelt - Vanderbilt National Historic Sites, New York

The vegetation association field keys prepared for ROVA have been divided into five individual dichotomous keys to vegetation associations and a primary key to select one of the five association keys to aid the user. The divisions are based primarily on physiognomy (Forest and Woodland, Shrubland, and Herbaceous Vegetation) and upland versus wetland habitat. The broad field key divisions are: (1) Upland Woody Vegetation; (2) Open Upland Vegetation; (3) Wetland Forests; (4) Wetland Shrublands; and (5) Herbaceous Wetlands.

A "KEY TO THE KEYS"

The following five keys have been divided into manageable portions to facilitate their use in the field. It is, however, important that you have the correct key! Please refer to the following primary key to choose the appropriate physiognomic/habitat key.

1. Vegetation primarily woody (trees or tall shrubs dominant; canopy closed (forest or shrubland) to open (woodland or shrubland). Includes forests, woodlands, and upland shrublands)...(go to 2)

    2. Forests and shrublands of uplands…….**Upland Woody Vegetation Key (UW)**

    2. Forests and shrublands of wetlands……. .....……..……(go to 3)

        3. Forested wetland community, includes swamps, floodplain forests……

        …….……**Wetland Forests Key (WF)**

        3. Shrub-dominated wetland community……..……..**Wet Shrublands Key (WS)**

1. Vegetation primarily herbaceous or sparse vascular……..……..……(go to 4)

    4. Herbaceous vegetation of uplands ……..…**Open Upland Vegetation Key (UO)**

    4. Herbaceous vegetation of wetlands (emergent and submerged)……

    …….**Herbaceous Wetlands Key (WH)**

UPLAND WOODY VEGETATION KEY

This key includes woody vegetation that is dominated by trees or shrubs; it includes forests, open woodlands, and shrub thickets on upland sites.

UW1.Forests or woodlands dominated by coniferous trees (evergreen trees >50% of the total canopy cover) with a mix of deciduous trees possibly present in low-to-moderate cover……....
……...(go to UW2)

UW2.Woodlands dominated by coniferous trees (evergreen trees >50% cover), deciduous trees < 20-25% of the total canopy cover; stand characterized by eastern red-cedar (*Juniperus virginiana*) dominated woodland with a mix of deciduous associates including northern red oak (*Quercus rubra*), chestnut oak (*Quercus prinus*), white ash (*Fraxinus americana*), and/or black cherry (*Prunus serotina*), the herbaceous layer is comprised of little bluestem (*Schizachyrium scoparium*), wild oat (*Avena fatua*), poverty oatgrass (*Danthonia spicata*), and other grasses and forbs…….…**Red-cedar Rocky Summit (CEGL006002)**
[=*Juniperus virginiana* - *Fraxinus americana / Danthonia spicata* - *Poa compressa* Woodland;
=Eastern Red-cedar - White Ash / Poverty Oatgrass - Canada Bluegrass Woodland]

UW2.Forests dominated by native or non-native coniferous trees (evergreen trees >50% cover), including eastern white pine (*Pinus strobus*), red pine (*Pinus resinosa*), eastern hemlock (*Tsuga canadensis*), white spruce (*Picea glauca*), Norway spruce (*Picea abies*); deciduous trees < 20-25% of the total canopy cover may occur and include sugar maple (*Acer saccharum*), red maple (*Acer rubrum*), northern red oak, chestnut oak, tulip tree (*Liriodendron tulipifera*), American beech (*Fagus grandifolia*), American elm (U*lmus americana*), sweet birch (*Betula lenta*), yellow birch (*Betula alleghaniensis*), black cherry, and white ash…...……
……..……..……...……..…(go to UW3)

UW3.Stands plantations of trees in obvious rows, characterized by Norway spruce, white spruce, eastern white pine, or red pine…..…….…….(go to UW4)

UW4.Coniferous forest plantation dominated by Norway spruce; trees in obvious rows……..….. …….**Norway Spruce Plantation CEGL007167)**
[=*Picea abies* Planted Forest; =Norway Spruce Planted Forest]

UW4.Coniferous forest plantation dominated by eastern hemlock, white spruce, eastern white pine, or red pine; trees in obvious rows…..……(go to UW5)

UW5.Coniferous forest plantation dominated by eastern hemlock, white spruce, and/or eastern white pine; trees in obvious rows……..……
……...…….**Mixed Pine Conifer Plantation (CEGL006313)**
[=*Tsuga canadensis* - *Pinus strobus* Planted Forest;
=Eastern Hemlock - Eastern White Pine Planted Forest]

UW5.Coniferous forest plantation dominated by eastern white pine or red pine; trees in obvious rows……..…….……...(go to UW6)

UW6.Eastern white pine plantation; trees in obvious rows……
….……..**White Pine Plantation (CEGL007178)**
[=*Pinus strobus* Planted Forest; =Eastern White Pine Planted Forest]

UW6.Red pine plantation; trees in obvious rows..**Red Pine Plantation (CEGL007177)**
[=*Pinus resinosa* Planted Forest; =Red Pine Planted Forest]

UW3.Stands naturally-appearing, trees not in obvious rows…..……(go to UW7)

UW7.Forest dominated by eastern white pine stands of greater diversity (trees not in obvious rows); deciduous trees including sugar maple, red maple, northern red oak, American elm, black cherry, and/or white ash may be present in low-to-moderate cover; in one type eastern hemlock may be co-dominant with eastern white pine in terms of canopy cover……..…(go to UW8)

UW8.Successional forest canopy co-dominated by eastern white pine and red maple, northern red oak is usually present in low cover……
……**Northeastern Oak - Red Maple Successional Forest (CEGL006506)**
[=Northeastern *Quercus* spp. – *Acer rubrum* Successional Forest;
=Northeastern Oak – Red Maple Successional Forest]

UW8.Successional forest canopy strongly dominated by eastern white pine with associated low-to-moderate canopy cover provided by oak species (*Quercus* spp.), mixed hardwood trees, and/or eastern hemlock.……..……..…(go to UW9)

UW9.Early successional forest occurring in a variety of environmental settings, strongly dominated by eastern white pine; low-to-moderate cover of mixed hardwood trees including American elm, red maple, sugar maple, black cherry, and/or white ash may occur……...…….
…….**Eastern White Pine Successional Forest (CEGL007944)**
[=*Pinus strobus* Successional Forest; =Eastern White Pine Successional Forest]

UW9.Forest dominated by eastern white pine, often in an emergent canopy layer; abundant eastern hemlock provides moderate canopy and subcanopy cover…**White Pine - Hemlock Dry-Mesic Coniferous Forest (CEGL006328)**
[=*Pinus strobus* - *Tsuga canadensis* Lower New England / Northern Piedmont Forest;
=Eastern White Pine - Eastern Hemlock Lower New England / Northern Piedmont Forest]

UW7.Forest dominated by eastern hemlock; deciduous trees including sugar maple, northern red oak, chestnut oak, American beech, tulip tree, sweet birch, and/or yellow birch may be present in low-to-moderate cover; in one type eastern white pine may be co-dominant with eastern hemlock in terms of canopy cover…….……(go to UW10)

UW10.Forest dominated by eastern hemlock with a strong component of or co-dominated by eastern white pine; coniferous trees >75% canopy cover (eastern hemlock usually with greater relative cover than eastern white pine…… ….……...**White Pine - Hemlock Dry-Mesic Coniferous Forest (CEGL006328)**
[=*Pinus strobus* - *Tsuga canadensis* Lower New England / Northern Piedmont Forest; =Eastern White Pine - Eastern Hemlock Lower New England / Northern Piedmont Forest]

UW10.Forest dominated by eastern hemlock, may be co-dominated by hardwood tree species; coniferous trees usually <75% canopy cover……(go to UW11)

UW11.Forest with a mixed canopy of eastern hemlock-hardwood species with a strong component of sugar maple; stands lack a significant presence of oak species (*Quercus* spp.), eastern white pine, or sweet birch……..**Hemlock - Northern Hardwood Forest (CEGL006109)**
[=*Tsuga canadensis* - *Betula alleghaniensis* - *Acer saccharum / Dryopteris intermedia* Forest; =Eastern Hemlock - Yellow Birch - Sugar Maple / Intermediate Woodfern Forest]

UW11.Forest with a mixed canopy of eastern hemlock with strong components of northern red oak, chestnut oak, oak species, sweet birch, tulip tree, and/or American beech; sugar maple may be absent or provide low-to-moderate cover in the canopy layer……(go to UW12)

UW12.Forest canopies comprised primarily of eastern hemlock, tulip tree, and American beech; mesic understory shrubs present including American witchhazel (*Hamamelis virginiana*), northern spicebush (*Lindera benzoin*), and/or American hornbeam (*Carpinus caroliniana*); stands established on dry-mesic sites with moist well-drained loamy soils…….…..…
Hemlock / White Pine - Red Oak - Mixed Hardwood Forest (CEGL006566)
[=*Quercus rubra* - *Tsuga canadensis* - *Liriodendron tulipifera / Hamamelis virginiana* Forest; =Northern Red Oak - Eastern Hemlock - Tuliptree / American Witch-hazel Forest]

UW12.Forest canopies comprised primarily of eastern hemlock, northern red oak, chestnut oak, sweet birch, and oak species……(go to UW13)

UW13.Forest canopy comprised primarily of eastern hemlock, northern red oak, oak species, and/or sweet birch; sites are generally drier than other eastern hemlock forest types……..… ……...…**Hemlock - Beech - Oak Forest (CEGL006088)**
[=*Tsuga canadensis* - *Fagus grandifolia* - *Quercus rubra* Forest; =Eastern Hemlock - American Beech - Northern Red Oak Forest]

UW13.Forest canopy comprised primarily of eastern hemlock, chestnut oak, oak species, and/or sweet birch, tulip tree, and American beech; canopy cover by oak species is usually 10-50%; sites are usually on ridge tops with very stony soils…….
..**Central Appalachian Hemlock - Chestnut Oak Forest (CEGL006923)**
[=*Tsuga canadensis* - *Quercus prinus* - *Betula lenta* Forest;
=Eastern Hemlock - Chestnut Oak - Sweet Birch Forest]

UW1.Forests or shrublands dominated by deciduous trees or a mix of deciduous and evergreen species (deciduous trees > 25% of the total canopy cover)…..…...……(go to UW14)

UW14.Stands plantations of deciduous trees in obvious rows; dominated by sugar maple (*Acer saccharum*) and/or tulip tree (*Liriodendron tulipifera*)..**Hardwood Plantation (CEGL006613)**
[=*Acer saccharum – Liriodendron tulipifera* Hardwood Plantation;
=Sugar Maple – Tulip Tree Hardwood Plantation]

UW14.Stands naturally-appearing forest, woodland, and/or shrubland types; trees and shrubs not in obvious rows……..……(go to UW15)

UW15.Early successional deciduous forests, woodlands, and shrublands characterized by quaking aspen (*Populus tremuloides*), bigtooth aspen (*Populus grandidentata*), black locust (*Robinia pseudoacacia*), tree of heaven (*Ailanthus altissima*), Tatarian honeysuckle (*Lonicera tatarica*), common buckthorn (*Rhamnus cathartica*), and gray dogwood (*Cornus racemosa*)……. ……(go to UW16)

UW16. Early successional deciduous shrublands dominated by Tatarian honeysuckle, common buckthorn, and gray dogwood; scattered canopy trees may include species of ash (*Fraxinus* spp.) and elm (*Ulmus* spp.) in low cover; the herbaceous layer is comprised of species typical of old fields, grasslands, and agricultural sites…… ……...**Northeastern Successional Shrubland (CEGL006451)**
[=*Lonicera tatarica – Rhamnus cathartica – Cornus racemosa* Successional Shrubland;
=Tatarian Honeysuckle – Common Buckthorn – Gray Dogwood Successional Shrubland]

UW16. Early successional forests and woodlands dominated by species of aspen (*Populus* spp.), black locust, or tree of heaven; canopies of individual stands range from open-to-closed……..…(go to UW17)

UW17.Forest or woodland canopy dominated by quaking aspen and/or bigtooth aspen……**Early-Successional Aspen – Birch Woodland (CEGL006303)**
[=*Populus (tremuloides, grandidentata)* Early-Successional Forest;
=(Quaking, Bigtooth) Aspen Early-Successional Forest]

UW17.Forest or woodland canopy dominated by black locust or tree of heaven…….. ……..……...(go to UW18)

UW18.Forest or woodland canopy dominated by black locust……
…….……..……..**Black Locust Successional Forest (CEGL007279)**
[=*Robinia pseudoacacia* Successional Forest; =Black Locust Successional Forest]

UW18.Forest or woodland canopy dominated by tree-of-heaven……..……
..….…….**Successional Tree-of-Heaven Forest (CEGL007191)**
=[*Ailanthus altissima* Semi-natural Successional Forest;
=Tree of Heaven Semi-natural Successional Forest]

UW15.Mid-successional to mature deciduous forests and woodlands characterized by species of oak (*Quercus* spp.), hickory (*Carya* spp.), sugar maple, red maple (*Acer rubrum*), Norway maple *(Acer platanoides*), tulip tree, American beech (*Fagus grandifolia*), American basswood (*Tilia americana*), white ash (*Fraxinus americana*), sweet birch (*Betula lenta*), yellow birch (*Betula alleghaniensis*), eastern white pine (*Pinus strobus*), and/or eastern hemlock (*Tsuga canadensis*)...……..……(go to UW19)

UW19.Forests dominated by species of oak; oaks usually comprising at least 50% of canopy cover; stands may be co-dominated by or associated with species of hickory……...
……(go to UW20)

UW20.Forests of mixed coniferous-deciduous trees; species of oak co-dominant with eastern hemlock (which occur in >25% cover)….....……..(go to UW21)

UW21.Northern red oak (*Quercus rubra*) forest with eastern hemlock co-dominant; stands are mixed hemlock-hardwood forest with a strong component of northern red oak, other species of oak, and/or sweet birch; sugar maple, and yellow birch are rare occurrences; sites are generally drier than other eastern hemlock forest stands……
……...……...**Hemlock - Beech - Oak Forest (CEGL006088)**
[*Tsuga canadensis* - *Fagus grandifolia* - *Quercus rubra* Forest;
=Eastern Hemlock - American Beech - Northern Red Oak Forest]

UW21.Chestnut oak (*Quercus prinus*) and other oak species co-dominant along with eastern hemlock; sugar maple, tulip tree, and American beech may occur in low cover; sites are on ridge tops with stony soils or are dry-mesic on moist, well-drained loam soils……...……(go to UW22)

UW22.Oak forest with eastern hemlock co-dominant; mixed hemlock-hardwood forest with strong component (go to Usually 10-50%) of chestnut oak, other oak species, and/or sweet birch, tulip tree, and American beech; sites are usually ridge top with very stony soils……...
……**Central Appalachian Hemlock - Chestnut Oak Forest (CEGL006923)**
[=*Tsuga canadensis* - *Quercus prinus* - *Betula lenta* Forest;
=Eastern Hemlock - Chestnut Oak - Sweet Birch Forest]

UW22.Oak and eastern hemlock forest, co-dominant with other deciduous tree species including sugar maple, tulip tree, and/or American beech; mixed hemlock-hardwood forest with a variety of deciduous trees and a mesic understory shrub layer

comprised of American witchhazel (*Hamamelis virginiana*), northern spicebush (*Lindera benzoin*), and/or American hornbeam (*Carpinus caroliniana*); a dry-mesic site on moist well-drained loam soils……..……..…….…**Hemlock / White Pine - Red Oak - Mixed Hardwood Forest (CEGL006566)**
[=Quercus rubra - Tsuga canadensis - Liriodendron tulipifera / Hamamelis virginiana Forest; =Northern Red Oak - Eastern Hemlock - Tuliptree / American Witch-hazel Forest]

UW20.Forests of species of oak that may be co-dominant with other deciduous tree species; eastern hemlock is much less frequent (<25% cover)……..…..…(go to UW23)

UW23.Oak forests of uplands exhibiting frequent and sometimes abundant canopy enrichment indicator species (pignut hickory (*Carya glabra*), shagbark hickory (*Carya ovata*), sugar maple, American basswood, white ash, and hophornbeam (*Ostrya virginiana*) and/or herbaceous layer (white baneberry (*Actaea pachypoda*), Pennsylvania sedge (*Carex pensylvanica*), Robert geranium (*Geranium robertianum*), and roundlobe hepatica (*Hepatica nobilis* var. *obtusa*)……(go to UW24)

UW24.Enriched oak forests with abundant hickory species (hickories comprise 10-20% of canopy cover); oak-hickory forests lacking park/lawn-like sedge cover in the herbaceous layer; hophornbeam and Pennsylvania sedge are present, not abundant, and provide low cover….……..…**Dry - Rich Oak - Hickory Forest (CEGL006301)**
=[*Quercus rubra - Carya (glabra, ovata) / Ostrya virginiana / Carex lucorum* Forest; =Northern Red Oak - (Pignut Hickory, Shagbark Hickory) / Hophornbeam / Blue Ridge Sedge Forest]

UW24. Enriched oak forests without abundant hickory species; hickory trees typically comprise less than 10% of total canopy cover; oak forests dominated by northern red oak in association with sugar maple and/or white ash……...…….
..……..**Mesic Sugar Maple - Ash - Oak - Hickory Forest (CEGL006046)**
[=*Acer saccharum - Quercus rubra / Hepatica nobilis* var. *obtusa* Forest; =Sugar Maple - Northern Red Oak / Round-lobe Liverleaf Forest]

UW23.Oak forests lacking significant cover of enrichment indicators; hickory species may be present in low abundance and cover……(go to UW25)

UW25.Oak forest or woodland established on rocky upper slopes or hill summits; canopy cover is variable, ranging from open and patchy to closed depending on site conditions; stand dominated by northern red oak (*Quercus rubra*) with the minor associates black oak (*Quercus velutina*), chestnut oak (*Quercus prinus*), red maple, gray birch (*Betula populifolia*), and other tree species; the shrub layer is often comprised of blueberry (*Vaccinium* spp.), huckleberry (*Gaylussacia baccata*), and sweet fern (*Comptonia peregrina*)……..….
……..**Red Oak - Heath Woodland / Rocky Summit (CEGL006134)**
[=*Quercus rubra - (Quercus prinus) / Vaccinium* spp. / *Deschampsia flexuosa* Woodland; =Northern Red Oak - (Chestnut Oak) / Blueberry species / Wavy Hairgrass Woodland]

UW25.Oak forest not necessarily established on rocky upper slopes or summits…..…
……...……(go to UW26)

UW26.Mixed oak forest dominated by scarlet oak (*Quercus coccinea*) and white oak (*Quercus alba*) largely without species of hickory; flowering dogwood (*Cornus florida*) characteristic in the shrub layer when present……
……**Northeastern Dry Oak - Hickory Forest (CEGL006336)**
[=*Quercus (alba, rubra, velutina)* - *Carya* spp. / *Viburnum acerifolium* Forest; =(White Oak, Northern Red Oak, Black Oak) / Hickory species / Mapleleaf Viburnum Forest]

UW26.Northern red oak forest with strong component of northern hardwood species, including sugar maple and American beech……..
……..……**Red Oak - Northern Hardwood Forest (CEGL006173)**
[=*Quercus rubra* - *Acer saccharum* - *Fagus grandifolia / Viburnum acerifolium* Forest; =Northern Red Oak - Sugar Maple - American Beech / Mapleleaf Viburnum Forest]

UW19.Forests not dominated by species of oak (oaks may be present but not abundant in the canopy); common canopy species include red maple or northern hardwoods including sugar maple, yellow birch, and American beech……(go to UW27)

UW27.Forests primarily deciduous, mid-successional…..…...……(go to UW28)

UW28.Forests mid-successional with a closed canopy heavily dominated by Norway maple…….
……...……Norway Maple Forest (CEGL006047)
[=*Acer platanoides* Forest; =Norway Maple Forest]

UW28.Forests mid-successional with an open-to-closed canopy dominated by either red maple with eastern white pine or by a variable mix that may include black cherry, white ash, American elm (*Ulmus americana*), and red maple……..…(go to UW29)

UW29. Forests mid-successional with an open-to-closed canopy co-dominated by red maple and eastern white pine; northern red oak (*Quercus rubra*), white ash, and sugar maple are usually present with low cover….……
…….**Northeastern Oak - Red Maple Successional Forest (CEGL006506)**
[=*Quercus rubra* - *Acer rubrum* - *Betula* spp. - *Pinus strobus* Forest =Northern Red Oak - Red Maple - Birch species - Eastern White Pine Forest]

UW29.Forests mid-successional, dominated by a variable mix of trees that include black cherry, white ash, eastern red-cedar (*Juniperus virginiana*), green ash (*Fraxinus pennsylvanica*), American sycamore (*Platanus occidentalis*), American elm, and red maple; stands typically occur on wetter soils than the above type (CEGL006506)…...
……..……..….**Northeastern Modified Successional Forest (CEGL006599)**
[=*Prunus serotina* - *Liriodendron tulipifera* - *Acer rubrum* - *Fraxinus Americana* Forest; =Black Cherry – Tulip Tree – Red Maple – Green Ash Forest]

UW27.Forests primarily deciduous, late successional……(go to UW30)

UW30.Late successional deciduous forests with the canopy layer enrichment indicators of sugar maple, American basswood, white ash, hophornbeam (*Ostrya virginiana*), and species of hickory; herbaceous layer enrichment indicators include northern maidenhair (*Adiantum pedatum*), white baneberry (*Actaea pachypoda*), roundleaf yellow violet (*Viola rotundifolia*), roundlobe hepatica (*Hepatica nobilis* var. *obtusa*), broadleaf sedge (*Carex platyphylla*), and Robert geranium (*Geranium robertianum*)……..(go to UW31)

UW31.Enriched northern hardwood forests with a strong component of oak species (25-50% cover)……..…….…….…….(go to UW32)

UW32.Sugar maple-oak species dominated forests with abundant hickory species (comprising 10-20% of the total canopy cover)….…...……..…(go to UW33)

UW33.Sugar maple-oak species forests lacking dense/park-like sedge herbaceous cover/lawn; hophornbeam in the shrub layer and Pennsylvania sedge (*Carex pennsylvanica*)in the herbaceous layer are present, but not abundantly/in low cover…..……..……**Dry- Rich Oak - Hickory Forest (CEGL006301)**
=[*Quercus rubra - Carya (glabra, ovata) / Ostrya virginiana / Carex lucorum* Forest;
=Northern Red Oak - (Pignut Hickory, Shagbark Hickory) / Hophornbeam / Blue Ridge Sedge Forest]

UW33.Sugar maple-oak species forests dominated by northern red oak *(Quercus rubra*) with white ash common (lacks abundant hickory species…….……
……..**Mesic Sugar Maple - Ash - Oak - Hickory Forest (CEGL006046)**
[=*Acer saccharum - Quercus rubra / Hepatica nobilis* var. *obtusa* Forest;
=Sugar Maple - Northern Red Oak / Round-lobe Liverleaf Forest]

UW32.Sugar maple-oak species dominated forests without abundant hickory species; the canopy associate tulip tree and other hardwood species contribute to canopy cover…..….…….…….…….……(go to UW34)

UW34.Sugar maple-oak species forests dominated by sugar maple and northern red oak (*Quercus rubra*); white oak (*Quercus alba*) and tulip tree are common associates; hickory species and red maple may also occur…..…..……
……...**High Allegheny Rich Red Oak - Sugar Maple Forest (CEGL006125)**
[=*Quercus rubra - Acer saccharum - Liriodendron tulipifera* Forest;
=Northern Red Oak - Sugar Maple - Tuliptree Forest]

UW34.Sugar maples and/or tulip trees planted in obvious rows……
……..……**Hardwood Plantation (CEGL006613)**
[=*Acer saccharum – Liriodendron tulipifera* Hardwood Plantation;
=Sugar Maple – Tulip Tree Hardwood Plantation]

UW31.Enriched northern hardwood forests with a weak or lacking component of oak species; without abundant oak species or oak species in low cover..……(go to UW35)

UW35.Forest dominated by sugar maple with canopy associates including white ash, American beech, American basswood, white oak *(Quercus alba*), and scarlet oak (*Quercus alba)* that are present in lesser amounts and provide low cover; rich indicators including northern maidenhair, white baneberry, and broadleaf sedge are usually present; this forest type is less rich than the next type (CEGL005008)…..…
…….……...……..**Semi-rich Northern Hardwood Forest (CEGL006211)**
[=*Acer saccharum - (Fraxinus americana) / Arisaema triphyllum* Forest;
=Sugar Maple - (White Ash) / Jack-in-the-Pulpit Forest]

UW35. Forest dominated by sugar maple, American basswood, and/or white ash established on nutrient-rich, mesic or wet mesic sites on sloped-to-rolling terrain; rich herbaceous indicators including northern maidenhair, white baneberry, and broadleaf sedge are sometimes abundant……..……
…**Sugar Maple - Ash - Basswood Northern Rich Mesic Forest (CEGL005008)**
[=*Acer saccharum - Fraxinus americana - Tilia americana / Acer spicatum / Caulophyllum thalictroides* Forest;
=Sugar Maple - White Ash - American Basswood / Mountain Maple / Blue Cohosh Forest]

UW30.Late successional deciduous forests not as above; northern hardwood species dominant but canopy and herbaceous layer enrichment indicators lacking.(go to UW36)

UW36.Northern hardwood forests with significant oak species canopy cover (conifers sparse or absent); co-dominant trees are sugar maple and northern red oak (*Quercus rubra*) with low cover of American beech……..…….
…..……..….…….**Red Oak - Northern Hardwood Forest (CEGL006173)**
[=*Quercus rubra - Acer saccharum - Fagus grandifolia / Viburnum acerifolium* Forest;
=Northern Red Oak - Sugar Maple - American Beech / Mapleleaf Viburnum Forest]

UW36.Northern hardwood forests with significant eastern hemlock canopy cover…..……..……..……..……(go to UW37)

UW37.Mixed eastern hemlock-hardwood forest with a strong component of northern hardwood tree species and lacking a significant presence of oak species, eastern white pine, or sweet birch; sugar maple, yellow birch, and American beech are common associates in moderate-to-high cover…..…….
…..……**Hemlock - Northern Hardwood Forest (CEGL006109)**
[=*Tsuga canadensis - Betula alleghaniensis - Acer saccharum / Dryopteris intermedia* Forest;
=Eastern Hemlock - Yellow Birch - Sugar Maple / Intermediate Woodfern Forest]

UW37.Mixed eastern hemlock-hardwood forest with a strong component of American beech and/or a common occurrence of oak species and/or sweet birch; sites are generally drier than other eastern hemlock forests…….……
……**Hemlock - Beech - Oak Forest (CEGL006088)**

[=*Tsuga canadensis* - *Fagus grandifolia* - *Quercus rubra* Forest;
=Eastern Hemlock - American Beech - Northern Red Oak Forest]

WETLAND FORESTS KEY

This key includes wet forests of basins, saturated slopes, or other lowlands.

WF1.Intermittent streams or forested seeps dominated by skunk cabbage (*Symplocarpus foetidus*). Canopy similar to surrounding upland forest…….……..……..……..……..**Skunk Cabbage – Orange Jewelweed Seep (CEGL006567)**
[=*Symplocarpus foetidus* - *Impatiens capensis* Herbaceous Vegetation;
=Skunk-cabbage - Orange Jewelweed Herbaceous Vegetation]

WF1.Forested swamps characterized by a mix of conifers and/or hardwoods……..…(go to WF2)

WF2.Mixed conifer and hardwood swamp characterized by eastern hemlock (*Tsuga canadensis*) and yellow birch (*Betula alleghaniensis*); an associated conifer is eastern white pine (*Pinus strobus*) and associated hardwoods include yellow birch (*Betula alleghaniensis*), red maple (*Acer rubrum*), blackgum (*Nyssa sylvatica*), and black ash (*Fraxinus nigra*)..……
…..…….**Hemlock - Hardwood Swamp (CEGL006226)**
[=*Tsuga canadensis* - *Betula alleghaniensis / Ilex verticillata / Sphagnum* spp. Forest;
=Eastern Hemlock - Yellow Birch / Common Winterberry / Peatmoss species Forest]

WF2.Hardwood forest swamp characterized by red maple, pin oak (*Quercus palustris*), swamp white oak (*Quercus bicolor*), and/or blackgum….…….……(go to WF3)

WF3.Hardwood forest swamp strongly dominated by red maple with scattered American elm (*Ulmus americana*) trees in the canopy layer….…….……(go to WF4)

WF4.Red maple - American elm forest with groundwater seepage (although not very enriched) which supports sensitive fern (*Onoclea sensibilis*) and skunk cabbage in the herbaceous layer……
…**Southern New England / Northern Piedmont Red Maple Seepage Swamp (CEGL006406)**
[=*Acer rubrum* - *Fraxinus (pennsylvanica, americana) / Lindera benzoin / Symplocarpus foetidus* Forest;
=Red Maple - (Green Ash, White Ash) / Northern Spicebush / Skunk-cabbage Forest]

WF4.Open red maple canopy with low cover of American elm and occasionally eastern hemlock or eastern white pine in low cover; upright sedge (*Carex stricta*), additional sedge species and species of forbs characterize the herbaceous layer…….……...
..…….……**Red Maple / Tussock Sedge Wooded Marsh (CEGL006119)**
[=*Acer rubrum / Carex stricta* - *Onoclea sensibilis* Woodland;
=Red Maple / Upright Sedge - Sensitive Fern Woodland]

WF3.Hardwood forest swamp characterized by red maple, pin oak, swamp white oak, and/or blackgum…..……..….……(go to WF5)

WF5. Red maple-pin oak and/or swamp white oak characterize the hardwood forest canopy layer; American elm and blackgum trees may be present in low cover…..……
…..…….……..**Northeastern Pin Oak - Swamp White Oak Forest (CEGL006240)**
[=*Quercus palustris* - *(Quercus bicolor)* - *Acer rubrum / Vaccinium corymbosum / Osmunda cinnamomea* Forest;
=Pin Oak - (Swamp White Oak) - Red Maple / Highbush Blueberry / Cinnamon Fern Forest]

WF5.Red maple- blackgum and/or yellow birch and/or the conifers white pine, and eastern hemlock characterize the hardwood forest canopy layer; the shrub and herbaceous layers provide dense cover within the stand…….
. …….**Red Maple - Blackgum Basin Swamp (CEGL006014)**
[=*Acer rubrum* - *Nyssa sylvatica* - *Betula alleghaniensis / Sphagnum* spp. Forest;
=Red Maple - Blackgum - Yellow Birch / Peatmoss species Forest]

WET SHRUBLANDS KEY

This key contains vegetation commonly known as shrub swamps.

WS1.Shrub vegetation characterized by common buttonbush (*Cephalanthus occidentalis)*; habitat variable - low basins, pond shores, streamsides, riversides; shrub wetlands with common buttonbush as a dominant and characteristic tall and short shrub in association with highbush blueberry (*Vaccinium corymbosum*), northern spicebush (*Lindera benzoin*), and common winterberry (*Ilex verticillata*) in the shrub layer, and sensitive fern (*Onoclea sensibilis*) in the herbaceous layer…...……..……**Northeastern Buttonbush Shrub Swamp (CEGL006069)**
[=*Cephalanthus occidentalis – Decodon verticillatus* Shrubland;
=Common Buttonbush – Swamp Loosestrife Shrubland]

WS1.Shrub vegetation within alluvial or wet meadow settings characterized by dogwood (*Cornus* spp.) or white meadowsweet (*Spiraea alba* var. *latifolia*) with swamp rose (*Rosa palustris*) and/or a variety of herbaceous wet meadow species.……(go to WS2)

WS2.Shrub wetlands within alluvial sites characterized by silky dogwood (*Cornus amomum*), gray dogwood (*Cornus racemosa*), swamp rose, common winterberry, speckled alder (*Alnus incana* ssp. *rugosa*), and other shrub species...……..**Alluvial Alder Swamp (CEGL006414)**
[=*Cornus amomum – Alnus serrulata* Shrubland; =Silky Dogwood – Hazel Alder Shrubland]

WS2.Shrub wetlands and wet meadows characterized by co-dominance of white meadowsweet, swamp rose, and a variety of herbaceous wet meadow species……..……
……..…..…**Steeplebush / Reed Canarygrass Successional Wet Meadow (CEGL006571)**
[=*Spiraea tomentosa – Rubus* spp *. / Phalaris arundinacea* Shrubland;
=Steeplebush – Blackberry species / Reed Canarygrass Shrubland]

OPEN UPLAND VEGETATION KEY

This key includes natural and semi-natural upland vegetation (vegetation that grows spontaneously without human management) that is primarily treeless (scattered stunted trees may be present). It includes a variety of habitats: rock outcrops, cliffs, old fields, and vernal pools that are dominated largely by herbaceous vegetation or lichens.

UO1.Successional fields characterized by a mix of herbs and graminoids; vegetation is dominated by non-native, early successional grasses and herbs on abandoned pasture and post-agricultural fields. The vegetation of these old fields is quite variable from one site to the next. The most characteristic and consistent species are smooth brome (*Bromus inermis*), Kentucky bluegrass (*Poa pratensis*), orchardgrass (*Dactylis glomerata*), timothy (*Phleum pratense*), Canada goldenrod (*Solidago canadensis*), wrinkleleaf goldenrod (*Solidago rugosa*), flat-top goldenrod (*Euthamia graminifolia*), and common milkweed (*Asclepias syriaca*) with numerous associates…….**Northeastern Old Field (CEGL006107)**
[=*Bromus inermis – Poa pratensis - Dactylis glomerata - Phleum pratense - Solidago* spp. Semi-natural Herbaceous Vegetation;
=Smooth Brome – Kentucky Bluegrass - Orchardgrass – Timothy – Goldenrod species Semi-natural Herbaceous Vegetation]

UO1.Ephemeral pools within forested habitats characterized by a mix of shrub and herbaceous vegetation, with over hanging trees and shrubs from surrounding forests and woodlands or shoreline outcrops characterized by sparse-to-dense cover of stunted trees, shrubs, herbs, and graminoids……..……(go to UO2)

UO2.Sparse vegetation of forested vernal pools, characterized by fluctuating water levels supporting herbaceous species dominated by cinnamon fern (*Osmunda cinnamomea*) with lesser cover of royal fern (*Osmunda regalis*) and smallspike false nettle (*Boehmeria cylindrica*). A suite of invertebrate and amphibian species, including fingernail clams (*Sphaeriidae)*, wood frogs (*Rana sylvatica*), and spotted salamanders (*Ambystoma maculatum*) may also be present…….....….**Eastern Woodland Vernal Pool (CEGL006453)**
[=*Osmunda (cinnamomea, regalis) - Boehmeria cylindrica* Herbaceous Vegetation;
=(Cinnamon Fern, Royal Fern) – Smallspike False Nettle Herbaceous Vegetation)]

UO2.Vegetation established on shoreline outcrops along Hudson River, a mix of shrub, tree, and herbaceous species including desert false indigo (*Amorpha fruticosa*), common ninebark (*Physocarpus opulifolius*), eastern red-cedar (*Juniperus virginiana*), northern white cedar (*Thuja occidentalis*), little bluestem (*Schizachyrium scoparium*), and Canada bluegrass (*Poa compressa*), among other associated species…….. ……...**Northern Riverside Rock Outcrop (CEGL006284)**
[=*Amorpha fruticosa – Physocarpus opulifolius / Schizachyrium scoparium* Shrubland;
=Desert False Indigo – Common Ninebark / Little Bluestem Shrubland]

HERBACEOUS WETLANDS KEY

This key includes herbaceous vegetation commonly known as marshes, emergent wetlands, seeps, springs, ponds, tidal wetlands (freshwater and brackish water), subtidal marshes, and open water, as well as other vegetation occurring in naturally small patches within wetlands.

WH1.Herbaceous freshwater wetlands associated with/established along intermittent streams or on forested seeps…..……..……(go to WH2)

WH2. Forested seeps dominated by skunk cabbage (*Symplocarpus foetidus*). Canopy similar to that of surrounding upland forest…… ……..…**Skunk Cabbage – Orange Jewelweed Seep (CEGL006567)**
[=*Symplocarpus foetidus – Impatiens capensis* Herbaceous Vegetation;
=Skunk Cabbage – Orange Jewelweed Herbaceous Vegetation]

WH2. Forested seeps, springs, seepage areas, and intermittent streams that are dominated by American golden saxifrage (*Chrysosplenium americanum*), sensitive fern (*Onoclea sensibilis*), skunk cabbage, fowl mannagrass (*Glyceria striata*), Japanese stiltgrass (*Microstegium vimineum*), Jack in the pulpit (*Arisaema triphyllum*), orange jewelweed (*Impatiens capensis*), among others……..……**Golden-saxifrage Forested Seep (CEGL006193)**
[=*Chrysosplenium americanum* Herbaceous Vegetation;
=American Golden-saxifrage Herbaceous Vegetation]

WH1.Open wetlands not as above, comprised of non-tidal freshwater marshes (including submerged vegetation (soils typically organic, often deep) or emergent marsh vegetation; majority of plants above water although floating-leaved plants may be a component) or comprised of tidal marshes, including freshwater and brackish…...…….(go to WH3)

WH3. Freshwater non-tidal marsh dominated by graminoids (grasses, sedges, rushes, cattails, etc.) or freshwater marsh dominated by broad-leaved emergent herbs (low cover of white meadowsweet (*Spiraea alba* var. *latifolia*) and swamp rose (*Rosa palustris*) shrubs may be present)…..……....(go to WH4)

WH4.Freshwater marsh dominated by graminoids…..…….……..(go to WH5)

WH5.Freshwater marsh dominated by species of cattail (*Typha* spp.); marsh vegetation dominated by broadleaf cattail (*Typha latifolia*).…**Eastern Cattail Marsh (CEGL006153)**
[=*Typha (angustifolia, latifolia) – Schoenoplectus* spp. Eastern Herbaceous Vegetation;
=(Narrowleaf Cattail, Broadleaf Cattail) – Clubrush species Eastern Herbaceous Vegetation]

WH5.Freshwater marsh dominated by rice cutgrass (*Leersia oryzoides*) or common reed (*Phragmites australis*)…..…….……...(go to WH6)

WH6.Vegetation dominated by rice cutgrass with Japanese stiltgrass, reed canarygrass *(Phalaris arundinacea*), swamp smartweed *(Polygonum hydropiperoides*), arrowleaf tearthumb (*Polygonum sagittatum*), smallspike false nettle, and jewelweed occurring as fairly consistent associates…….**Central Appalachian Cutgrass Marsh (CEGL006461)**
[=*Leersia oryzoides – Sagittaria latifolia* Herbaceous Vegetation;
=Rice Cutgrass – Broadleaf Arrowhead Herbaceous Vegetation]

WH6.Freshwater marsh dominated by common reed, often to the exclusion of other species..……..……..……..……**Eastern Reed Marsh (CEGL004141)**
[=*Phalaris arundinacea* Eastern North America Temperate Semi-natural Herbaceous Vegetation;
=Common Reed Eastern North America Temperate Semi-natural Herbaceous Vegetation]

WH4.Freshwater marsh dominated by broad-leaved emergent herbs (forbs)...…..(go to WH7)

WH7.Vegetation of ponds with permanent, standing water; vegetation dominated by common duckweed (*Lemna minor*)……..……..…**Duckweed Pond (CEGL005451)**
[=*Lemna* spp. Permanently Flooded Herbaceous Vegetation;
=Duckweed species Permanently Flooded Herbaceous Vegetation]

WH7.Vegetation of marshes without permanent standing water; vegetation characterized by the herbs purple loosestrife (*Lythrum salicaria*) and/or sensitive fern with hairy sedge (*Carex lacustris*), or spotted joepyeweed (*Eupatorium maculatum* var. *maculatum*) with sensitive fern; low cover of the shrubs white meadowsweet and/or swamp rose may occur in one association with a variety of herbaceous wet meadow species….……(go to WH8)

WH8.Association dominated by the invasive, exotic purple loosestrife to the exclusion of other species..…….…….……**Purple Loosestrife Wetland (CEGL006403)**
[=*Lythrum salicaria* Semi-natural Herbaceous Vegetation;
=Purple Loosestrife Semi-natural Herbaceous Vegetation]

WH8.Association dominated by sensitive fern with hairy sedge, or spotted joepyeweed (*Eupatorium maculatum* var. *maculatum*) with sensitive fern (*Onoclea sensibilis*); low cover of the shrubs white meadowsweet and/or swamp rose may occur in one association with a variety of herbaceous wet meadow species….…….…….…….(go to WH9)

WH9.Vegetation is characterized by spotted joepyeweed with sensitive fern, eastern marsh fern (*Thelypteris palustris*), field horsetail (*Equisetum arvense*), flat-top goldenrod (*Euthamia graminifolia*), and a diverse mix of varied herbs…… ……**Mixed Forb Marsh (CEGL006446)**
[=*Eupatorium maculatum - Onoclea sensibilis – Thelypteris palustris* – Mixed Forbs Herbaceous Vegetation;
=Spotted Joepyeweed – Sensitive Fern – Eastern Marsh Fern – Mixed Forbs Herbaceous Vegetation]

WH9. Site characterized by shrub or herbaceous vegetation with co-dominance of white meadowsweet, swamp rose, and a variety of herbaceous wet meadow species…... ……**Steeplebush / Reed Canarygrass Successional Wet Meadow (CEGL006571)**
[=*Spiraea tomentosa – Rubus* spp . / *Phalaris arundinacea* Shrubland; =Steeplebush – Blackberry species / Reed Canarygrass Shrubland]

WH3.Freshwater or brackish tidal marsh…..…….……..(go to WH10)

WH10.Brackish tidal marsh; vegetation characterized by narrowleaf cattail (*Typha angustifolia*), orange jewelweed (*Impatiens capensis*), green arrow arum (*Peltandra virginica*), swamp smartweed, longroot smartweed (*Polygonum amphibium* var. *emersum*), bur-reed (*Sparganium* spp.), and devil's beggartick (*Bidens frondosa*)……..…… …….....……..**Cattail Brackish Tidal Marsh (CEGL004201)**
[=*Typha angustifolia* - *Hibiscus moscheutos* Herbaceous Vegetation; =Narrowleaf Cattail - Eastern Rosemallow Herbaceous Vegetation**]**

WH10.Freshwater tidal marshes.....……..(go to WH11)

WH11.Marsh dominated by annual wildrice associated with green arrow arum, broad-fruit bur-reed (*Sparganium eurycarpum*), common arrowhead (*Sagittaria latifolia*), and other herbaceous species…..……..…**Atlantic Coast Wild Rice Tidal Marsh (CEGL004202)**
[=*Zizania aquatica* Tidal Herbaceous Vegetation; =Annual Wildrice Tidal Herbaceous Vegetation]

WH11.Marsh dominated by yellow pond-lily (*Nuphar lutea* ssp. *advena*) or American eelgrass (*Vallisneria americana*)….……..…….…….……..…(go to WH12)

WH12.Tidal marsh dominated by yellow pond-lily with low cover by broadfruit bur-reed and annual wildrice..….……..…**Broadleaf Pond-lily Tidal Marsh (CEGL004472)**
[=*Nuphar lutea* ssp. *advena* Tidal Herbaceous Vegetation; =Yellow Pond-lily Tidal Herbaceous Vegetation]

WH12.Subtidal marsh with submerged or emergent plants and dominated by American eelgrass, with only minor floating-leaved components…...…… ……**Open Water Marsh with Mixed Submergents/Emergents (CEGL006196)**
[=*Vallisneria americana* - *Potamogeton perfoliatus* Herbaceous Vegetation; =American Eelgrass - Claspingleaf Pondweed Herbaceous Vegetation]

Appendix F: Local and Global descriptions of Vegetation Associations, Roosevelt – Vanderbilt National Historic Sites

Vascular plant species nomenclature within the local and global descriptions follows the nationally standardized list of Kartesz (1999), with very few exceptions. This nomenclature differs from PLANTS 3.5 Database (USDA NRCS 2004) in only a very few cases, and when this difference occurs, synonymy is indicated parenthetically in the local description information. Nomenclature for nonvascular plants (mosses) follows Anderson (1990) and Anderson et al. (1990). English names for associations and alliances use NatureServe Central Ecology-accepted names and may differ slightly from PLANTS 3.5 Database (USDA NRCS 2004) common names that are used within the local description information and throughout the rest of the report. Sources cited in the local and global vegetation descriptions are included in the literature section at the end of this appendix. Representative photographs of the vegetation types are provided after the descriptions when available.

TERRESTRIAL ECOLOGICAL CLASSIFICATIONS

Alliances and Associations of Roosevelt-Vanderbilt National Historic Sites

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This subset of the International Ecological Classification Standard covers vegetation alliances and associations attributed to Roosevelt-Vanderbilt National Historic Site. 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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Local Name: Red Oak - Heath Woodland / Rocky Summit (CEGL006134)

SYNONYMS

USNVC English Name: **Northern Red Oak - (Chestnut Oak) / Blueberry species / Wavy Hairgrass Woodland**

USNVC Scientific Name: ***Quercus rubra* - (*Quercus prinus*) / *Vaccinium* spp. / *Deschampsia flexuosa* Woodland**

USNVC Identifier: **CEGL006134**

LOCAL INFORMATION

Environmental Description: This association occurs as a rare type at ROVA on rocky upper slopes or ridge tops on well-drained silt loam soils with underlying bedrock comprised of shale and siltstone with minor amounts of sandstone of the Ordovician Formation. Adjacent associations include Northeastern Dry Oak-Hickory Forest (CEGL006336) and Southern Blue Ridge Mafic Barrens (CEGL0006196).

Vegetation Description: The canopy for this dry acidic woodland/forest type at Vanderbilt Mansion NHS is somewhat more closed than is typical for this association. The lone occurrence of this type at ROVA is situated upslope from the Hudson River. The tree canopy averages 65% cover and 13 meters in height. Characteristic species include *Quercus rubra* (northern red oak), *Quercus coccinea* (scarlet oak), and *Pinus rigida* (pitch pine). The tree subcanopy has 40% canopy coverage and averages 7 meters in height and is dominated by *Pinus rigida* (pitch pine), *Quercus rubra* (northern red oak), *Pinus strobus* (eastern white pine), and *Quercus prinus* (chestnut oak). The very sparse tall shrub layer averages 5% cover and 3 meters in height. The most abundant species is *Tsuga canadensis* (eastern hemlock). The short shrub layer averages 28% cover and is dominated by *Vaccinium pallidum* (Blue Ridge blueberry) and *Hamamelis virginiana* (American witchhazel). The herbaceous layer has 20% cover and is heavily dominated by *Gaultheria procumbens* (eastern teaberry).

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Quercus coccinea* (scarlet oak)
Tree canopy/subcanopy	Broad-leaved deciduous tree	*Quercus rubra* (northern red oak)
Tree subcanopy	Needle-leaved coniferous tree	*Pinus rigida* (pitch pine)
Tall shrub/sapling	Needle-leaved coniferous tree	*Tsuga canadensis* (eastern hemlock)
Short shrub/sapling	Broad-leaved deciduous shrub	*Vaccinium pallidum* (Blue Ridge blueberry)
Herb (field)	Forb	*Gaultheria procumbens* (eastern teaberry)

Characteristic Species: *Quercus rubra* (northern red oak), *Quercus coccinea* (scarlet oak), *Pinus rigida* (pitch pine), *Vaccinium pallidum* (Blue Ridge blueberry), and *Gaultheria procumbens* (eastern teaberry).

Other Noteworthy Species: None

Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
NY	S4*	B	1	Appalachian oak-hickory forest	Edinger et al. 2002

Local Range: This upper slope dry acidic woodland was only documented at Vanderbilt Mansion NHS adjacent to the Hudson River.

Classification Comments: This association was classified to this type with a suite of species that includes *Quercus rubra* (northern red oak), *Quercus coccinea* (scarlet oak), *Pinus rigida* (pitch pine), *Vaccinium pallidum* (Blue Ridge blueberry), and *Gaultheria procumbens* (eastern teaberry) in combination with substrate, canopy percentage, and topographic position.
Other Comments: None.
Local Description Authors: Frederick C. Sechler, Jr.
Plots: Vanderbilt Mansion NHS (ROVA.12)
AA Points: None.
Roosevelt-Vanderbilt National Historic Site Inventory Notes: None.
None.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Class	Forest and Woodland (1)
Subclass	Temperate Forest (1.C)
Formation	Cool Temperate Forest (1.C.2)
Division	Eastern North American Cool Temperate Forest (D008)
Macrogroup	Central Oak-Hardwood and Pine Forest (M012)
Group	Appalachian Oak - Chestnut Forest Group (G015)
Alliance*	*Quercus rubra - Quercus prinus* Woodland Alliance (A.624)
Alliance (English name)*	Northern Red Oak - Chestnut Oak Woodland Alliance
Association	*Quercus rubra - (Quercus prinus) / Vaccinium* spp. / *Deschampsia flexuosa* Woodland
Association (English name)	Northern Red Oak - (Chestnut Oak) / Blueberry species / Wavy Hairgrass Woodland
Ecological System(s)	Northern Appalachian-Acadian Rocky Heath Outcrop (CES201.571) Central and Southern Appalachian Montane Oak Forest (CES202.596) Central Appalachian Pine-Oak Rocky Woodland (CES202.600)

* Alliance assignment as of 2007. All USNVC alliances are currently (2014) under review and revision.

GLOBAL DESCRIPTION

Concept Summary: This dry, acidic oak woodland occurs on rocky upper slopes and summits from New England south to the highest peaks in West Virginia. Typical settings are low- to mid-elevation summits and south-facing, upper slopes. Elevations of known occurrences range from near sea level to about 610 m (0-2000 feet) in New England, and to 1370 m (4500 feet) in West Virginia. Soils are shallow, well-drained, acidic, nutrient-poor gravels and coarse sands, often with prominent exposed bedrock. Canopy cover is variable, ranging from open and patchy to closed depending on site conditions. It overtops a dwarf-shrub layer that is frequently extensive and a sparse tall-shrub layer. Herb cover is patchy and variable. Bryoid cover is minor, scattered patches on the rocky substrate. The canopy is dominated by scattered, often stunted *Quercus rubra* (northern red oak) with minor associates depending on geography and often including *Quercus velutina* (black oak), *Quercus prinus* (chestnut oak), *Betula populifolia* (gray birch), *Betula papyrifera* (paper birch), *Betula lenta* (sweet birch), and *Acer rubrum* (red maple) or *Quercus coccinea* (scarlet oak) in more coastal regions. *Quercus rubra* (northern red oak) tends to be the only oak at the northern end of the range. *Pinus strobus* (eastern white pine), *Pinus rigida* (pitch pine), or other conifers may be present, but only in minor amounts. The dwarf-shrub layer is strongly dominated by heaths, especially *Vaccinium angustifolium* (lowbush blueberry), *Vaccinium pallidum* (Blue Ridge blueberry), *Vaccinium myrtilloides* (velvetleaf huckleberry), and *Gaylussacia baccata* (black huckleberry) with *Gaylussacia frondosa* (blue huckleberry), *Comptonia peregrina* (sweet fern), and *Kalmia angustifolia* (sheep laurel) also common. Tall shrubs may include *Quercus ilicifolia* (bear oak), *Hamamelis virginiana*

(American witch-hazel), *Amelanchier* (serviceberry) spp., and *Prunus pensylvanica* (pin cherry). The herbaceous layer is comprised of *Deschampsia flexuosa* (wavy hairgrass), *Danthonia spicata* (poverty oatgrass), *Carex lucorum* (Blue Ridge sedge), *Pteridium aquilinum* (western brackenfern), *Comandra umbellata* (bastard toadflax), *Melampyrum lineare* (narrowleaf cowwheat), *Polygala paucifolia* (gaywings), *Epigaea repens* (trailing arbutus), *Gaultheria procumbens* (eastern teaberry), and *Aralia nudicaulis* (wild sarsaparilla). The bryophyte layer includes *Polytrichum commune* (polytrichum moss), *Leucobryum glaucum* (leucobryum moss), and others.

Environmental Description: This red oak woodland occurs on rocky upper slopes and summits from New England south to the highest peaks in West Virginia. Typical settings are low- to mid-elevation summits and south-facing, upper slopes. Elevations of known occurrences range from near sea level to about 610 m (0-2000 feet) in New England, and to 1370 m (4500 feet) in West Virginia. Soils are shallow, well-drained, acidic, nutrient-poor gravels and coarse sands, often with prominent exposed bedrock.

Vegetation Description: The open and patchy canopy overtops a sparse tall-shrub layer, and dwarf-shrub layer is frequently extensive. Herb cover is patchy and variable. Bryoid cover is minor, scattered patches on the rocky substrate. The canopy is dominated by scattered, often stunted *Quercus rubra* (northern red oak) with minor associates depending on geography and often including *Quercus velutina* (black oak), *Quercus prinus* (chestnut oak), *Betula populifolia* (gray birch), *Betula papyrifera* (paper birch), *Betula lenta* (sweet birch), and *Acer rubrum* (red maple) with *Quercus coccinea* (scarlet oak) in more coastal regions. *Pinus strobus* (eastern white pine), *Pinus rigida* (pitch pine), or other conifers may be present, but only in minor amounts. The dwarf-shrub layer is strongly dominated by heaths, especially *Vaccinium angustifolium* (lowbush blueberry), *Vaccinium pallidum* (Blue Ridge blueberry), *Vaccinium myrtilloides* (velvetleaf huckleberry), and *Gaylussacia baccata* (black huckleberry) with *Gaylussacia frondosa* (blue huckleberry), *Comptonia peregrina* (sweet fern), and *Kalmia angustifolia* (sheep laurel) also common. Tall shrubs may include *Quercus ilicifolia* (bear oak), *Hamamelis virginiana* (American witch-hazel), *Amelanchier* (serviceberry) spp., and *Prunus pensylvanica* (pin cherry). The herbaceous layer is comprised of *Deschampsia flexuosa* (wavy hairgrass), *Danthonia spicata* (poverty oatgrass), *Carex lucorum* (Blue Ridge sedge), *Pteridium aquilinum* (western brackenfern), *Comandra umbellata* (bastard toadflax), *Melampyrum lineare* (narrowleaf cowwheat), *Polygala paucifolia* (gaywings), *Epigaea repens* (trailing arbutus), *Gaultheria procumbens* (eastern teaberry), and *Aralia nudicaulis* (wild sarsaparilla). The bryophyte layer includes *Polytrichum commune* (polytrichum moss), *Leucobryum glaucum* (leucobryum moss), and others.

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Quercus rubra* (northern red oak)
Tall shrub/sapling	Broad-leaved deciduous shrub	*Quercus ilicifolia* (bear oak)
Short shrub/sapling	Broad-leaved deciduous shrub	*Gaylussacia baccata* (black huckleberry), *Vaccinium angustifolium* (lowbush blueberry), *Vaccinium myrtilloides* (velvetleaf huckleberry), *Vaccinium pallidum* (Blue Ridge blueberry)
Herb (field)	Graminoid	*Deschampsia flexuosa* (wavy hairgrass)
Herb (field)	Fern or fern ally	*Pteridium aquilinum* (western brackenfern)

Characteristic Species: *Deschampsia flexuosa* (wavy hairgrass), *Quercus rubra* (northern red oak), *Vaccinium angustifolium* (lowbush blueberry), *Vaccinium pallidum* (Blue Ridge blueberry)

Other Noteworthy Species: Information not available.

USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: This red oak woodland occurs on low- to mid-elevation summits and south-facing, steep upper slopes from New England south to the highest peaks in West Virginia.
States/Provinces: CT, MA, ME, NH, NJ, NY, PA, VA?, VT, WV
Federal Lands: NPS (Acadia, Upper Delaware)

CONSERVATION STATUS

Rank: G3G5 (1-Dec-1997)
Reasons: Information not available.

CLASSIFICATION INFORMATION

Status: Standard
Confidence: 2 - Moderate
Comments: Information not available.
Similar Associations:

- (*Pinus strobus, Quercus rubra*) / *Danthonia spicata* Acidic Bedrock Wooded Herbaceous Vegetation (CEGL005101)
- *Betula alleghaniensis - Quercus rubra / Polypodium virginianum* Woodland (CEGL006320)
- *Quercus rubra - Acer rubrum - Betula* spp. - *Pinus strobus* Forest (CEGL006506)

Related Concepts:

- Dry Oak Woodland (Thompson 1996) B
- Northern Red Oak: 55 (Eyre 1980) B
- Red oak woodlands (NAP pers. comm. 1998) ?
- Red oak-chestnut oak acid mid-high elevation, rocky slopes (CAP pers. comm. 1998) ?
- SNE circumneutral rocky summit/rock outcrop community (Rawinski 1984) ?

SOURCES

Description Authors: S.C. Gawler, mod. S.L. Neid and E. Largay
References: Breden et al. 2001, CAP pers. comm. 1998, Eastern Ecology Working Group n.d., Edinger et al. 2002, Eyre 1980, Fike 1999, Fleming 1985, Gawler 2002, Lundgren 1999a, Metzler and Barrett 2003, NAP pers. comm. 1998, Northern Appalachian Ecology Working Group 2000, Rawinski 1984, Sperduto 2000a, Swain and Kearsley 2001, Thompson 1996, Thompson and Sorenson 2000

Local Name: Red-Cedar Rocky Summit (CEGL006002)

SYNONYMS

USNVC English Name: **Eastern Red-cedar - White Ash / Poverty Oatgrass / Canada Bluegrass Woodland**

USNVC Scientific Name: ***Juniperus virginiana - Fraxinus americana* / *Danthonia spicata - Poa compressa* Woodland**

USNVC Identifier: **CEGL006002**

LOCAL INFORMATION

Environmental Description: This association typically occurs as open woodlands on ridge tops, midslopes, and interfluves on exceedingly stony substrates. The soils consist of loams and silt loams with underlying bedrock of shale and siltstone with minor amounts of sandstone of the Ordovician Formation. The exceedingly dry and heat summer conditions can heavily influence the vegetation composition. Adjacent associations include Central Appalachian Hemlock - Chestnut Oak Forest (CEGL006923), Dry, Rich Oak - Hickory Forest (CEGL006236), Semi-rich Northern Hardwood Forest (CEGL006211), Red Oak - Northern Hardwood Forest (CEGL006173), Hemlock - Northern Hardwood Forest (CEGL006109), and Hemlock - Beech - Oak Forest (CEGL006088).

Vegetation Description: The relatively open tree canopy averages 35.8% percent cover and 9.3 meters in height. Characteristic species include *Juniperus virginiana* (eastern red-cedar), *Quercus rubra* (northern red oak), *Carya glabra* (pignut hickory) and *Fraxinus americana* (white ash). The sparse tree subcanopy averages 2.3% cover and 6 meters in height. Species found in the canopy layer characterize the subcanopy layer. The sparse tall shrub layer averages 10.3% cover and 3.2 meters in height. The layer is dominated by *Juniperus virginiana* (eastern red-cedar) with minor components *Staphylea trifolia* (American bladdernut), *Quercus rubra* (northern red oak), and *Viburnum rafinesquianum* (downy arrowwood). The short shrub layer averages 16% cover and is dominated by *Juniperus virginiana* (eastern red-cedar) and *Viburnum rafinesquianum* (downy arrowwood). The vine layer averages 8.6% cover and is characterized by *Toxicodendron radicans* (eastern poison ivy) and *Celastrus orbiculatus* (Asian bittersweet). The herbaceous layer averages 38.6% cover and is characterized by *Danthonia spicata* (poverty oatgrass), *Schizachyrium scoparium* (little bluestem), *Avena fatua* (wild oat), *Polypodium virginianum* (rock polypody), and *Dryopteris marginalis* (marginal woodfern).

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy/subcanopy	Broad-leaved deciduous tree	*Quercus rubra* (red oak), *Carya glabra* (pignut hickory), and *Fraxinus americana* (white ash)
Tree canopy/subcanopy	Needle-leaved coniferous tree	*Juniperus virginiana* (eastern red-cedar)
Tall/short shrub/sapling	Needle-leaved coniferous tree	*Juniperus virginiana* (eastern red-cedar)
Tall shrub/sapling	Broad-leaved deciduous tree	*Staphylea trifolia* (American bladdernut)
Short shrub/sapling	Broad-leaved deciduous tree	*Viburnum rafinesquianum* (downy arrowwood)
Herb (field)	Forb	*Dryopteris marginalis* (marginal woodfern), *Danthonia spicata* (poverty

oatgrass), *Schizachyrium scoparium* (little bluestem)

Characteristic Species: *Juniperus virginiana* (eastern red-cedar), *Staphylea trifolia* (American bladdernut), *Viburnum rafinesquianum* (downy arrowwood), and *Danthonia spicata* (poverty oatgrass).

Other Noteworthy Species: None.

Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
NY	S3*	B	1	Red-cedar Rocky Summit	Edinger et al. 2002

Local Range: This association was only documented at Home of Franklin D. Roosevelt NHS (excluding Roosevelt Farm and Forest) where it is very localized in distribution.

Classification Comments: This association was used to classify red-cedar rocky summits.

Other Comments: None.

Local Description Authors: Frederick C. Sechler, Jr.

Plots: Home of Franklin D. Roosevelt NHS (excluding Roosevelt Farm and Forest) (ROVA.21, ROVA.66, ROVA.56, ROVA.57, ROVA.62, ROVA.63, ROVA.66, ROVA.67, ROVA.70, , ROVA.78,).

AA Points: Home of Franklin D. Roosevelt NHS (excluding Roosevelt Farm and Forest (ROVA.90, ROVA.91).

Roosevelt-Vanderbilt National Historic Site Inventory Notes: None.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Class	Forest and Woodland (1)
Subclass	Temperate Forest (1.C)
Formation	Cool Temperate Forest (1.C.2)
Division	Eastern North American Cool Temperate Forest (D008)
Macrogroup	Central Oak-Hardwood and Pine Forest (M012)
Group	Chinkapin Oak – Ash – Red-cedar Alkaline Forest Group (G016)
Alliance*	*Juniperus virginiana* Woodland Alliance (A.545)
Alliance (English name)*	Eastern Red-cedar Woodland Alliance
Association	*Juniperus virginiana - Fraxinus americana / Danthonia spicata - Poa compressa* Woodland
Association (English name)	Eastern Red-cedar - White Ash / Poverty Oatgrass / Canada Bluegrass Woodland
Ecological System(s)	Central Appalachian Pine-Oak Rocky Woodland (CES202.600)

* Alliance assignment as of 2007. All USNVC alliances are currently (2014) under review and revision.

GLOBAL DESCRIPTION

Concept Summary: This traprock ridge open woodland is known from mountainous sites in New England, New Jersey, and Pennsylvania, and may occur in southeastern New York. The vegetation occurs primarily on exposed outcrops of basaltic rock in the Connecticut Valley of New England and the Piedmont physiographic province in New Jersey. While most sites are on igneous rock, along the Kittatinny Ridge in Pennsylvania and New Jersey, it occurs on conglomerates of the Shawangunk Formation. Sites supporting this community are upper slopes of basalt, diorite, or conglomerate ridges from 365-1050 m elevation, characteristically south- or west-facing and range in slope from 5-30 degrees. Most sites have minimal soil development. Tree cover is sparse, ranging from 5-30% cover (average 20%) with *Juniperus virginiana* (eastern red-cedar) being the most constant canopy tree. Other woody species sometimes present include *Fraxinus americana* (white ash), *Quercus rubra* (northern red oak), *Quercus prinus*

(chestnut oak), *Ostrya virginiana* (hophornbeam), and *Carya glabra* (pignut hickory). The actual canopy composition reflects, to some extent, the surrounding forest. The scattered shrub layer often includes *Rosa carolina* (Carolina rose), *Quercus prinus* (chestnut oak), *Quercus ilicifolia* (bear oak), *Rhus hirta* (staghorn sumac), *Vaccinium pallidum* (Blue Ridge blueberry), *Vaccinium angustifolium* (lowbush blueberry), *Viburnum rafinesquianum* (downy arrow-wood), and *Prunus virginiana* (chokecherry). The herbaceous layer usually covers 12-50% of the ground and is dominated by *Schizachyrium scoparium* (little bluestem), *Deschampsia flexuosa* (wavy hairgrass), and *Danthonia spicata* (poverty oatgrass), with their relative abundance varying from site to site. Numerous other herbaceous species occur in this community type, including *Carex pensylvanica* (Pennsylvania sedge), *Anthoxanthum odoratum* (sweet vernalgrass), *Hypericum gentianoides* (orangegrass), *Antennaria plantaginifolia* (woman's tobacco), *Corydalis sempervirens* (rock harlequin), *Solidago nemoralis* (gray goldenrod), *Poa compressa* (Canada bluegrass), *Maianthemum racemosum* (feathery false lily of the valley), *Uvularia perfoliata* (perfoliate bellwort), *Aquilegia canadensis* (red columbine), *Asclepias verticillata* (whorled milkweed), *Polygonum scandens* (climbing false buckwheat), *Krigia virginica* (Virginia dwarfdandelion), and *Houstonia longifolia* (longleaf summer bluet). No species is restricted to this community, but the assemblage listed above is very characteristic.

Environmental Description: This sparse woodland occurs primarily on exposed outcrops of basaltic rock in the Connecticut Valley of New England and the Piedmont physiographic province in New Jersey and adjacent Pennsylvania. While most sites are on igneous rock, along the Kittatinny Ridge in Pennsylvania and New Jersey, it occurs on conglomerates of the Shawangunk Formation. Sites supporting this community are upper slopes of basalt, diorite, or conglomerate ridges from 365-1050 m elevation. The ridges are characteristically south- or west-facing and range in slope from 5-30 degrees. Most sites have minimal soil development.

Vegetation Description: This community occurs as exposed, mainly herbaceous openings on ridge tops of resistant mafic rock. Occurrences are generally less than 0.1 ha in size. Tree cover is sparse, ranging from 5-30% cover (average 20%) with *Juniperus virginiana* (eastern red-cedar) being the most constant canopy tree. Other woody species sometimes present include *Fraxinus americana* (white ash), *Quercus rubra* (northern red oak), *Quercus prinus* (chestnut oak), *Ostrya virginiana* (hophornbeam), and *Carya glabra* (pignut hickory). The actual canopy composition reflects, to some extent, the surrounding forest. The scattered shrub layer often includes *Rosa carolina* (Carolina rose), *Quercus prinus* (chestnut oak), *Quercus ilicifolia* (bear oak), *Rhus hirta* (staghorn sumac), *Vaccinium pallidum* (Blue Ridge blueberry), *Vaccinium angustifolium* (lowbush blueberry), *Viburnum rafinesquianum* (downy arrow-wood), and *Prunus virginiana* (chokecherry). The herbaceous layer usually covers 12-50% of the ground and is dominated by *Schizachyrium scoparium* (little bluestem), *Deschampsia flexuosa* (wavy hairgrass), and *Danthonia spicata* (poverty oatgrass), with their relative abundance varying from site to site. Numerous other herbaceous species occur in this community type, including *Carex pensylvanica* (Pennsylvania sedge), *Anthoxanthum odoratum* (sweet vernalgrass), *Hypericum gentianoides* (orangegrass), *Antennaria plantaginifolia* (woman's tobacco), *Corydalis sempervirens* (rock harlequin), *Solidago nemoralis* (gray goldenrod), *Poa compressa* (Canada bluegrass), *Maianthemum racemosum* (feathery false lily of the valley), *Uvularia perfoliata* (perfoliate bellwort), *Aquilegia canadensis* (red columbine), *Asclepias verticillata* (whorled milkweed), *Polygonum scandens* (climbing false buckwheat), *Krigia virginica* (Virginia dwarfdandelion), and *Houstonia longifolia* (longleaf summer bluet). No species is restricted to this community, but the assemblage listed above is very characteristic.

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Juniperus virginiana* (eastern red-cedar)
Herb (field)	Graminoid	*Carex pensylvanica* (Pennsylvania sedge), *Danthonia spicata* (poverty oatgrass), *Deschampsia flexuosa* (wavy hairgrass), *Schizachyrium scoparium* (little bluestem)

Characteristic Species: *Danthonia spicata* (poverty oatgrass), *Deschampsia flexuosa* (wavy hairgrass), *Helianthemum bicknellii* (hoary frostweed), *Isanthus brachiatus* (fluxweed), *Poa compressa* (Canada bluegrass), *Rosa carolina* (Carolina rose), *Solidago nemoralis* (gray goldenrod)

Other Noteworthy Species:

Species	GRank	Type	Note
Arabis missouriensis (green rockcress)	-	plant	
Houstonia longifolia (longleaf summer bluet)	-	plant	
Muhlenbergia capillaris (hairawn muhly)	-	plant	
Polygonum tenue (pleatleaf knotweed)	-	plant	
Pycnanthemum clinopodioides (basil mountainmint)	G1G2	plant	
Pycnanthemum torrei (Torrey's mountainmint)	G2	plant	
Scutellaria parvula var. *missouriensis* (Leonard's plant)	-	plant	
Selaginella rupestris (northern selaginella)	-	plant	

USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: This community has been described from mountainous sites in New England states: Fall Mountain in New Hampshire; Bare Mountain, East Mountain, Mount Tom and Mount Norwottuck in Massachusetts; Onion Mountain, Sugarloaf, Sleeping Giant and West Mountain in Connecticut. It has also been documented at sites in the Watchung Mountains in New Jersey, Kittatinny Ridge in New Jersey and Pennsylvania, and in southeastern New York.
States/Provinces: CT, MA, ME?, NH, NJ:S1S2, NY, ON?, PA, VT
Federal Lands: NPS (Delaware Water Gap, Upper Delaware)

CONSERVATION STATUS

Rank: G2G3 (16-Nov-1997)
Reasons: There are probably 30-60 occurrences of this community rangewide. At least 19 occurrences have been documented from Connecticut, Massachusetts, Pennsylvania and New Jersey, with outliers in New Hampshire and southeastern New York. This community is restricted to exposed outcrops of basaltic rock in the Connecticut River valley of New England and the Piedmont and High Allegheny Plateau physiographic province of New Jersey and adjacent Pennsylvania. Most occurrences are small; total acreage is probably less than 500 acres rangewide.

CLASSIFICATION INFORMATION

Status: Standard
Confidence: 2 - Moderate
Comments: In general, this community is similar to a number of other sparse woodland ridge top communities. New Jersey occurrences are floristically related to ridge top sparse woodlands in Virginia (e.g., greenstone glades) but appear to share more species with the northern

occurrences with which they have been grouped here. However, further research may indicate that the New Jersey occurrences represent a unique vegetation assemblage. In Massachusetts, this community typically occurs as herbaceous (and probably successional) patches within a hickory-hop hornbeam forest. New York contains some examples of this community which they classify under the name "red-cedar rocky summit community."

Similar Associations:

- *Juniperus virginiana - Ostrya virginiana / Carex eburnea* Woodland (CEGL006180)

Related Concepts:

- Eastern Redcedar: 46 (Eyre 1980) B
- Red-cedar Woodland (Thompson 1996) ?
- SNE circumneutral rocky summit/rock outcrop community (Rawinski 1984) ?

SOURCES

Description Authors: M. Anderson, mod. S.C. Gawler

References: Breden 1989, Breden et al. 2001, Eastern Ecology Working Group n.d., Eyre 1980, Fike 1999, Grossman et al. 1994, Lee 1985, Livingston and Lund 1982, Metzler and Barrett 1992, Metzler and Barrett 2001, Motzkin 1993, Nichols 1914, Perles et al. 2007, Rawinski 1984, Roberts 1914, Swain and Kearsley 2001, Thompson 1996, Thompson and Sorenson 2000, Walz 1996

Figure F-1. Red-cedar Rocky Summit. Home of Franklin D. Roosevelt National Historic Site.

Local Name: Dry, Rich Oak - Hickory Forest (CEGL006301)

SYNONYMS

USNVC English Name: **Northern Red Oak - (Pignut Hickory, Shagbark Hickory) / Hophornbeam / Blue Ridge Sedge Forest**

USNVC Scientific Name: ***Quercus rubra - Carya* (*glabra, ovata*) / *Ostrya virginiana* / *Carex lucorum* Forest**

USNVC Identifier: **CEGL006301**

LOCAL INFORMATION

Environmental Description: This dry to dry-mesic forest is located on mid-slopes at elevations of about 230 feet. Soils are varied forms of loamy, sandy loamy, gravelly sandy loam and gravelly loamy sand with underlying bedrock is Ordovician, shale and siltstone with minor amounts of sandstone from the Austin Glen formation. Adjacent upland communities are Hemlock - Beech - Oak Forest (CEGL006088), Red Oak-Northern Hardwood Forest (CEGL006173), and Central Appalachian Hemlock - Chestnut Oak Forest (CEGL006923). Adjacent wetland communities include Southern New England / Northern Piedmont Red Maple Seepage Swamp (CEGL006406), and Red Maple / Tussock Sedge Wooded Marsh (CEGL006119).

Vegetation Description: The tree canopy averages 58% cover and 27.6 m in height. The tree subcanopy averages 43.6% and 12.6 meters in height. Both the canopy and subcanopy of this forest is dominated by *Quercus rubra* (northern red oak), *Quercus alba* (white oak), *Acer saccharum* (sugar maple), *Fraxinus americana* (white ash), *Carya glabra* (pignut hickory), *Carya ovata* (shagbark hickory), and *Quercus prinus* (chestnut oak). The tall shrub cover averages 14.3% cover and 4.3 meters in height and is characterized by *Ostrya virginiana* (hophornbeam), *Hamamelis virginiana* (American witchhazel), regenerating *Acer saccharum* (sugar maple), and *Carpinus caroliniana* (American hornbeam). The short shrub layer averages 24.7% cover and is characterized by *Viburnum acerifolium* (mapleleaf viburnum), saplings and seedlings of *Acer saccharum* (sugar maple), *Ostrya virginiana* (hophornbeam), and *Hamamelis virginiana* (American witchhazel). The herbaceous layer averages 19% cover and is characterized by *Carex pensylvanica* (Pennsylvania sedge), *Alliaria petiolata* (garlic mustard), *Desmodium nudiflorum* (nakedflower ticktrefoil), *Polystichum acrostichoides* (Christmas fern), and *Eurybia divaricata* (white wood aster).

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy/subcanopy	Broad-leaved deciduous tree	*Quercus rubra* (northern red oak) *Quercus alba* (white oak) *Acer saccharum* (sugar maple)
Tall shrub/sapling	Broad-leaved deciduous shrub	*Ostrya virginiana* (hophornbeam) *Hamamelis virginiana* (American witchhazel)
Herb (field)	Graminoid	*Carex pensylvanica* (Pennsylvania sedge)
Herb (field)	Forb	*Alliaria petiolata* (garlic mustard), *Desmodium nudiflorum* (nakedflower ticktrefoil), *Eurybia divaricata* (white wood aster)

Herb (field)	Fern or fern ally	*Polystichum acrostichoides* (Christmas fern)

Characteristic Species: *Quercus rubra* (northern red oak), *Quercus alba* (white oak), *Carya glabra* (pignut hickory), *Fraxinus americana* (white ash), *Carya ovata* (shagbark hickory), *Ostrya virginiana* (hophornbeam), *Hamamelis virginiana* (American witchhazel), *Viburnum acerifolium* (mapleleaf viburnum), and *Carex pensylvanica* (Pennsylvania sedge).
Other Noteworthy Species: None.
Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
NY	S4*	B	1	Appalachian Oak-Hickory Forest	Edinger et al. 2002

Local Range: This association is located at all four units of Roosevelt-Vanderbilt Historic Sites, but apparently is least common at Vanderbilt Mansion NHS.
Classification Comments: This association was used to classify Appalachian oak-hickory forests with a species combination of *Quercus rubra* (northern red oak), *Quercus alba* (white oak), *Carya glabra* (pignut hickory), *Carya ovata* (shagbark hickory), *Ostrya virginiana* (hophornbeam), *Fraxinus americana* (white ash) and *Hamamelis virginiana* (American witchhazel) with a slightly mesic and enriched understory.
Other Comments: None.
Local Description Authors: Frederick C. Sechler, Jr.
Plots: None.
AA Points: None.
Roosevelt-Vanderbilt National Historic Site Inventory Notes: None.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Class	Forest and Woodland (1)
Subclass	Temperate Forest (1.C)
Formation	Cool Temperate Forest (1.C.2)
Division	Eastern North American Cool Temperate Forest (D008)
Macrogroup	Central Oak-Hardwood and Pine Forest (M012)
Group	Northeastern and North-Central Oak-Hickory Forest Group (G158)
Alliance*	*Carya (glabra, ovata) - Fraxinus americana - Quercus (alba, rubra)* Forest Alliance (A.258)
Alliance (English name)*	(Pignut Hickory, Shagbark Hickory) - White Ash - (White Oak, Northern Red Oak) Forest Alliance
Association	*Quercus rubra - Carya (glabra, ovata) / Ostrya virginiana / Carex lucorum* Forest
Association (English name)	Northern Red Oak - (Pignut Hickory, Shagbark Hickory) / Hophornbeam / Blue Ridge Sedge Forest
Ecological System(s)	Northeastern Interior Dry-Mesic Oak Forest (CES202.592) Central Appalachian Pine-Oak Rocky Woodland (CES202.600) Central Appalachian Alkaline Glade and Woodland (CES202.602)

* Alliance assignment as of 2007. All USNVC alliances are currently (2014) under review and revision.

GLOBAL DESCRIPTION

Concept Summary: This association is a dry, rich oak-hickory forest of the northeastern United States, occurring from Maine and Vermont to Pennsylvania and northern New Jersey. It is dominated by a mixture of hickories and oaks over a hop-hornbeam subcanopy with or without a parklike sedge lawn. The vegetation occurs on low-elevation ridge tops, upper slopes, south- or west-facing sideslopes, and is supported by well-drained loams or sandy loams, often derived from alkaline bedrock. The tree canopy, which ranges from nearly closed forest to partially open

woodland, is dominated by a mixture of *Carya glabra* (pignut hickory), *Carya ovata* (shagbark hickory), *Carya ovalis* ((red hickory), *Quercus rubra* (northern red oak), *Quercus alba* (white oak), *Quercus velutina* (black oak), with occasional *Ostrya virginiana* (hophornbeam) and *Acer rubrum* (red maple). Minor associates include *Acer saccharum* (sugar maple), *Pinus strobus* (eastern white pine), and *Fraxinus americana* (white ash). A subcanopy of *Ostrya virginiana* (hophornbeam) is conspicuous in most areas. Additional species in the subcanopy or tall-shrub layer that occur in lower abundance can include *Hamamelis virginiana* (American witchhazel), *Cornus florida* (flowering dogwood), *Amelanchier arborea* (downy serviceberry), *Acer pensylvanicum* (striped maple), and *Viburnum acerifolium* (mapleleaf viburnum). Low shrubs can include *Vaccinium angustifolium* (late lowbush blueberry), *Vaccinium pallidum* (early lowbush blueberry), *Rubus idaeus* (common red raspberry), or *Viburnum rafinesquianum* (downy arrow-wood). The herb layer can range from a sedge lawn of *Carex lucorum* (Blue Ridge sedge), with some *Carex pensylvanica* (Pennsylvania sedge) *Carex woodii* (pretty sedge), *Carex appalachica* (Appalachian sedge), or *Carex rosea* (rosy sedge), to a more patchy herbaceous layer with sedges in addition to scattered *Elymus hystrix* (bottlebrush grass), *Bromus pubescens* (hairy woodland brome), *Danthonia spicata* (poverty oatgrass), *Anthoxanthum odoratum* (sweet vernal grass), *Ageratina altissima* (white snakeroot), *Festuca subverticillata* (nodding fescue), *Uvularia perfoliata* (perfoliate bellwort), *Aralia nudicaulis* (wild sarsaparilla), *Maianthemum racemosum (= Smilacina racemosa)* (feathery false lily of the valley), *Desmodium glutinosum* (pointedleaf ticktrefoil), *Desmodium paniculatum* (panicledleaf ticktrefoil), *Prenanthes alba* (white rattlesnake-root), *Solidago bicolor* (white goldenrod), *Solidago juncea* (early goldenrod), *Hepatica nobilis var. obtusa (= Hepatica americana)* (roundlobe hepatica), *Carex* spp. (section *Laxiflorae* group), *Deschampsia flexuosa*, *Packera paupercula (= Senecio pauperculus)* (balsam ragwort), *Packera obovata (= Senecio obovatus)* (roundleaf groundsel), *Symphyotrichum undulatum (= Aster undulatus)* (wavyleaf aster), *Symphyotrichum patens (= Aster patens)* (late purple aster), *Veronica officinalis* (gypsy-weed), *Polystichum acrostichoides* (Christmas fern), and *Dichanthelium* spp. (witchgrasses). Spring ephemerals such as *Erythronium americanum* (yellow trout-lily) and *Claytonia virginica* (narrowleaf springbeauty) also occur in some portions of the range.

Environmental Description: This community occupies upper slopes and sideslopes at low elevations, generally with southeastern to western exposures. The low relief of southern New England limits this vegetation to small occurrences, most of which are <4 ha (10 acres). Soils are well-drained loams or sandy loams and often circumneutral. Soils are often stony, but exposed bedrock, boulders, cobbles, and mineral soil are sparse.

Vegetation Description: This forest has a closed to open canopy dominated by a mixture of *Carya glabra* (pignut hickory), *Carya ovata* (shagbark hickory), *Carya ovalis* ((red hickory), *Quercus rubra* (northern red oak), *Quercus alba* (white oak), *Quercus velutina* (black oak), with occasional *Ostrya virginiana* (hophornbeam), *Quercus prinus* (chestnut oak), *Carya alba* (mockernut hickory), and *Acer rubrum* (red maple). Minor associates include *Acer saccharum* (sugar maple), *Pinus strobus* (eastern white pine), and *Fraxinus americana* (white ash). A subcanopy of *Ostrya virginiana* (hophornbeam) is conspicuous in most areas. Additional species in the subcanopy or tall-shrub layers that occur in lower abundance include *Hamamelis virginiana* (American witchhazel), *Cornus florida* (flowering dogwood), *Amelanchier arborea* (downy serviceberry), *Acer pensylvanicum* (striped maple), and *Viburnum acerifolium* (mapleleaf viburnum). Low shrubs can include *Vaccinium angustifolium* (late lowbush blueberry), *Vaccinium pallidum* (early lowbush blueberry), *Rubus idaeus* (common red

raspberry), or *Viburnum rafinesquianum* (downy arrow-wood). *Vaccinium stamineum* (deerberry) may be present in the most southerly (NJ/PA) occurrences of this association. The herb layer can range from a sedge lawn of *Carex lucorum* (Blue Ridge sedge), with some *Carex pensylvanica* (Pennsylvania sedge) *Carex woodii* (pretty sedge), *Carex appalachica* (Appalachian sedge), or *Carex rosea* (rosy sedge), to a more patchy herbaceous layer with sedges in addition to scattered *Elymus hystrix* (bottlebrush grass), *Bromus pubescens* (hairy woodland brome), *Danthonia spicata* (poverty oatgrass), *Anthoxanthum odoratum* (sweet vernal grass), *Ageratina altissima* (white snakeroot), *Festuca subverticillata* (nodding fescue), *Uvularia perfoliata* (perfoliate bellwort), *Aralia nudicaulis* (wild sarsaparilla), *Maianthemum racemosum (= Smilacina racemosa)* (feathery false lily of the valley), *Desmodium glutinosum* (pointedleaf ticktrefoil), *Desmodium paniculatum* (panicledleaf ticktrefoil), *Prenanthes alba* (white rattlesnake-root), *Solidago bicolor* (white goldenrod), *Solidago juncea* (early goldenrod), *Hepatica nobilis var. obtusa (= Hepatica americana)* (roundlobe hepatica), *Carex* spp. (section *Laxiflorae* group), *Deschampsia flexuosa*, *Packera paupercula (= Senecio pauperculus)* (balsam ragwort), *Packera obovata (= Senecio obovatus)* (roundleaf groundsel), *Symphyotrichum undulatum (= Aster undulatus)* (wavyleaf aster), *Symphyotrichum patens (= Aster patens)* (late purple aster), *Veronica officinalis* (gypsy-weed), *Polystichum acrostichoides* (Christmas fern), and *Dichanthelium* spp. (witchgrasses). Spring ephemerals such as *Erythronium americanum* (yellow trout-lily) and *Claytonia virginica* (narrowleaf springbeauty) also occur in some portions of the range.

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Carya ovata* (shagbark hickory), *Carya glabra* (pignut hickory), *Carya ovalis* (red hickory), *Quercus alba* (white oak), *Quercus prinus* (chestnut oak), *Quercus rubra* (northern red oak), *Quercus velutina* (black oak) and *Amelanchier arborea* (downy serviceberry)
Shrub/sapling (tall & short)	Broad-leaved deciduous tree	*Carpinus caroliniana* (American hornbeam), *Ostrya virginiana* (hophornbeam)
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Crataegus spathulata* (littlehip hawthorn)
Herb (field)	Graminoid	*Carex pensylvanica* (Pennsylvania sedge), *Carex lucorum* (Blue Ridge sedge), *Carex rosea* (rosy sedge), *Carex lucorum* (Blue Ridge sedge), *Deschampsia flexuosa* (wavy hairgrass), *Elymus hystrix* (bottlebrush grass)
Herb (field)	Forb	*Ageratina altissima* var. *altissima* (white snakeroot), *Maianthemum racemosum* (feathery false lily of the valley), *Potentilla canadensis* (Canada cinquefoil), *Potentilla simplex* (common cinquefoil), *Solidago bicolor* (white goldenrod), *Solidago juncea* (early goldenrod), *Uvularia perfoliata* (perfoliate bellwort)

Characteristic Species: *Carya ovata* (shagbark hickory), *Carya glabra* (pignut hickory), *Carya ovalis* (red hickory), *Quercus alba* (white oak), *Quercus prinus* (chestnut oak), *Quercus rubra* (northern red oak), *Quercus velutina* (black oak), *Amelanchier arborea* (common serviceberry), *Carex pensylvanica* (Pennsylvania sedge), *Carex lucorum* (Blue Ridge sedge), *Carex rosea* (rosy sedge), *Carex lucorum* (Blue Ridge sedge), *Deschampsia flexuosa* (wavy hairgrass), *Elymus hystrix* (bottlebrush grass), *Maianthemum racemosum* (feathery false lily of the valley), *Potentilla canadensis* (Canada cinquefoil), *Potentilla simplex* (common cinquefoil), *Solidago*

bicolor (white goldenrod), *Solidago juncea* (early goldenrod), *Uvularia perfoliata* (perfoliate bellwort)
Other Noteworthy Species: Information not available.
USFWS Wetland System: Not applicable.

DISTRIBUTION
Range: This forest occurs in the Lower New England - Northern Piedmont, Central Appalachians, Western Allegheny Plateau, and High Allegheny Plateau ecoregions.
States/Provinces: CT, MA, ME, NH, NJ, NY, PA, RI, VT
Federal Lands: NPS (Roosevelt-Vanderbilt, Upper Delaware)

CONSERVATION STATUS
Rank: G4 (apparently secure) (20-May-2011)
Reasons: This association is a large-patch to matrix-forming forest association of the northeastern U.S. There are likely to be over 1000 occurrences of this vegetation, with approximately half of those having good ecological integrity. The association is ranked G4 rather than G5 because it has declined up to 30% over the long term, and continues to be threatened by residential and commercial development, invasive species, and repeated gypsy moth infestations. The impact of climate change is not currently known.

CLASSIFICATION INFORMATION
Status: Standard
Confidence: **2** - Moderate
Comments: The former *Carya (glabra, ovata) - Fraxinus americana - Quercus* spp. Forest (CEGL006236) was lumped into this community in 2009 allowing for oak-hickory without sedge lawn stands to be included in this type (CEGL006301)..
Similar Associations:
- *Quercus alba - Quercus prinus - Carya glabra / Cornus florida / Vaccinium pallidum* Forest (CEGL008515)
- *Quercus prinus - Quercus rubra - Carya ovalis / Carex pensylvanica – (Calamagrostis porteri)* Forest (CEGL008516)

Related Concepts:
- Pignut hickory – White ash (*Carya glabra – Fraxinus americana*) forests (Metzler and Barrett 2006) >
- Oak - Hickory Forest (Gawler 2002) >
- Hickory – Hop Hornbeam Forest / Woodland (Swain and Kearsley 2001) =
- Red Oak – Ironwood – Pennsylvania Sedge Lawn (Sperduto and Nichols 2004) =
- *Quercus rubra - Carya (galbra, ovata) / Ostrya virginiana / Carex pensylvanica* Forest (Breden et al. 2001) =
- Appalachian Oak - Hickory Forest (Edinger et al. 2002) >
- Dry Oak – Mixed Hardwood Forest (Fike 1999) >
- Oak - Hickory Forest (Enser 1999) >
- Dry Oak - Hickory – Hophornbeam Forest (Thompson and Sorenson 2000) =

SOURCES
Description Authors: G. Fleming and P. Coulling, mod. S.L. Neid and S. Gawler
References: Breden 1989, Breden et al. 2001, CAP pers. comm. 1998, Eastern Ecology Working Group n.d., Edinger et al. 2002, Enser 1999, Eyre 1980, Fike 1999, Fleming et al. 2001,

Fleming and Coulling 2001, Fleming and Morehead 2000, Gawler 2002, Harrison 2004, Lundgren 2000, Lundgren 2001, Metzler and Barrett 2001, Metzler and Barrett 2004, NRCS 2004, Rawinski 1984, Rawinski et al. 1996, Sperduto 2000, Sperduto and Nichols 2004, Swain and Kearsley 2001, Thompson 1996, Thompson and Sorenson 2000, Vanderhorst 2000, VDNH 2003

Figure F-2. Dry, Rich Oak - Hickory Forest (AA point ROVA.138). 06/17/2008. NAD 1983 / UTM-18 easting 589589, northing 4624980.

Local Name: Northeastern Dry Oak-Hickory Forest (CEGL006336)

SYNONYMS

USNVC English Name:	**(White Oak, Northern Red Oak, Black Oak) / Flowering Dogwood / Mapleleaf Viburnum Forest**
USNVC Scientific Name:	***Quercus* (*alba, rubra, velutina*) / *Cornus florida* / *Viburnum acerifolium* Forest**
USNVC Identifier:	**CEGL006336**

LOCAL INFORMATION

Environmental Description: This forest type occurs on relatively steep mid to high slopes on moderately stony substrates. The soils are variable and include silt loam, sandy loam, and fine sandy loam types. The underlying bedrock consists of Ordovician shale and siltstone with minor amounts of sandstone, Austin Glen Formation. Adjacent associations include Dry, Rich Oak - Hickory Forest (CEGL006236), Hemlock - Beech - Oak Forest (CEGL006088), Northeastern Oak - Red Maple Successional Forest (CEGL006506), Red Oak - Heath Woodland / Rocky Summit (CEGL006134), and Southern Blue Ridge Mafic Barrens (CEGL006215).

Vegetation Description: Vegetation from this forest type typically contains a combination of both dry acidic and semi-rich mesic species. The tree canopy averages 75.8% cover and 23.3 meters in height. Characteristic species of the canopy include *Quercus rubra* (northern red oak), *Quercus alba* (white oak), *Quercus coccinea* (scarlet oak), *Betula lenta* (sweet birch), *Carya glabra* (pignut hickory), *Acer rubrum* (red maple), *Quercus prinus* (chestnut oak), and *Acer saccharum* (sugar maple). The tree subcanopy averages 51.3% cover and 15.2 meters in height. Many species found in the tree canopy layer are also found in the subcanopy layer. Frequently encountered species occurring only in the tree subcanopy layer include *Ostrya virginiana* (hophornbeam), *Tsuga canadensis* (eastern hemlock), *Fraxinus pennsylvanica* (green ash), and *Carpinus caroliniana* (American hornbeam). The tall shrub layer averages 28.3% cover and 3 meters in height and is characterized by *Hamamelis virginiana* (American witchhazel), *Ostrya virginiana* (hophornbeam), *Carpinus caroliniana* (American hornbeam) and species from the canopy layers. The short shrub layer averages 41.7% cover and is characterized by *Viburnum acerifolium* (mapleleaf viburnum), *Hamamelis virginiana* (American witchhazel), *Rubus flagellaris* (northern dewberry), saplings and seedlings from canopy species, and *Vaccinium pallidum* (Blue Ridge blueberry). The sparse vine layer averages 2.6% cover and is characterized by *Parthenocissus quinquefolia* (Virginia creeper). The typically sparse herbaceous layer averages 16.2% cover. The most abundant species include *Aralia nudicaulis* (wild sarsaparilla), *Eurybia divaricata* (white wood aster), *Deschampsia flexuosa* (wavy hairgrass), and *Lycopodium obscurum* (rare clubmoss).

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy/subcanopy	Broad-leaved deciduous tree	*Quercus rubra* (northern red oak) *Quercus alba* (white oak) *Quercus coccinea* (scarlet oak) *Betula lenta* (sweet birch)
Tall shrub/sapling	Broad-leaved deciduous shrub	*Ostrya virginiana* (hophornbeam)

		Hamamelis virginiana (American witchhazel) *Carpinus caroliniana* (American hornbeam)
Short shrub/sapling	Broad-leaved deciduous shrub	*Viburnum acerifolium* (mapleleaf viburnum)
Herb (field)	Graminoid	*Deschampsia flexuosa* (wavy hairgrass)
Herb (field)	Forb	*Aralia nudicaulis* (wild sarsaparilla) *Eurybia divaricata* (white wood aster)

Characteristic Species: *Quercus rubra* (northern red oak), *Quercus alba* (white oak), *Quercus coccinea* (scarlet oak), *Hamamelis virginiana* (American witchhazel), *Viburnum acerifolium* (mapleleaf viburnum), *Aralia nudicaulis* (wild sarsaparilla).
Other Noteworthy Species: None.
Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
NY	S4*	I	1	Appalachian Oak-Hickory Forest	Edinger et al. 2002

Local Range: This Appalachian oak-hickory forest is present throughout the four units of the park, being very common type at Val-Kill, and less common at, Vanderbilt Mansion NHS, and Home of Franklin D. Roosevelt NHS (including Roosevelt Farm and Forest).
Classification Comments: This association was used to classify Appalachian oak-hickory forests at Roosevelt-Vanderbilt National Historic Park without *Fraxinus americana* (white ash) and with a combination of dry semi-rich and dry acidic rich indicators in the understory.
Other Comments: None.
Local Description Authors: Frederick C. Sechler, Jr.
Plots: Roosevelt Farm and Forest (ROVA.118), Vanderbilt Mansion NHS (ROVA.17, ROVA.18).
AA Points: Val-Kill (ROVA.106, ROVA.107, ROVA.108, ROVA.109, ROVA.110, , ROVA.111, ROVA.112 , ROVA.121, ,), Vanderbilt Mansion NHS (ROVA.8, ROVA.31).
Roosevelt-Vanderbilt National Historic Site Inventory Notes: None.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Class	Forest and Woodland (1)
Subclass	Temperate Forest (1.C)
Formation	Cool Temperate Forest (1.C.2)
Division	Eastern North American Cool Temperate Forest (D008)
Macrogroup	Central Oak-Hardwood and Pine Forest (M012)
Group	Northeastern and North-Central Oak-Hickory Forest Group (G158)
Alliance*	*Quercus alba - (Quercus rubra, Carya* spp.) Forest Alliance (A.239)
Alliance (English name)*	White Oak - (Northern Red Oak, Hickory species) Forest Alliance
Association	*Quercus (alba, rubra, velutina) / Cornus florida / Viburnum acerifolium* Forest
Association (English name)	(White Oak, Northern Red Oak, Black Oak) / Flowering Dogwood / Mapleleaf Viburnum Forest
Ecological System(s)	Northeastern Interior Dry-Mesic Oak Forest (CES202.592) Central Appalachian Dry Oak-Pine Forest (CES202.591)

* Alliance assignment as of 2007. All USNVC alliances are currently (2014) under review and revision.

GLOBAL DESCRIPTION

Concept Summary: This oak-hickory forest occurs on well-drained loamy sand of midslopes in the northeastern United States. This vegetation is ecologically transitional between dry-rich oak-hickory forests of relatively high diversity and dry, acidic oak species-poor forests. *Quercus rubra* (northern red oak), *Quercus alba* (white oak), and *Quercus velutina* (black oak) are prominent in the canopy. *Quercus prinus* (chestnut oak) and *Quercus coccinea* (scarlet oak) are canopy associates in the southern portion of the range. Typical hickory species include *Carya glabra* (pignut hickory), *Carya ovata* (shagbark hickory), *Carya alba* (mockernut hickory), and *Carya ovalis* (red hickory). Other canopy associates may include *Acer rubrum* (red maple), *Sassafras albidum* (sassafras), and *Amelanchier arborea* (common serviceberry). At the northern range limit of this type, *Pinus strobus* (eastern white pine) and *Betula lenta* (sweet birch) also occur as minor associates. *Cornus florida* (flowering dogwood) is a characteristic understory tree in portions of the range. The shrub layer is characterized by *Viburnum acerifolium* (mapleleaf viburnum), with other frequent associates including *Hamamelis virginiana* (American witch-hazel), *Vaccinium corymbosum* (highbush blueberry), *Corylus cornuta* (beaked hazelnut), and *Corylus americana* (American hazelnut). A dwarf-shrub layer may be common, but is generally not abundant, and is characterized by *Vaccinium pallidum* (Blue Ridge blueberry) and *Gaylussacia baccata* (black huckleberry), with *Vaccinium angustifolium* (lowbush blueberry) occurring more frequently to the north. The herbaceous layer is characterized by *Carex pensylvanica* (Pennsylvania sedge), *Carex rosea* (rosy sedge), *Maianthemum racemosum* (feathery false lily of the valley), *Aralia nudicaulis* (wild sarsaparilla), *Hieracium venosum* (rattlesnakeweed), *Solidago bicolor* (white goldenrod), *Desmodium glutinosum* (pointedleaf ticktrefoil), *Desmodium paniculatum* (panicledleaf ticktrefoil), *Melampyrum lineare* (narrowleaf cowwheat), *Chimaphila maculata* (striped prince's pine), *Eurybia divaricata* (white wood aster), *Danthonia spicata* (poverty oatgrass), *Aureolaria* (false foxglove) spp., *Pteridium aquilinum* (western brackenfern), *Dennstaedtia punctilobula* (eastern hayscented fern), and *Helianthemum canadense* (longbranch frostweed).

Environmental Description: This forest type occurs on well-drained loamy sand of midslopes and other dry-mesic sites.

Vegetation Description: This vegetation is ecologically transitional between dry-rich oak-hickory forests of relatively high diversity and dry, acidic oak-species-poor forests. *Quercus rubra* (northern red oak), *Quercus alba* (white oak), and *Quercus velutina* (black oak) are prominent in the canopy. Typical hickory species include *Carya glabra* (pignut hickory), *Carya ovata* (shagbark hickory), *Carya alba* (mockernut hickory), and *Carya ovalis* (red hickory). Other canopy associates may include *Acer rubrum* (red maple), *Quercus prinus* (chestnut oak), *Sassafras albidum* (sassafras), and *Amelanchier arborea* (common serviceberry). *Pinus strobus* (eastern white pine), *Tsuga canadensis* (eastern hemlock), and *Betula lenta* (sweet birch) may also occur as minor associates. *Cornus florida* (flowering dogwood) is a characteristic understory tree in portions of the range. The shrub layer is typically rather sparse and characterized by *Viburnum acerifolium* (mapleleaf viburnum), with other frequent associates including *Hamamelis virginiana* (American witch-hazel), *Vaccinium corymbosum* (highbush blueberry), *Kalmia latifolia* (mountain laurel), *Corylus cornuta* (beaked hazelnut), and *Corylus americana* (American hazelnut). A dwarf-shrub layer may be common but generally not abundant, characterized by *Vaccinium pallidum* (Blue Ridge blueberry) and *Gaylussacia baccata* (black huckleberry), with *Vaccinium angustifolium* (lowbush blueberry) occurring more frequently to the north. The herbaceous layer is characterized by *Carex pensylvanica* (Pennsylvania sedge),

Maianthemum racemosum (feathery false lily of the valley), *Dryopteris marginalis* (marginal woodfern), *Aralia nudicaulis* (wild sarsaparilla), *Hieracium venosum* (rattlesnakeweed), *Solidago bicolor* (white goldenrod), *Desmodium glutinosum* (pointedleaf ticktrefoil), *Desmodium paniculatum* (panicledleaf ticktrefoil), *Melampyrum lineare* (narrowleaf cowwheat), *Chimaphila maculata* (striped prince's pine), *Eurybia divaricata* (white wood aster), *Danthonia spicata* (poverty oatgrass), *Deschampsia flexuosa* (wavy hairgrass), *Dennstaedtia punctilobula* (eastern hayscented fern), *Aureolaria* (false foxglove) spp., *Pteridium aquilinum* (western brackenfern), *Dennstaedtia punctilobula* (eastern hayscented fern), and *Helianthemum canadense* (longbranch frostweed). The invasive species *Microstegium vimineum* (Nepalese browntop) and *Berberis thunbergii* (Japanese barberry) may also be present in this forest type.

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Quercus alba* (white oak), *Quercus prinus* (chestnut oak), *Quercus rubra* (northern red oak), *Quercus velutina* (black oak)
Shrub/sapling (tall & short)	Broad-leaved deciduous tree	*Cornus florida* (flowering dogwood)
Short shrub/sapling	Broad-leaved deciduous shrub	*Gaylussacia baccata* (black huckleberry)
Herb (field)	Graminoid	*Carex pensylvanica* (Pennsylvania sedge)

Characteristic Species: *Aralia nudicaulis* (wild sarsaparilla), *Carex pensylvanica* (Pennsylvania sedge), *Carya alba* (mockernut hickory), *Carya glabra* (pignut hickory), *Carya ovalis* (red hickory), *Cornus florida* (flowering dogwood), *Gaylussacia baccata* (black huckleberry), *Maianthemum racemosum* (feathery false lily of the valley), *Quercus prinus* (chestnut oak), *Vaccinium pallidum* (Blue Ridge blueberry), *Viburnum acerifolium* (mapleleaf viburnum)

Other Noteworthy Species: Information not available.

USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: This association occurs from Maine to Maryland.

States/Provinces: CT, DE, MA, MD, ME, NH, NJ:S4S5, NY, PA, RI, VT

Federal Lands: NPS (Boston Harbor Islands, Cape Cod, Delaware Water Gap, Fort Necessity, Gettysburg, Minute Man, Morristown, Sagamore Hill, Roosevelt-Vanderbilt, Upper Delaware, Weir Farm); USFWS (Assabet River, Cape May, Great Meadows)

CONSERVATION STATUS

Rank: G4G5 (24-Jan-2005)

Reasons: This type is not naturally rare and has a wide geographic distribution. Mature stands, however, are uncommon and most stands are subject to logging disturbances or even complete destruction if located in rapidly developing suburban areas.

CLASSIFICATION INFORMATION

Status: Standard

Confidence: 2 - Moderate

Comments: Information not available.

Similar Associations:

- *Acer saccharum - Betula alleghaniensis - Quercus rubra / Viburnum acerifolium* Forest (CEGL006943)
- *Carya (glabra, ovata) - Fraxinus americana - Quercus* spp. Forest (CEGL006236)

- *Pinus strobus - Quercus (rubra, velutina) - Fagus grandifolia* Forest (CEGL006293)--can intergrade with this type in New England but is characterized by *Fagus grandifolia* (more or less absent in CEGL006336), a greater amount of *Pinus strobus* in the canopy (usually >20%), and little or no *Carya*.
- *Quercus alba - Quercus rubra - Carya (alba, ovata) / Cornus florida* Acidic Forest (CEGL002067)--also contains *Actaea racemosa* and can occur on cherty limestone, and *Quercus velutina* is not characteristic.
- *Quercus alba - Quercus rubra - Carya alba / Cornus florida / Vaccinium stamineum / Desmodium nudiflorum* Piedmont Forest (CEGL008475)--southern analogue of CEGL006336; is more diverse and occupies soils with slightly higher base status. *Quercus velutina* is not as characteristic of this type. A number of southern herbs such as *Aristolochia serpentaria* are not found in CEGL006336; northern species such as *Corylus cornuta, Vaccinium angustifolium,* and *Aralia nudicaulis* are not found in CEGL008475.
- *Quercus coccinea - Quercus velutina / Sassafras albidum / Vaccinium pallidum* Forest (CEGL006375)--lacks *Viburnum acerifolium* and *Cornus florida* and in general is less diverse and occurring on relatively more nutrient-poor soils.
- *Quercus prinus - Quercus (rubra, velutina) / Vaccinium angustifolium* Forest (CEGL006282)
- *Quercus velutina - Quercus alba - Carya (glabra, ovata)* Forest (CEGL002076)--also contains *Quercus ellipsoidalis* or *Quercus macrocarpa* and is of shorter stature and more open canopy.
- *Quercus velutina / Carex pensylvanica* Forest (CEGL002078)--is drier and more infertile, and lacks *Viburnum acerifolium, Hamamelis virginiana* and other shrubs.

Related Concepts:

- *Quercus (alba, rubra, velutina) / Cornus florida - Viburnum acerifolium* Forest (Bartgis 1986) =
- *Quercus alba - Quercus coccinea - Carya glabra / Cornus florida / Viburnum acerifolium* Forest (VDNH 2003) =
- Mesic Coastal Plain mixed oak forest (Breden 1989) ?
- Piedmont Oak-Beech-Mountain Laurel Forest (Clancy 1996) =
- SNE mesic central hardwood forest on acidic till (Rawinski 1984) ?

SOURCES

Description Authors: S.L. Neid and L.A. Sneddon, mod. S.C. Gawler

References: Bartgis 1986, Berdine 1998, Breden 1989, Breden et al. 2001, Clancy 1996, Damman 1977, Eastern Ecology Working Group n.d., Edinger et al. 2002, Enser 1999, Fike 1999, Fleming et al. 2001, Fleming pers. comm., Gawler 2002, Harrison 2004, Hunt 1997, MENHP 1991, McCoy and Fleming 2000, Metzler and Barrett 2001, NRCS 2004, Patterson pers. comm., Rawinski 1984, Soil Conservation Service 1987, Sperduto 1997b, Sperduto and Nichols 2004, Swain and Kearsley 2001, VDNH 2003

Figure F-3. Northeastern Dry Oak-Hickory Forest (plot ROVA.17). 07/02/2003. NAD 1983 / UTM-18 easting 587560, northing 4626911.

Local Name: Black Locust Successional Forest (CEGL007279)

SYNONYMS

USNVC English Name: **Black Locust Forest**
USNVC Scientific Name: ***Robinia pseudoacacia* Forest**
USNVC Identifier: **CEGL007279**

LOCAL INFORMATION

Environmental Description: This successional forest generally results from severe disturbances such as abandoned agricultural fields, or development. The soils are generally nearly level gravelly loam and occur on mostly gently sloping to no sloping topographical locations. Surrounding areas include suburban development, agricultural fields, and mowed lawns. A few adjacent associations include Semi-rich Northern Hardwood Forest (CEGL006211) and Southern New England / Northern Piedmont Red Maple Seepage Swamp (CEGL006406).

Vegetation Description: This successional forest is usually associated with abandoned agricultural land in which invasive species *Robinia pseudoacacia* (black locust) has invaded and become the dominant species. Associated species vary according to adjacent natural communities, land-use history, and degree of disturbance. At Roosevelt Farm and Forest, the tree canopy averages 60% cover and 26 meters in height. It is dominated by *Catalpa speciosa* (northern catalpa), *Robinia pseudoacacia* (black locust), and *Acer saccharum* (sugar maple). The subcanopy averages 65% cover and 17 meters in height and has the same species that dominate in the canopy. Both tall and short shrub layers are dominated by *Lonicera morrowii* (Morrow's honeysuckle) and regenerating *Acer saccharum* (sugar maple). A vine layer is present, and the dominant species is *Parthenocissus quinquefolia* (Virginia creeper). The herbaceous layer averages 40%, and is dominated by the exotic *Alliaria petiolata* (garlic mustard) with very few other species present.

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy/subcanopy	Broad-leaved deciduous tree	*Robinia pseudoacacia* (black locust), *Acer saccharum* (sugar maple), and *Catalpa speciosa* (northern catalpa)
Tall/short shrub/sapling	Broad-leaved deciduous shrub	*Lonicera morrowii* (Morrow's honeysuckle)
Herb (field)	Vine/liana	*Parthenocissus quinquefolia* (Virginia creeper
Herb (field)	Forb	*Alliaria petiolata* (garlic mustard)

Characteristic Species: *Robinia pseudoacacia* (black locust), *Catalpa speciosa* (northern catalpa), *Lonicera morrowii* (Morrow's honeysuckle), and *Alliaria petiolata* (garlic mustard).

Other Noteworthy Species: None.

Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
NY	S5*	B	1	Successional Southern Hardwoods	Edinger et al. 2002

Local Range: This successional forest type was documented only at Roosevelt Farm and Forest, but the dominant exotic species of this type, *Robinia pseudoacacia* (black locust), is present throughout the four units, and could be dominant as a forest type in other units.

Classification Comments: This association is used for successional woodlands/forests dominated by *Robinia pseudoacacia* (black locust).

Other Comments: None.
Local Description Authors: Frederick C. Sechler, Jr.
Plots: Roosevelt Farm and Forest (ROVA.119)
AA Points: None.
Roosevelt-Vanderbilt National Historic Site Inventory Notes: None.
None.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Class	Forest and Woodland (1)
Subclass	Temperate Forest (1.C)
Formation	Cool Temperate Forest (1.C.2)
Division	Eastern North American Cool Temperate Forest (D008)
Macrogroup	Eastern North American Ruderal Forest and Plantation (M013)
Group	Northern and Central Hardwood and Conifer Ruderal Forest Group (G030)
Alliance*	*Robinia pseudoacacia* Forest Alliance (A.256)
Alliance (English name)*	Black Locust Forest Alliance
Association	*Robinia pseudoacacia* Forest
Association (English name)	Black Locust Forest
Ecological System(s)	Southern Interior Low Plateau Dry-Mesic Oak Forest (CES202.898)

* Alliance assignment as of 2007. All USNVC alliances are currently (2014) under review and revision.

GLOBAL DESCRIPTION

Concept Summary: This black locust semi-natural forest is found locally throughout the eastern United States. Stands often establish on old fields abandoned after agricultural cropping or pasturing or around old homesites. In some areas it occurs on post-agricultural floodplain terraces. This vegetation has also become established following the planting of *Robinia pseudoacacia* (black locust) to stabilize and enrich nutrient-poor soils that are subject to erosion. The vegetation is dominated by *Robinia pseudoacacia* (black locust). Associated woody species vary from site to site and include *Prunus serotina* (black cherry), *Juniperus virginiana* (eastern red-cedar), *Ulmus americana* (American elm), *Ulmus rubra* (slippery elm), *Carya ovata* (shagbark hickory), *Celtis occidentalis* (common hackberry), *Juglans nigra* (black walnut), *Quercus rubra* (northern red oak), *Ulmus rubra* (slippery elm), and in some areas *Acer platanoides* (Norway maple) or *Ailanthus altissima* (tree of heaven). Understory vegetation is highly variable depending on site history and often includes *Toxicodendron radicans* (eastern poison-ivy); *Lindera benzoin* (northern spicebush) is sometimes present. The invasive non-native *Rosa multiflora* (multiflora rose) may be present as a shrub, along with the non-native bramble *Rubus phoenicolasius* (wine raspberry). Non-native species such as *Alliaria petiolata* (garlic mustard), *Chelidonium majus* (celandine), *Glechoma hederacea* (ground ivy), and *Convallaria majalis* (European lily of the valley) can characterize the herb layer, which may also have a native component.
Environmental Description: This type often establishes on old fields abandoned after agricultural cropping or pasturing or around old home sites. This vegetation has also become established following the planting of *Robinia pseudoacacia* (black locust) to stabilize and enrich nutrient-poor soils that are subject to erosion (Rabie 2000). Soils are variable and may be highly acidic, especially where established on old mine sites.
Vegetation Description: The vegetation is dominated by *Robinia pseudoacacia* (black locust) forming a partial to nearly complete canopy. Associated woody species vary from site to site and include *Prunus serotina* (black cherry), *Juniperus virginiana* (eastern red-cedar), *Ulmus*

americana (American elm), *Ulmus rubra* (slippery elm), *Carya ovata* (shagbark hickory), *Celtis occidentalis* (common hackberry), *Juglans nigra* (black walnut), *Quercus rubra* (northern red oak), *Ulmus rubra* (slippery elm), *Acer rubrum* (red maple), *Nyssa sylvatica* (blackgum), and in some areas *Acer platanoides* (Norway maple) or *Ailanthus altissima* (tree of heaven). Understory vegetation is highly variable depending on site history and often includes *Toxicodendron radicans* (eastern poison-ivy); *Lindera benzoin* (northern spicebush) is sometimes present. The invasive non-natives *Rosa multiflora* (multiflora rose) and *Elaeagnus umbellata* (autumn olive) are typically the most common shrubs, along with the non-native bramble *Rubus phoenicolasius* (wine raspberry). *Cornus florida* (flowering dogwood) may be present in the subcanopy. Non-native species such as *Alliaria petiolata*, *Chelidonium majus* (celandine), *Glechoma hederacea* (ground ivy), *Dactylis glomerata* (orchardgrass), *Daucus carota* (Queen Anne's lace), and *Convallaria majalis* (European lily of the valley) can characterize the herb layer, which may have a native component as well, for example with (depending on geography) *Ageratina altissima* (white snakeroot), *Dichanthelium clandestinum* (deertongue), *Elymus hystrix var. hystrix* (eastern bottlebrush grass), *Leersia virginica* (whitegrass), *Parthenocissus quinquefolia* (Virginia creeper), *Pilea pumila* (Canadian clearweed), *Solidago canadensis* (Canada goldenrod), *Solidago rugosa* (wrinkleleaf goldenrod), *Verbesina alternifolia* (wingstem), *Verbesina occidentalis* (yellow crownbeard), and *Viola* (violet) spp.

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Robinia pseudoacacia* (black locust)

Characteristic Species: *Acer rubrum* (red maple), *Robinia pseudoacacia* (black locust), *Rosa multiflora* (multiflora rose)

Other Noteworthy Species:

Species	GRank	Type	Note
Acer platanoides (Norway maple)	-	plant	exotic
Ailanthus altissima (tree of heaven)		plant	exotic
Alliaria petiolata (garlic mustard)	-	plant	exotic
Chelidonium majus (celandine)	-	plant	exotic
Convallaria majalis (European lily of the valley)	-	plant	exotic
Dactylis glomerata (orchardgrass)	-	plant	exotic
Daucus carota (Queen Anne's lace)	-	plant	exotic
Elaeagnus umbellata (autumn olive)	-	plant	exotic
Glechoma hederacea (ground ivy)	-	plant	exotic
Rosa multiflora (multiflora rose)	-	plant	exotic
Rubus phoenicolasius (wine raspberry)	-	plant	exotic

USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: This black locust semi-natural forest is found locally throughout the eastern United States.

States/Provinces: AR, DC?, DE, IA, KY, MA, MD?, MS, NC, NJ, NY, OK, PA, TN, VA, VT, WV

Federal Lands: NPS (Blue Ridge Parkway, Bluestone, Buffalo River?, C&O Canal?, Cape Cod, Catoctin Mountain?, George Washington Birthplace, Marsh-Billings-Rockefeller, Minute Man, Morristown, National Capital-East?, New River Gorge, Roosevelt-Vanderbilt, Vicksburg);

USFS (George Washington, Jefferson, Monongahela, Nantahala, Ouachita, Ouachita (Mountains), Ozark, Pisgah); USFWS (Montezuma)

CONSERVATION STATUS

Rank: GNA (ruderal) (24-Oct-2002)

Reasons: Although *Robinia pseudoacacia* (black locust) is a native species found in the Central Appalachians and Ozark Mountains, it does not typically become a dominant species in these natural habitats (Elias 1980). It is now widespread in the eastern U.S. in disturbed habitats. This forest represents early-successional vegetation and is thus not of high conservation concern and does not receive a conservation status rank.

CLASSIFICATION INFORMATION

Status: Standard

Confidence: 2 - Moderate

Comments: Information not available.

Similar Associations:

- *Prunus serotina - Liriodendron tulipifera - Acer rubrum - Fraxinus americana - (Robinia pseudoacacia)* Forest (CEGL006599)--can have *Robinia* as an important canopy component but is not dominated by it as is this type.
- *Prunus serotina - Sassafras albidum - (Fraxinus americana) / Juniperus virginiana* Forest (CEGL004133)
- *Robinia pseudoacacia - Celtis occidentalis - (Fraxinus americana, Liriodendron tulipifera)* Forest (CEGL007281)

Related Concepts:

- *Juglans nigra - Robinia pseudoacacia / Lonicera japonica / Verbesina alternifolia* Association (Rawinski et al. 1996) ?
- Successional black locust disturbed forests (CAP pers. comm. 1998) ?
- Successional communities (Ehrenfeld 1977) B

SOURCES

Description Authors: D. Faber-Langendoen, mod. S.C. Gawler and L.A. Sneddon

References: Baalman 1965, CAP pers. comm. 1998, Ehrenfeld 1977, Elias 1980, Fleming and Coulling 2001, Gaertner 1955, Hoagland 2000, INAI unpubl. data, McDonald 1938, NRCS 2004, Rabie 2000, Rawinski et al. 1996, Southeastern Ecology Working Group n.d., TDNH unpubl. data, Vanderhorst et al. 2007, Vanderhorst et al. 2008

Local Name: Early-Successional Aspen – Birch Woodland (CEGL006303)

SYNONYMS

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

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

USNVC Identifier: **CEGL006303**

LOCAL INFORMATION

Environmental Description: This early successional forest association occurs as a result of disturbances and typically occupies abandoned agricultural fields and edges of woodlands. The soils are typically gravelly loam, nearly level and somewhat excessively drained with underlying bedrock comprised of shale and siltstone with minor amounts of sandstone of the Ordovician Formation. Adjacent associations include Mesic Sugar Maple - Ash - Oak - Hickory Forest (CEGL006046), White Pine - Hemlock Dry-Mesic Coniferous Forest (CEGL006328), High Allegheny Rich Red Oak - Sugar Maple Forest (CEGL006125), and agricultural lands.

Vegetation Description: Even though *Populus tremuloides* (quaking aspen) dominates the canopy, the example of this association within Roosevelt-Vanderbilt National Historic Site (ROVA) is in a more advanced stage of succession than is typical for this association. The only example within ROVA is described as a regenerating forest after a severe disturbance. The canopy has 70% cover and 26 meters in height. The canopy is dominated by *Populus tremuloides* (quaking aspen), *Carya glabra* (pignut hickory) and *Betula lenta* (sweet birch). The tree subcanopy has 50% canopy coverage and averages 18 meters in height. This tree subcanopy contains regenerating species that occur mainly in later successional forests such as *Acer saccharum* (sugar maple), *Tsuga canadensis* (eastern hemlock), along with *Betula lenta* (sweet birch). The moderately dense tall shrub layer averages 40% cover and 3 meters in height. The most abundant species include *Acer saccharum* (sugar maple) and *Lindera benzoin* (northern spicebush). The short shrub layer has 35% cover with the same dominant species as in the tall shrub layer. The relatively sparse vine layer averages 15% and is dominated by the exotic *Celastrus orbiculatus* (oriental bittersweet) and *Toxicodendron radicans* (eastern poison ivy). The herbaceous layer is very sparse and consists only of *Eurybia divaricata* (white wood aster).

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Populus tremuloides* (quaking aspen), *Carya glabra* (pignut hickory)
Tree canopy/subcanopy	Broad-leaved deciduous tree	*Betula lenta* (sweet birch)
Tree subcanopy	Broad-leaved deciduous tree	*Acer saccharum* (sugar maple)
Tree subcanopy	Needle-leaved coniferous tree	*Tsuga canadensis* (eastern hemlock)
Tall/short shrub/sapling	Broad-leaved deciduous tree	*Acer saccharum* (sugar maple)
Tall/short shrub	Broad-leaved deciduous shrub	*Lindera benzoin* (northern spicebush)
Herb (field)	Forb	*Eurybia divaricata* (white wood aster)

Characteristic Species: *Populus tremuloides* (quaking aspen) and *Betula lenta* (sweet birch).

Other Noteworthy Species: None.

Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
NY	S5*	B	1	Successional Northern Hardwoods	Edinger et al. 2002

Local Range: This type was documented only at Vanderbilt Mansion NHS during accuracy assessment. However, it may occur sporadically elsewhere where forests are regenerating after a disturbance, or in abandoned agricultural lands where *Populus* sp. (aspen) or *Betula* sp. (birch) has become established.
Classification Comments: This early successional association is classified with *Populus tremuloides* (quaking aspen) and *Betula lenta* (sweet birch) as the dominant species. The example at this park will likely succeed to a maple-ash-hickory forest.
Other Comments: None.
Local Description Authors: Frederick C. Sechler, Jr.
Plots: None.
AA Points: Vanderbilt Mansion NHS (ROVA.25).
Roosevelt-Vanderbilt National Historic Site Inventory Notes: None.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Class	Forest and Woodland (1)
Subclass	Temperate Forest (1.C)
Formation	Cool Temperate Forest (1.C.2)
Division	Eastern North American Cool Temperate Forest (D008)
Macrogroup	Eastern North American Ruderal Forest and Plantation (M013)
Group	Northern and Central Hardwood and Conifer Ruderal Forest Group (G030)
Alliance*	*Populus tremuloides* Woodland Alliance (A.610)
Alliance (English name)*	Quaking Aspen Woodland Alliance
Association	*Populus (tremuloides, grandidentata) - Betula (populifolia, papyrifera)* Woodland
Association (English name)	(Quaking Aspen, Bigtooth Aspen) - (Gray Birch, Paper Birch) Woodland
Ecological System(s)	Laurentian-Acadian Northern Hardwoods Forest (CES201.564)

* Alliance assignment as of 2007. All USNVC alliances are currently (2014) under review and revision.

GLOBAL DESCRIPTION

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

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

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

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

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

Most Abundant Species:

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

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

Other Noteworthy Species:

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

USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: Information not available.

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

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

CONSERVATION STATUS

Rank: G5 (20-Apr-2000)

Reasons: Information not available.

CLASSIFICATION INFORMATION

Status: Standard

Confidence: 3 - Weak

Comments: Information not available.

Similar Associations: Information not available.

Related Concepts:

- CNE mesic hardwood forest on acidic bedrock/till (Rawinski 1984) B
- Mesic Northern Hardwood Forest (Beech-Birch-Maple Forest) (Thompson 1996) B

SOURCES

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

References: Eastern Ecology Working Group n.d., Edinger et al. 2002, Gawler 2002, NRCS 2001, NRCS 2004, Rawinski 1984, Swain and Kearsley 2001, Thompson 1996, Thompson and Sorenson 2000

Figure F-4. Early-Successional Aspen – Birch Woodland (AA point ROVA.25). 08/31/2006. NAD 1983 / UTM-18 easting 587847, northing 4627275.

Local Name: Eastern White Pine Successional Forest (CEGL007944)

SYNONYMS

USNVC English Name: **Eastern White Pine Successional Forest**
USNVC Scientific Name: ***Pinus strobus* Successional Forest**
USNVC Identifier: **CEGL007944**

LOCAL INFORMATION

Environmental Description: This successional transition forest occurs in a variety of environmental settings, but most occur on silty loam soils with underlying bedrock of Ordovician shale and siltstone with minor amounts of sandstone, Austin Glen Formation. Adjacent associations include Northeastern Old Field (CEGL006107), Hardwood Plantation (CEGL006613), and Northeastern Oak - Red Maple Successional Forest (CEGL006506).
Vegetation Description: Only one example of this association was documented at the Home of Franklin D. Roosevelt NHS (excluding Roosevelt Farm and Forest). The tree canopy layer has 80% cover and averages 25 meters in height. The layer is characterized by *Pinus strobus* (eastern white pine), *Acer saccharum* (sugar maple), and *Betula lenta* (sweet birch). The tree subcanopy layer has 60% cover and averages 14 meters in height. This layer is characterized by *Acer saccharum* (sugar maple), *Fraxinus pennsylvanica* (green ash), and *Pinus strobus* (eastern white pine). The sparse tall shrub layer has 15% cover and averages 3 meters in height. The most abundant species is regenerating *Acer saccharum* (sugar maple). The sparse short shrub layer averages 15% cover. The most abundant species includes saplings and seedlings of *Acer saccharum* (sugar maple), plus *Viburnum acerifolium* (mapleleaf viburnum). The relatively sparse herbaceous layer averages 15% cover and the most abundant species include *Alliaria petiolata* (garlic mustard), *Dryopteris intermedia* (intermediate woodfern), and *Allium tricoccum* (wild leek).
Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy/subcanopy	Needle-leaved tree	*Pinus strobus* (eastern white pine)
Tree canopy/subcanopy	Broad-leaved deciduous tree	*Acer saccharum* (sugar maple)
Tall/short shrub/sapling	Broad-leaved deciduous tree	*Acer saccharum* (sugar maple)
Short shrub/sapling	Broad-leaved deciduous shrub	*Viburnum acerifolium* (mapleleaf viburnum)
Herb (field)	Forb	*Alliaria petiolata* (garlic mustard)
Herb (field)	Fern and ally	*Dryopteris intermedia* (intermediate woodfern)

Characteristic Species: *Pinus strobus* (eastern white pine)
Other Noteworthy Species: Information not available.
Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
NY	S5*	B	1	Successional Northern Hardwoods	Edinger et al. 2002

Local Range: This association, along with natural occurring *Pinus strobus* (eastern white pine), is not common at ROVA. The only documented example of this association was recorded at the Home of Franklin D. Roosevelt NHS (excluding Roosevelt Farm and Forest) during accuracy assessment.
Classification Comments: This association was used to classify successional northern hardwoods forest types with *Pinus strobus* (eastern white pine) as the dominant species.

Other Comments: None.
Local Description Authors: Frederick C. Sechler, Jr.
Plots: None.
AA Points: Home of Franklin D. Roosevelt NHS (excluding Roosevelt Farm and Forest) (ROVA.63)
Roosevelt-Vanderbilt National Historic Site Inventory Notes: None.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Class	Forest and Woodland (1)
Subclass	Temperate Forest (1.C)
Formation	Cool Temperate Forest (1.C.2)
Division	Eastern North American Cool Temperate Forest (D008)
Macrogroup	Eastern North American Ruderal Forest and Plantation (M013)
Group	Northern and Central Hardwood and Conifer Ruderal Forest Group (G030)
Alliance*	*Pinus strobus* Forest Alliance (A.128)
Alliance (English name)*	Eastern White Pine Forest Alliance
Association	*Pinus strobus* Successional Forest
Association (English name)	Eastern White Pine Successional Forest
Ecological System(s)	Information not available.

* Alliance assignment as of 2007. All USNVC alliances are currently (2014) under review and revision.

GLOBAL DESCRIPTION

Concept Summary: This is an early-successional forest dominated by *Pinus strobus* (eastern white pine), typically with a very dense canopy and little understory. It is commonly associated with anthropogenic disturbance (e.g., former old fields and formerly cleared flats along streams) and could potentially occur anywhere within the range of the *Pinus strobus* Forest Alliance (A.128). Associated woody and herbaceous species vary with geography. In the northeastern states, the tree canopy is often monotypic and even-aged, with occasional associates including *Acer rubrum* (red maple), *Juniperus virginiana* (eastern red-cedar), *Liriodendron tulipifera* (tuliptree) (within its range), or scattered *Quercus rubra* (northern red oak) or *Quercus velutina* (black oak). In regions where northern hardwoods are more prevalent, canopy associates include *Fraxinus americana* (white ash) and *Acer saccharum* (sugar maple). In the Southern Blue Ridge and nearby areas, typical canopy and subcanopy associates include *Liriodendron tulipifera* (tuliptree), *Acer rubrum* (red maple), *Pinus rigida* (pitch pine), and *Liquidambar styraciflua* (sweetgum), with *Tsuga canadensis* (eastern hemlock) often forming a dense shrub stratum. The understory is typically poorly developed or characterized by scattered individuals found in the canopy. The herbaceous cover is variable depending on the density of tree and shrub cover, and may be characterized by ruderal or exotic species that favor openings or disturbance. In more open stands, typical species are those associated with old fields, including *Solidago rugosa* (wrinkleleaf goldenrod), *Solidago gigantea* (giant goldenrod), *Anthoxanthum odoratum* (sweet vernalgrass), *Poa pratensis* (Kentucky bluegrass), *Schizachyrium scoparium* (little bluestem), *Elymus repens* (quackgrass), *Bromus inermis* (smooth brome), *Agrostis gigantea* (redtop), *Euthamia graminifolia* (flat-top goldentop), *Achillea millefolium* (common yarrow), and *Daucus carota* (Queen Anne's lace). In stands that are more heavily forested, typical herbs include *Aralia nudicaulis* (wild sarsaparilla), *Ageratina altissima* (white snakeroot), *Galium triflorum* (fragrant bedstraw), *Maianthemum canadense* (Canada mayflower), *Trientalis borealis* (starflower), *Mitchella repens* (partridgeberry), *Polystichum acrostichoides* (Christmas fern), and *Lycopodium* (clubmoss) species. The particular composition of the herb layer will vary with geography. The

substrate is usually covered by a thick layer of pine needle duff. In the Daniel Boone National Forest of Kentucky, *Pinus strobus* (eastern white pine) is spreading from plantings, especially in the Red River Gorge.

Environmental Description: This wide-ranging successional forest is commonly associated with anthropogenic disturbance and could potentially occur anywhere within the range of the *Pinus strobus* Forest Alliance (A.128). It typically occurs on former agricultural lands and old fields that are no longer intensively mowed, plowed or managed, developing as *Pinus strobus* (eastern white pine) colonizes the open fields. Associated woody and herbaceous species vary with geography but are typically ruderal or exotic species that favor openings or disturbance.

Vegetation Description: The tree canopy ranges from woodland to forest closure, with 25-85% cover. It is often monotypic and even-aged *Pinus strobus* (eastern white pine), with occasional associates, including *Acer rubrum* (red maple), *Betula lenta* (sweet birch), *Juniperus virginiana* (eastern red-cedar), or scattered *Quercus rubra* (northern red oak) or *Quercus velutina* (black oak). In regions where northern hardwoods are more prevalent, canopy associates include *Fraxinus americana* (white ash) and *Acer saccharum* (sugar maple). In the Southern Blue Ridge and nearby areas, typical canopy and subcanopy associates include *Liriodendron tulipifera* (tuliptree), *Acer rubrum* (red maple), *Pinus rigida* (pitch pine), and *Liquidambar styraciflua* (sweetgum), with *Tsuga canadensis* (eastern hemlock) often forming a dense shrub stratum. The understory is poorly developed or characterized by scattered individuals found in the canopy. Shrubs are often present in the more open stands and include native species, such as *Cornus racemosa* (gray dogwood), *Rhus glabra* (smooth sumac), *Viburnum prunifolium* (blackhaw), and *Rubus* (blackberry) spp., as well as exotics, such as *Elaeagnus umbellata* (autumn olive), *Rosa multiflora* (multiflora rose), *Lonicera morrowii* (Morrow's honeysuckle), and *Berberis thunbergii* (Japanese barberry). The herbaceous cover is variable depending on the density of tree and shrub cover, and may be characterized by ruderal or exotic species that favor openings or disturbance. In more open stands, typical species are those associated with old fields, such as *Solidago rugosa* (wrinkleleaf goldenrod), *Solidago gigantea* (giant goldenrod), *Anthoxanthum odoratum* (sweet vernalgrass), *Poa pratensis* (Kentucky bluegrass), *Schizachyrium scoparium* (little bluestem), *Elymus repens* (quackgrass), *Bromus inermis* (smooth brome), *Agrostis gigantea* (redtop), *Euthamia graminifolia* (flat-top goldentop), *Achillea millefolium* (common yarrow), and *Daucus carota* (Queen Anne's lace). In stands that are more heavily forested, typical herbs include *Aralia nudicaulis* (wild sarsaparilla), *Ageratina altissima* (white snakeroot), *Galium triflorum* (fragrant bedstraw), *Maianthemum canadense* (Canada mayflower), *Medeola virginiana* (Indian cucumber), *Polystichum acrostichoides* (Christmas fern), *Trientalis borealis* (starflower), *Mitchella repens* (partridgeberry), and *Lycopodium* (clubmoss) species. The particular composition of the herb layer will vary with geography. The substrate is usually covered by a thick layer of pine needle duff.

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Pinus strobus* (eastern white pine)

Characteristic Species: *Pinus strobus* (eastern white pine)

Other Noteworthy Species:

Species	GRank	Type	Note
Achillea millefolium (common yarrow)	-	plant	exotic
Agrostis gigantea (redtop)	-	plant	exotic
Anthoxanthum odoratum (sweet vernalgrass)	-	plant	exotic
Berberis thunbergii (Japanese barberry)	-	plant	exotic

Daucus carota (Queen Anne's lace)	-	plant	exotic
Elaeagnus umbellata (autumn olive)	-	plant	exotic
Elymus repens (quackgrass)	-	plant	exotic
Lonicera morrowii (Morrow's honeysuckle)	-	plant	exotic
Rosa multiflora (multiflora rose)	-	plant	exotic

USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: This successional type may be expected to occur throughout the range of the alliance (i.e., from Michigan, northern Wisconsin, northern and eastern Minnesota, extreme northeastern Iowa, and from Maine and New Hampshire south to Georgia and Tennessee, as well as in Ontario, Canada). It has been documented primarily in areas where project-specific needs have required it.

States/Provinces: CT, GA, KY, MA, MD?, ME, MI, MN, NC, NH, NJ, NY, PA, RI, SC, TN, VA, VT, WI, WV

Federal Lands: BIA (Eastern Band of Cherokee); NPS (Big South Fork, Blue Ridge Parkway, Bluestone, Carl Sandburg Home, Delaware Water Gap, Gettysburg, Great Smoky Mountains, Marsh-Billings-Rockefeller, New River Gorge, Obed, Saint-Gaudens, Roosevelt-Vanderbilt); USFS (Cherokee?, Daniel Boone, George Washington, Jefferson, Monongahela); USFWS (Great Meadows, Moosehorn)

CONSERVATION STATUS

Rank: GNA (ruderal) (11-Feb-2001)

Reasons: This forest represents successional vegetation and is thus not of high conservation concern and does not receive a conservation status rank.

CLASSIFICATION INFORMATION

Status: Standard

Confidence: 2 - Moderate

Comments: This successional type may be expected to occur throughout the range of the alliance but has primarily been attributed in areas where The Nature Conservancy ecoregional planning or other project-specific needs have documented its occurrence. Rangewide review should greatly expand its geographic scope.

Similar Associations:

- *Pinus strobus* Planted Forest (CEGL007178)

Related Concepts:

- *Pinus strobus / (Diphasiastrum digitatum, Lycopodium obscurum)* forest (Vanderhorst 2001b) =
- White Pine - White Oak - Chestnut Oak Type (Schmalzer and DeSelm 1982) B
- semi-natural (Chapman et al. 1989) ?

SOURCES

Description Authors: K.D. Patterson, mod. L.A. Sneddon and S.C. Gawler

References: Chapman et al. 1989, Fleming and Coulling 2001, NRCS 2004, NatureServe Ecology - Southeastern U.S. unpubl. data, Schmalzer and DeSelm 1982, Southeastern Ecology Working Group n.d., TDNH unpubl. data, Vanderhorst 2001b, Vanderhorst et al. 2007, Vanderhorst et al. 2008

Figure F-5. Eastern White Pine Successional Forest (AA point ROVA.63). 09/07/2006. NAD 1983 / UTM-18 easting 588519, northing 4624339.

Local Name: Northeastern Modified Successional Forest (CEGL006599)

SYNONYMS

USNVC English Name:	**Black Cherry - Tuliptree - Red Maple - White Ash - (Black Locust) Forest**
USNVC Scientific Name:	***Prunus serotina - Liriodendron tulipifera - Acer rubrum - Fraxinus americana* - (*Robinia pseudoacacia*) Forest**
USNVC Identifier:	**CEGL006599**

LOCAL INFORMATION

Environmental Description: This successional forest is associated with a variety of severely disturbed areas, including regenerating forests, forests in close proximity to suburban development, and areas on edges of successional old fields and agricultural areas. This forest type can occur either in altered wet bottomlands or dry uplands. The forests are generally young and usually contain exotic species. Soils are extremely variable with underlying bedrock of Ordovician shale and siltstone with minor amounts of sandstone, Austin Glen Formation. Adjacent natural communities occurring at Roosevelt-Vanderbilt National Historic Site include Northeastern Oak - Red Maple Successional Forest (CEGL006506), Red Maple / Tussock Sedge Wooded Marsh (CEGL006119), Alluvial Alder Swamp (CEGL006414), Central Appalachian Hemlock - Chestnut Oak Forest (CEGL006923), Mixed Pine Conifer Plantation (CEGL006313), High Allegheny Rich Red Oak - Sugar Maple Forest (CEGL006125), and Northeastern Old Field (CEGL006107).

Vegetation Description: This successional forest averages 53.6% cover and 21.8 meters in height. The species composition for each site depends largely upon disturbance and land-use history, and the type of natural communities and landscape adjacent to this association. Characteristic species include *Platanus occidentalis* (American sycamore), *Acer rubrum* (Acer rubrum), *Fraxinus americana* (white ash), *Quercus rubra* (northern red oak), *Prunus serotina* (black cherry), *Acer saccharum* (sugar maple), *Carya ovat*a (pignut hickory), *Fraxinus pennsylvanica* (green ash), and *Ailanthus altissima* (tree of heaven). The tree subcanopy layer has similar species as the tree canopy and averages 25.7% cover and 11.5 meters in height. Species not in the tree canopy layer found in the subcanopy layer include *Carya ovata* (shagbark hickory), *Juniperus virginiana* (eastern red-cedar), and *Fraxinus americana* (white ash). The tall shrub layer averages 36.4% cover and 3.1 meters in height. Species found within this layer, in addition to regenerating canopy species, include exotic species such as *Lonicera tatarica* (Tatarian honeysuckle), *Cornus racemosa* (gray dogwood), and *Alnus incana* ssp. *rugosa* (speckled alder). The short shrub layer averages 27.4% cover and contain many similar species found in the tall shrub layers. The most abundant species include *Lonicera tatarica* (Tatarian honeysuckle), *Carya glabra* (pignut hickory), *Rhus glabra* (smooth sumac), *Cornus racemosa* (gray dogwood), *Fraxinus pennsylvanica* (green ash), *Prunus serotina* (black cherry), *Acer rubrum* (red maple), and *Acer platanoides* (Norway maple). The vine layer averages 22.9% cover and is dominated by exotic species *Celastrus orbiculatus* (oriental bittersweet), along with *Parthenocissus quinquefolia* (Virginia creeper), and *Toxicodendron radicans* (eastern poison ivy). The herbaceous layer averages 35.7% cover and is dominated by the exotic *Alliaria petiolata* (garlic mustard), plus *Solidago canadensis* (Canada goldenrod), *Solidago rugosa* (wrinkleleaf goldenrod), *Eurybia divaricata* (white wood aster), *Artemisia vulgaris* (common wormwood), and *Ageratina altissima* (white snakeroot).

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Platanus occidentalis* (American sycamore), *Acer rubrum* (red maple), *Fraxinus americana* (white ash), *and Prunus serotina* (black cherry)
Tree subcanopy	Broad-leaved deciduous tree	*Ailanthus altissim*a (tree of heaven), *Acer rubrum* (red maple)
Tall/short shrub sapling	Broad-leaved deciduous shrub	*Lonicera tatarica* (Tatarian honeysuckle)
Tall shrub/sapling	Broad-leaved deciduous tree	*Carya glabra* (Pignut hickory)
Herb (field)	Vine/liana	*Celastrus orbiculatus* (oriental bittersweet)
Herb (field)	Forb	*Alliaria petiolata* (garlic mustard), *Solidago canadensis* (Canada goldenrod)

Characteristic Species: *Acer rubrum* (red maple), *Prunus serotina* (black cherry), and *Lonicera tatarica* (Tatarian honeysuckle).
Other Noteworthy Species: None.
Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
NY	S5*	B	1	Successional Southern Hardwoods	Edinger et al. 2002

Local Range: This successional forest type can be found throughout the four units of Roosevelt-Vanderbilt National Historic Site on a variety of mesic and dry areas that have had a history of severe disturbance.
Classification Comments: This type is used to classify successional forests without significant amounts of successional northern forest indicators.
Other Comments: None.
Local Description Authors: Frederick C. Sechler, Jr.
Plots: None.
AA Points: Roosevelt Farm and Forest (ROVA.152, ROVA.209, ROVA.215), Val-Kill (ROVA.120), Vanderbilt Mansion NHS (ROVA. 23, ROVA.33), Home of Franklin D. Roosevelt NHS (excluding Roosevelt Farm and Forest) (ROVA.62).
Roosevelt-Vanderbilt National Historic Site Inventory Notes: None.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Class	Forest and Woodland (1)
Subclass	Temperate Forest (1.C)
Formation	Cool Temperate Forest (1.C.2)
Division	Eastern North American Cool Temperate Forest (D008)
Macrogroup	Eastern North American Ruderal Forest and Plantation (M013)
Group	Northern and Central Hardwood and Conifer Ruderal Forest Group (G030)
Alliance*	*Prunus serotina - Acer rubrum - Amelanchier canadensis - Quercus* spp. Forest Alliance (A.237)
Alliance (English name)*	Black Cherry - Red Maple - Canadian Serviceberry - Oak species Forest Alliance
Association	*Prunus serotina - Liriodendron tulipifera - Acer rubrum - Fraxinus americana - (Robinia pseudoacacia)* Forest

Association (English name) Black Cherry - Tuliptree - Red Maple - White Ash - (Black Locust) Forest
Ecological System(s) Semi-natural / Altered Vegetation and Conifer Plantations (CES203.074)
* Alliance assignment as of 2007. All USNVC alliances are currently (2014) under review and revision.

GLOBAL DESCRIPTION

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

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

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Acer rubrum* (red maple), *Fraxinus americana* (white ash), *Liriodendron tulipifera* (tuliptree), *and Prunus serotina* (black cherry), *Robinia pseudoacacia* (black locust)
Tree subcanopy	Broad-leaved deciduous tree	*Acer rubrum* (red maple)
Tall shrub/sapling	Broad-leaved deciduous tree	*Carpinus caroliniana* (American hornbeam)
Tall shrub/sapling	Broad-leaved deciduous shrub	*Lindera benzoin* (northern spicebush), *Rosa multiflora* (multiflora rose)

Herb (field)	Forb	*Alliaria petiolata* (garlic mustard), *Polygonum persicaria* (spotted ladysthumb)
Herb (field)	Graminoid	*Microstegium vimineum* (Nepalese browntop)

Characteristic Species: *Acer rubrum* (red maple), *Alliaria petiolata* (garlic mustard), *Berberis thunbergii* (Japanese barberry), *Elaeagnus umbellata* (autumn olive), *Fraxinus americana* (white ash), *Juglans nigra* (black walnut), *Liriodendron tulipifera* (tuliptree), *Microstegium vimineum* (Nepalese browntop), *Polygonum persicaria* (spotted ladysthumb), *Prunus serotina* (black cherry), *Robinia pseudoacacia* (black locust), *Rosa multiflora* (multiflora rose), *Rubus allegheniensis* (Allegheny blackberry)
Other Noteworthy Species: Information not available.
USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: This vegetation is currently described from Pennsylvania, New York, and New Jersey but is of broader distribution in the northeastern U.S.
States/Provinces: CT, DE, IN, MA, NJ, NY, PA, VA
Federal Lands: NPS (Allegheny Portage Railroad, Boston Harbor Islands, Delaware Water Gap, Fort Necessity, Friendship Hill, Gateway, George Washington Parkway?, Gettysburg, Harpers Ferry, Indiana Dunes, Johnstown Flood, Manassas, Morristown, Sagamore Hill, Roosevelt-Vanderbilt, Saugus Iron Works, Shenandoah, Upper Delaware, Valley Forge, Weir Farm); USFWS (Cape May, Erie, Great Meadows?, Montezuma, Prime Hook, Supawna Meadows)

CONSERVATION STATUS

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

CLASSIFICATION INFORMATION

Status: Standard
Confidence: 2 - Moderate
Comments: This vegetation is broadly defined and varies widely in composition across its range, presenting a classification challenge at the alliance level.
Similar Associations:

- *Juglans nigra / Verbesina alternifolia* Forest (CEGL007879)
- *Liriodendron tulipifera - Quercus* spp. Forest (CEGL007221)--is more strongly dominated by *Liriodendron* and is generally in a later successional state as evidenced by taller trees and more closed canopy.
- *Prunus serotina - Sassafras albidum - (Fraxinus americana) / Juniperus virginiana* Forest (CEGL004133)
- *Robinia pseudoacacia* Forest (CEGL007279)

Related Concepts: Information not available.

SOURCES

Description Authors: L.A. Sneddon, mod. S.C. Gawler, E. Largay, G.P. Fleming
References: Eastern Ecology Working Group n.d., Ehrenfeld 1977, Fike 1999, NRCS 2001, NRCS 2004, Perles et al. 2006c, Perles et al. 2007, Soil Conservation Service 1987, Young et al. 2006

Figure F-6. Northeastern Modified Successional Forest (AA point ROVA.209). 07/25/2008. NAD 1983 / UTM-18 easting 590642, northing 4624065.

Local Name: Northeastern Oak - Red Maple Successional Forest (CEGL006506)

SYNONYMS

USNVC English Name: **Northern Red Oak - Red Maple - Birch species - Eastern White Pine Forest**
USNVC Scientific Name: ***Quercus rubra - Acer rubrum - Betula* spp. *Pinus strobus* Forest**
USNVC Identifier: **CEGL006506**

LOCAL INFORMATION

Environmental Description: This early successional forest is located on a variety of landscapes with a history of severe disturbances. Soils are varied forms of loamy soils, including channery silt loam and channery loam. The underlying bedrock is Ordovician, shale and siltstone with minor amounts of sandstone from the Austin Glen formation. Adjacent associated upland communities include Hemlock-Northern Hardwood Forest (CEGL006109), Red Oak - Northern Hardwood Forest (CEGL006173), High Allegheny Rich Red Oak - Sugar Maple Forest (CEGL006125). Adjacent associated wetland communities include Red Maple / Tussock Sedge Wooded Marsh (CEGL006119).

Vegetation Description: This successional forest's tree canopy averages 58.8% cover and 21 meters in height. Characteristic species include *Acer rubrum* (red maple), *Fraxinus americana* (white ash), *Fraxinus pennsylvanica* (green ash), *Acer saccharum* (sugar maple), *Ulmus americana* (American elm), *Prunus serotina* (black cherry), *Platanus occidentalis* (American sycamore), *Pinus strobus* (eastern white pine), and *Acer saccharinum* (silver maple). The tree subcanopy layer averages 24.8% cover and 13 meters in height. The most abundant species include species in the canopy layer plus *Juniperus virginiana* (eastern red-cedar) and *Ailanthus altissima* (tree of heaven). The relatively sparse tall shrub layer averages 20.3% cover and 3.2 meters in height. This shrub layer is characterized by *Alnus incana* ssp. *rugosa* (speckled alder), *Viburnum dentatum* (southern arrowwood), *Sambucus nigra* var. *canadensis* (common elderberry), and *Lonicera tatarica* (Tatarian honeysuckle). The short shrub layer averages 33.3% cover and is characterized by *Rubus flagellaris* (northern dewberry), *Viburnum dentatum* (southern arrowwood), *Rubus allegheniensis* (Allegheny blackberry), and *Berberis thunbergii* (Japanese barberry). The vine layer averages 24.3% cover and the most abundant species include *Celastrus orbiculatus* (oriental bittersweet), *Cuscuta gronovii* (scaldweed), *Vitis aestivalis* (summer grape), and *Parthenocissus quinquefolia* (Virginia creeper). The herbaceous layer averages 40% cover and is characterized by *Impatiens capensis* (jewelweed), *Ageratina altissima* (white snakeroot), *Alliaria petiolata* (garlic mustard), *Solidago rugosa* (wrinkleleaf goldenrod) and *Solidago gigantea* (giant goldenrod).

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Acer rubrum* (red maple), *Fraxinus americana* (white ash), *Acer saccharum* (sugar maple)
Tree subcanopy	Needle-leaved tree	*Juniperus virginiana* (eastern red-cedar)
Tall shrub/sapling	Broad-leaved deciduous shrub	*Alnus incana* (speckled alder), *Viburnum dentatum* (southern arrowwood)
Short shrub/sapling	Broad-leaved deciduous shrub	*Rubus flagellaris* (northern dewberry)

Herb (field)	Vine/liana	*Celastrus orbiculatus* (oriental bittersweet)
Herb (field)	Forb	*Impatiens capensis* (jewelweed), *Ageratina altissima* (white snakeroot), *Alliaria petiolata* (garlic mustard)

Characteristic Species: *Acer rubrum* (red maple) and *Fraxinus americana* (white ash).
Other Noteworthy Species: None
Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
NY	S5*	B	1	Successional Northern Hardwoods	Edinger et al. 2002

Local Range: This successional forest is common and is mapped throughout the four units that comprise the park.
Classification Comments: This association includes successional forests dominated by *Quercus rubra* (northern red oak) and/or *Acer rubrum* (red maple). This association may contain *Pinus strobus* (eastern white pine), but it should not be dominant. White pine-dominated successional forests at Roosevelt-Vanderbilt Historical Sites should be classified as Eastern White Pine Successional Forest (CEGL007944).
Other Comments: None.
Local Description Authors: Frederick C. Sechler, Jr.
Plots: Home of Franklin D. Roosevelt NHS (excluding Roosevelt Farm and Forest) (ROVA.76).
AA Points: Vanderbilt Mansion NHS (ROVA.9), Roosevelt Farm and Forest (ROVA.162, ROVA.200).
Roosevelt-Vanderbilt National Historic Site Inventory Notes: None.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Class	Forest and Woodland (1)
Subclass	Temperate Forest (1.C)
Formation	Cool Temperate Forest (1.C.2)
Division	Eastern North American Cool Temperate Forest (D008)
Macrogroup	Eastern North American Ruderal Forest and Plantation (M013)
Group	Northern and Central Hardwood and Conifer Ruderal Forest Group (G030)
Alliance*	*Quercus rubra - (Acer saccharum)* Forest Alliance (A.251)
Alliance (English name)*	Northern Red Oak - (Sugar Maple) Forest Alliance
Association	*Quercus rubra - Acer rubrum - Betula* spp. - *Pinus strobus* Forest
Association (English name)	Northern Red Oak - Red Maple - Birch species - Eastern White Pine Forest
Ecological System(s)	Laurentian-Acadian Pine-Hemlock-Hardwood Forest (CES201.563) Northern Atlantic Coastal Plain Hardwood Forest (CES203.475) Laurentian-Acadian Northern Pine-(Oak) Forest (CES201.719)

* Alliance assignment as of 2007. All USNVC alliances are currently (2014) under review and revision.

GLOBAL DESCRIPTION

Concept Summary: This deciduous to mixed forest of northern New England is a broadly defined community, usually developing after severe disturbance, including clearing, pasturing, logging, fires, severe hurricanes, or simply heavily fragmented residential development. While in some cases it is a successional type, it may persist in some settings, particularly where soils are limited, for example along ridgelines. The canopy trees are mostly 40-100 years old. The canopy ranges from somewhat open to closed; the shrub, herb and bryoid layers are patchy and rarely extensive. Composition is variable depending on site history. The canopy is usually mostly

deciduous, dominated by a heterogeneous mixture of *Quercus rubra* (northern red oak), *Acer rubrum* (red maple), *Pinus strobus* (eastern white pine), and *Fagus grandifolia* (American beech). Typically these occur in association with light-requiring, wind-dispersed trees such as *Populus tremuloides* (quaking aspen), *Populus grandidentata* (bigtooth aspen), *Betula papyrifera* (paper birch), *Betula populifolia* (gray birch), *Fraxinus americana* (white ash), and *Prunus serotina* (black cherry). Minor associates include *Picea rubens* (red spruce) and *Acer saccharum* (sugar maple). Understory species tend to reflect predisturbance conditions and include *Acer pensylvanicum* (striped maple), *Corylus cornuta* (beaked hazelnut), *Viburnum acerifolium* (mapleleaf viburnum), or *Hamamelis virginiana* (American witch-hazel) in the shrub layer. *Vaccinium angustifolium* (lowbush blueberry) is a typical low shrub, although it does not form a coherent layer. *Pteridium aquilinum* (western brackenfern) is characteristic and may be abundant in the herbaceous layer; other common herbs include *Trientalis borealis* (starflower), *Maianthemum canadense* (Canada mayflower), *Deschampsia flexuosa* (wavy hairgrass), and *Aralia nudicaulis* (wild sarsaparilla). The bryophyte layer is of variable cover and may include *Polytrichum commune* (polytrichum moss) and *Dicranum polysetum* (dicranum moss). This association is differentiated from similar forests and woodlands by its thin canopy that usually includes early-successional species, particularly *Acer rubrum* (red maple), low abundance of tolerant hardwoods other than northern red oak, and the lack of a well-developed heath shrub layer (as is typical in oak-pine woodlands). Unlike oak and oak-pine forests to the south, *Quercus rubra* (northern red oak) is the only oak species present in any abundance.

Environmental Description: This deciduous to mixed forest of northern New England is a broadly defined community, usually developing after severe disturbance including clearing, pasturing, logging, fires, severe hurricanes, or simply heavily fragmented residential development. While in some cases it is a successional type, it may persist in some settings, particularly where soils are limited, for example along ridgelines.

Vegetation Description: Canopy trees are mostly 40-100 years old. The canopy ranges from somewhat open to closed; the shrub, herb, and bryoid layers are patchy and rarely extensive. Composition is variable depending on site history. The canopy is usually mostly deciduous, dominated by a heterogeneous mixture of *Quercus rubra* (northern red oak), *Pinus strobus* (eastern white pine), and *Fagus grandifolia* (American beech). Typically these occur in association with light-requiring, wind-dispersed trees such as *Acer rubrum* (red maple), *Populus tremuloides* (quaking aspen), *Populus grandidentata* (bigtooth aspen), *Betula papyrifera* (paper birch), *Betula populifolia* (gray birch), *Fraxinus americana* (white ash), and *Prunus serotina* (black cherry). Minor associates include *Picea rubens* (red spruce) and *Acer saccharum* (sugar maple). Understory species tend to reflect predisturbance conditions and include *Acer pensylvanicum* (striped maple), *Corylus cornuta* (beaked hazelnut), *Viburnum acerifolium* (mapleleaf viburnum), or *Hamamelis virginiana* (American witch-hazel) in the shrub layer. *Vaccinium angustifolium* (lowbush blueberry) is a typical low shrub. *Pteridium aquilinum* (western brackenfern) is characteristic, and may be abundant, in the herbaceous layer; other common herbs include *Trientalis borealis* (starflower), *Maianthemum canadense* (Canada mayflower), *Deschampsia flexuosa* (wavy hairgrass), and *Aralia nudicaulis* (wild sarsaparilla). The bryophyte layer is of variable cover and may include *Polytrichum commune* (polytrichum moss) and *Dicranum polysetum* (dicranum moss).

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Pinus strobus* (eastern white pine)

Tree canopy	Broad-leaved deciduous tree	*Fagus grandifolia* (American beech), *Quercus rubra* (northern red oak)
Tree subcanopy	Broad-leaved deciduous tree	*Acer rubrum* (red maple)
Tall shrub/sapling	Broad-leaved deciduous shrub	*Acer pensylvanicum* (striped maple), *Corylus cornuta* (beaked hazelnut), *Hamamelis virginiana* (American witch-hazel), *Viburnum acerifolium* (mapleleaf viburnum)
Short shrub/sapling	Broad-leaved deciduous shrub	*Vaccinium angustifolium* (lowbush blueberry)
Herb (field)	Fern or fern ally	*Pteridium aquilinum* (western brackenfern)

Characteristic Species: *Fagus grandifolia* (American beech), *Pinus strobus* (eastern white pine), *Pteridium aquilinum* (western brackenfern), *Quercus rubra* (northern red oak), *Vaccinium angustifolium* (lowbush blueberry)
Other Noteworthy Species: Information not available.
USFWS Wetland System: Not applicable.

DISTRIBUTION
Range: This forest occurs in northern and central New England.
States/Provinces: CT, MA, ME, NB, NH, NY, PA, RI, VT
Federal Lands: NPS (Acadia, Minute Man, Roosevelt-Vanderbilt, Upper Delaware); USFWS (Assabet River, Eastern Massachusetts, Great Meadows, Montezuma, Moosehorn?, Oxbow)

CONSERVATION STATUS
Rank: GNR (2-Jul-1999)
Reasons: Information not available.

CLASSIFICATION INFORMATION
Status: Standard
Confidence: 2 - Moderate
Comments: This association was first described from the Northern Appalachian-Acadian ecoregion, where it approaches a matrix landscape pattern in the southern portions of the region while being absent from areas to the north. Similar forests extend southward. Further work in Lower New England suggests that this type may represent an earlier successional version of *Pinus strobus - Quercus (rubra, velutina) - Fagus grandifolia* Forest (CEGL006293), and possibly of other later-successional types, distinguished by the preponderance of *Acer rubrum* (red maple) in the canopy.
Similar Associations:
- (*Pinus strobus, Quercus rubra*) / *Danthonia spicata* Acidic Bedrock Wooded Herbaceous Vegetation (CEGL005101)
- *Betula lenta - Acer rubrum / Lycopodium annotinum - Dennstaedtia punctilobula* Forest (CEGL008503)
- *Pinus strobus - Quercus (rubra, velutina) - Fagus grandifolia* Forest (CEGL006293)
- *Quercus (rubra, velutina, alba) - Betula lenta - (Pinus strobus)* Forest (CEGL006454)
- *Quercus rubra - (Quercus prinus) / Vaccinium* spp. / *Deschampsia flexuosa* Woodland (CEGL006134)
- *Quercus rubra - Acer saccharum - Fagus grandifolia / Viburnum acerifolium* Forest (CEGL006173)

Related Concepts: Information not available.

SOURCES
Description Authors: S.C. Gawler

References: Eastern Ecology Working Group n.d., Edinger et al. 2002, Gawler 2002, Kuchler 1956, Moore and Taylor 1927, NRCS 2004, Sperduto 2000a, Thompson and Jenkins 1992.

Figure F-7. Northeastern Oak - Red Maple Successional Forest (plot ROVA.76). 09/01/2004. NAD 1983 / UTM-18 easting 588668, northing 4623242.

Local Name: Norway Maple Forest (CEGL006407)

SYNONYMS

USNVC English Name: **Norway Maple Forest**
USNVC Scientific Name: ***Acer platanoides* Forest**
USNVC Identifier: **CEGL006407**

LOCAL INFORMATION

Environmental Description: This successional forest with exotic *Acer platanoides* (Norway Maple) as the dominant species usually occurs in severely disturbed areas regenerating to forests adjacent to residential areas. The soils are variable with underlying bedrock of Ordovician shale and siltstone with minor amounts of sandstone, Austin Glen Formation. In more disturbed areas, this forest type likely replaces Acer saccharum (sugar maple) and Fagus grandifolia (American beech) dominated forests (CEGL006211). Adjacent and associated natural community types include Eastern Woodland Vernal Pool (CEGL006453), Northeastern Oak - Red Maple Successional Forest (CEGL006506), Northeastern Dry Oak-Hickory Forest (CEGL006336), Northeastern Successional Shrubland (CEGL006451), Northeastern Old Field (CEGL006107), High Allegheny Rich Red Oak - Sugar Maple Forest (CEGL006125).

Vegetation Description: This successional forest averages 77.5% and 26 meters in height. It is dominated by the exotic *Acer platanoides* (Norway maple) to the exclusion of other species. Other species present within the canopy include *Acer saccharum* (sugar maple), *Quercus alba* (white oak), *Quercus rubra* (northern red oak), and *Fraxinus americana* (white ash). The tree subcanopy averages 42% cover and 16 meters in height and is dominated by *Acer platanoides* (Norway maple). The sparse tall shrub layer averages 10.5% and is characterized by *Fagus grandifolia* (American beech), *Acer saccharum* (sugar maple), and *Carpinus caroliniana* (American hornbeam). The moderately dense short shrub layer contains abundant regeneration of *Acer platanoides* (Norway maple) as the dominant species. The relatively sparse herbaceous layer averages 25% cover and is dominated by the exotic *Alliaria petiolata* (garlic mustard).

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Acer platanoides* (Norway maple)
Tree canopy	Broad-leaved deciduous tree	*Acer saccharum* (sugar maple), *Quercus alba* (white oak), *Quercus rubra* (northern red oak), and *Fraxinus americana* (white ash)
Tall/short shrub/sapling	Broad-leaved deciduous shrub	*Acer platanoides* (Norway maple)
Tall shrub/sapling	Broad-leaved deciduous shrub	*Fagus grandifolia* (American beech) *Carpinus caroliniana* (American hornbeam)
Herb (field)	Forb	*Alliaria petiolata* (garlic mustard)

Characteristic Species: *Acer platanoides* (Norway maple)

Other Noteworthy Species: None.

Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
NY	SNA			Successional Northern Hardwoods	Edinger et al. 2002

Local Range: This *Acer platanoides* (Norway maple) dominated forest is found in more disturbed areas within units Roosevelt Farm and Forest, Vanderbilt Mansion NHS, and likely in the other units in the park.
Classification Comments: This association was classified using successional forests dominated by *Acer platanoides* (Norway maple).
Other Comments: None.
Local Description Authors: Frederick C. Sechler, Jr.
Plots: Roosevelt Farm and Forest (ROVA.113)
AA Points: Vanderbilt Mansion NHS (ROVA.3, ROVA.20)
Roosevelt-Vanderbilt National Historic Site Inventory Notes: None.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Class	Forest and Woodland (1)
Subclass	Temperate Forest (1.C)
Formation	Cool Temperate Forest (1.C.2)
Division	Eastern North American Cool Temperate Forest (D008)
Macrogroup	Eastern North American Ruderal Forest and Plantation (M013)
Group	Northern and Central Hardwood and Conifer Ruderal Forest Group (G030)
Alliance	*Acer saccharum - Betula alleghaniensis - (Fagus grandifolia)* Forest Alliance (A.216)
Alliance (English name)	Sugar Maple - Yellow Birch - (American Beech) Forest Alliance
Association	*Acer platanoides* Forest
Association (English name)	Norway Maple Forest
Ecological System(s)	Information not available.

* Alliance assignment as of 2007. All USNVC alliances are currently (2014) under review and revision.

GLOBAL DESCRIPTION

Concept Summary: This association represents forests in the northeastern United States strongly dominated by the invasive tree *Acer platanoides* (Norway maple), often to the exclusion of virtually all other canopy species. Most documented stands are at low elevations, on flat or rolling topography both above and below the glacial boundary. *Acer platanoides* (Norway maple) is the overwhelmingly dominant tree, typically forming a closed or nearly closed canopy. In some stands native trees, including *Fraxinus americana* (white ash) and *Acer saccharum* (sugar maple) (the latter especially susceptible to exclusion by Norway maple), may be present in very limited amounts. Other stands may have non-native associates, including *Pinus nigra* (Austrian pine), *Pinus sylvestris* (Scotch pine), or *Robinia pseudoacacia* (black locust). The deep shade cast by *Acer platanoides* (Norway maple) limits understory growth, aside from regeneration of *Acer platanoides* (Norway maple), or incursions by non-native shrubs such as *Rosa multiflora* (multiflora rose), *Berberis vulgaris* (common barberry), *Lonicera japonica* (Japanese honeysuckle), or *Lonicera morrowii* (Morrow's honeysuckle). Native herbs are few, especially compared to more natural deciduous forests in similar settings. A few native or exotic herbaceous species or vines may occupy the ground layer, such as *Alliaria petiolata* (garlic mustard), *Eurybia divaricata* (white wood aster), *Toxicodendron radicans* (eastern poison-ivy), and *Vinca minor* (common periwinkle). This is a very species-poor vegetation type.
Environmental Description: Most documented stands are at low elevations, on flat or rolling topography both above and below the glacial boundary.
Vegetation Description: This association represents forests in the northeastern United States strongly dominated by the invasive tree *Acer platanoides* (Norway maple), often to the exclusion

of virtually all other canopy species. *Acer platanoides* (Norway maple) is the overwhelmingly dominant tree, typically forming a closed or nearly closed canopy. In some stands native trees, including *Fraxinus americana* (white ash) and *Acer saccharum* (sugar maple) (the latter especially susceptible to exclusion by Norway maple), may be present in very limited amounts. Other stands may have non-native associates, including *Pinus nigra* (Austrian pine) (black pine), *Pinus sylvestris* (Scotch pine) (Scotch pine), or *Robinia pseudoacacia* (black locust) (black locust). The deep shade cast by *Acer platanoides* (Norway maple) limits understory growth, aside from regeneration of *Acer platanoides* (Norway maple), or incursions by non-native shrubs such as *Rosa multiflora* (multiflora rose), *Berberis vulgaris* (common barberry), *Lonicera japonica* (Japanese honeysuckle), or *Lonicera morrowii* (Morrow's honeysuckle). Native herbs are few, especially compared to more natural deciduous forests in similar settings. A few native or exotic herbaceous species or vines may occupy the ground layer, such as *Alliaria petiolata* (garlic mustard), *Eurybia divaricata* (white wood aster), *Toxicodendron radicans* (eastern poison-ivy), and *Vinca minor* (common periwinkle). This is a very species-poor vegetation type.

Most Abundant Species:

Stratum	Lifeform	Species
Tree (canopy & subcanopy)	Broad-leaved deciduous tree	*Acer platanoides* (Norway maple)
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Rosa multiflora* (multiflora rose)
Herb (field)	Forb	*Alliaria petiolata* (garlic mustard)

Characteristic Species: *Acer platanoides* (Norway maple)
Other Noteworthy Species: Information not available.
USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: This association is found in the northeastern United States, perhaps extending into southern Ontario, Canada. Its westward extent has not been determined, but it may extend to Wisconsin.
States/Provinces: CT?, MA, MD?, NJ, NY, ON?, PA?, VA?
Federal Lands: NPS (Boston Harbor Islands, Minute Man, Sagamore Hill)

CONSERVATION STATUS

Rank: GNA (invasive) (6-Dec-2005)
Reasons: This is a non-native vegetation type dominated by an invasive tree species.

CLASSIFICATION INFORMATION

Status: Standard
Confidence: 3 - Weak
Comments: This association is intended for those forests so invaded by *Acer platanoides* (Norway maple) that the pre-invasion forest type cannot be distinguished. Forests that have been invaded, but where sufficient native trees and other flora still exist to determine the pre-invasion forest type, are classified as degraded examples of those pre-invasion types.
Similar Associations: Information not available.
Related Concepts: Information not available.

SOURCES

Description Authors: S.C. Gawler
References: Anderson 1999c, Eastern Ecology Working Group n.d., Elliman 2003, Soil Conservation Service 1987, Thompson and Jenkins 1992, Wyckoff and Webb 1996

Figure F-8. Norway Maple Forest (AA point ROVA.3). 08/30/2006. NAD 1983 / UTM-18 easting 587892, northing 4628654.

Local Name: Successional Tree-of-Heaven Forest (CEGL007191)

SYNONYMS

USNVC English Name: **Tree-of-Heaven Forest**
USNVC Scientific Name: ***Ailanthus altissima* Forest**
USNVC Identifier: **CEGL007191**

LOCAL INFORMATION

Environmental Description: This exotic dominated successional forest occurs in severely disturbed areas and on reclaimed forests in close proximity to suburban areas. The soils are typically enriched, classified as channery loamy till within the Nassau-Cardigan complex, and occur in hilly, very rocky and well drained locations with underlying bedrock of Ordovician shale and siltstone with minor amounts of sandstone, Austin Glen Formation. Adjacent natural communities include Red Oak - Northern Hardwood Forest (CEGL006173), Northeastern Dry Oak-Hickory Forest (CEGL006336), and Hemlock - Northern Hardwood Forest (CEGL006109).
Vegetation Description: This successional forest is heavily dominated by the exotic *Ailanthus altissima* (tree of heaven), often to the exclusion of other species. The rest of the vegetation within this association varies greatly depending on adjacent forest types, land-use history, and location. At the Home of Franklin D. Roosevelt NHS (excluding Roosevelt Farm and Forest), the minor tree canopy and sub-canopy associates occurring with *Ailanthus altissima* (tree of heaven) includes *Acer saccharum* (sugar maple), and *Ostrya virginiana* (hophornbeam). Shrubs included *Hamamelis virginiana* (American witchhazel). The herbaceous layer was dominated by *Ageratina altissima* (white snakeroot) and *Alliaria petiolata* (garlic mustard).
Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Ailanthus altissima* (tree of heaven)

Characteristic Species: *Ailanthus altissima* (tree of heaven)
Other Noteworthy Species: None.
Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
NY	SNA			Successional Southern Hardwoods	Edinger et al. 2002

Local Range: This successional forest dominated by exotic species was only documented at Home of Franklin D. Roosevelt NHS (excluding Roosevelt Farm and Forest). *Ailanthus altissima* (tree of heaven) occurs fairly regularly as a component of forests elsewhere within the park, and could become dominant in the future within areas of other units of the park.
Classification Comments: This association was used to classify successional southern hardwood forests with *Ailanthus altissima* (tree of heaven) as the dominant species.
Other Comments: None.
Local Description Authors: Frederick C. Sechler, Jr.
Plots: Home of Franklin D. Roosevelt NHS (excluding Roosevelt Farm and Forest) (ROVA.81)
AA Points: None.
Roosevelt-Vanderbilt National Historic Site Inventory Notes: None.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Class	Forest and Woodland (1)
Subclass	Temperate Forest (1.C)
Formation	Cool Temperate Forest (1.C.2)

Division	Eastern North American Cool Temperate Forest (D008)
Macrogroup	Eastern North American Ruderal Forest and Plantation (M013)
Group	Northern and Central Hardwood and Conifer Ruderal Forest Group (G030)
Alliance*	*Ailanthus altissima* Forest Alliance (A.221)
Alliance (English name)*	Tree-of-Heaven Forest Alliance
Association	*Ailanthus altissima* Forest
Association (English name)	Tree-of-Heaven Forest
Ecological System(s)	Information not available.

* Alliance assignment as of 2007. All USNVC alliances are currently (2014) under review and revision.

GLOBAL DESCRIPTION

Concept Summary: This southeastern forest association, strongly dominated by the alien *Ailanthus altissima* (tree of heaven), occurs generally on nutrient-rich substrates, in disturbed situations on slopes, urban abandoned lands, and on rocky limestone slopes.

Environmental Description: Information not available.

Vegetation Description: Information not available.

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Ailanthus altissima* (tree of heaven)

Characteristic Species: *Ailanthus altissima* (tree of heaven)

Other Noteworthy Species: Information not available.

USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: *Ailanthus altissima* (tree of heaven) Forest occurs throughout the Appalachians, the Piedmont, the Interior Low Plateau, eastern Kentucky, and in the Ozarks and Ouachita Mountains, and probably other areas in the northeastern United States.

States/Provinces: AR, KY, NC, NY, PA, TN, VA, WV

Federal Lands: NPS (Antietam, Appomattox Court House, C&O Canal, Colonial, Natchez Trace); USFS (Ouachita (possibly), Ozark (possibly)

CONSERVATION STATUS

Rank: GNA (invasive) (4-Jan-2000)

Reasons: This vegetation is dominated by an invasive, alien species and is thus not a conservation priority.

CLASSIFICATION INFORMATION

Status: Standard

Confidence: 1 - Strong

Comments: Information not available.

Similar Associations: Information not available.

Related Concepts: Information not available.

SOURCES

Description Authors: A.S. Weakley

References: Southeastern Ecology Working Group n.d., TDNH unpubl. Data

Figure F-9. Successional Tree-of-Heaven Forest (plot ROVA.81). 09/01/2004. NAD 1983 / UTM-18 easting 588472, northing 4623603.

Local Name: Hardwood Plantation (CEGL006613)

SYNONYMS
USNVC English Name: **Willow Oak - London Planetree Plantation**
USNVC Scientific Name: ***Quercus phellos - Platanus hybrida* Plantation**
USNVC Identifier: **CEGL006613**

LOCAL INFORMATION

Environmental Description: The environmental setting for these plantations is extremely varied, but most occur on silty loam soils with underlying bedrock of Ordovician shale and siltstone with minor amounts of sandstone, Austin Glen Formation. Associations that occur adjacent to these hardwood plantations include White Pine Plantation (CEGL007178), Northeastern Oak - Red Maple Successional Forest (CEGL006506), Mixed Pine Conifer Plantation (CEGL006313), and High Allegheny Rich Red Oak - Sugar Maple Forest (CEGL006125). These hardwood plantations are frequently planted surrounding New York cultural communities such as mowed lawn and mowed lawn with trees.

Vegetation Description: This is the only known USNVC association that has been created for a plantation that is dominated by hardwood trees. At ROVA, it is comprised of mostly planted deciduous trees but some examples contain naturalized vegetation from surrounding forested areas. The tree canopy layer averages 65.5% cover and 24.1 meters in height. The most abundant species include *Acer saccharum* (sugar maple), *Liriodendron tulipifera* (tuliptree) and *Tilia americana* (American basswood). The tree subcanopy layer averages 23.8% cover and 14.4 meters in height. The most abundant species include *Acer saccharum* (sugar maple), *Carya ovata* (shagbark hickory), and *Quercus coccinea* (scarlet oak) (2.3%). The sparse tall shrub layer averages 5.5% cover and 3.7 meters in height. The two most abundant species are regenerating *Acer saccharum* (sugar maple) and *Ulmus americana* (American elm). The sparse short shrub layer averages 3.2% cover and includes saplings/seedlings from *Acer saccharum* (sugar maple), plus small amounts of *Viburnum acerifolium* (mapleleaf viburnum) and *Lindera benzoin* (northern spicebush). The vine layer averages 4.5% cover and the most abundant species includes *Toxicodendron radicans* (eastern poison ivy) and *Parthenocissus quinquefolia* (Virginia creeper). The dense herbaceous layer averages 72.5% cover and is dominated by *Poa compressa* (Canada bluegrass), along with *Taraxacum officinale* (common dandelion), *Alliaria petiolata* (garlic mustard), *Oxalis stricta* (common yellow oxalis), *Plantago major* (common plantain), *Trifolium arvense* (rabbitfoot clover).

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy/subcanopy	Broad-leaved deciduous tree	*Acer saccharum* (sugar maple)
Tree canopy	Broad-leaved deciduous tree	*Liriodendron tulipifera* (tuliptree)
Tall/short shrub/sapling	Broad-leaved deciduous shrub	*Acer saccharum* (sugar maple), *Ulmus americana* (American elm)
Herb (field)	Vine	*Toxicodendron radicans* (eastern poison- ivy)
Herb (field)	Graminoid	*Poa compressa* (Canada bluegrass)
Herb (field)	Forb	*Taraxacum officinale* (common dandelion)

Characteristic Species: *Liriodendron tulipifera* (tuliptree), planted.

Other Noteworthy Species: None.
Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
NY	SNR*	B	1	Hardwood Plantation	Edinger et al. 2002

Local Range: This association includes delineated areas where hardwood trees were planted. Most hardwood plantations were documented at Home of Franklin D. Roosevelt NHS (excluding Roosevelt Farm and Forest) and Vanderbilt Mansion NHS, and only once at Val-Kill and Roosevelt Farm and Forest.
Classification Comments: This association was used to classify areas where hardwood trees are planted. Some of these hardwood plantations are in decline, and naturalized vegetation is replacing them.
Other Comments: None.
Local Description Authors: Frederick C. Sechler, Jr.
Plots: None.
AA Points: Vanderbilt Mansion (ROVA.11, ROVA.12, ROVA.34, ROVA.35, ROVA.36), Roosevelt Home (ROVA.54, ROVA.69, ROVA.70, ROVA.72, ROVA.73, ROVA.74), Val-Kill (ROVA.114)
Roosevelt-Vanderbilt National Historic Site Inventory Notes: None.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Class	Forest and Woodland (1)
Subclass	Temperate Forest (1.C)
Formation	Cool Temperate Forest (1.C.2)
Division	Eastern North American Cool Temperate Forest (D008)
Macrogroup	Eastern North American Ruderal Forest and Plantation (M013)
Group	Northern and Central Conifer and Hardwood Plantation Group (G032)
Alliance*	Alliance undefined
Alliance (English name)*	Alliance undefined
Association	*Quercus phellos - Platanus hybrida* Plantation
Association (English name)	Willow Oak - London Planetree Plantation
Ecological System(s)	Information not available.

*All USNVC alliances are currently (2014) under review and revision.

GLOBAL DESCRIPTION

Concept Summary: Information not available.
Environmental Description: Information not available.
Vegetation Description: Information not available.
Most Abundant Species: Information not available.
Characteristic Species: Information not available.
Other Noteworthy Species: Information not available.
USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: This plantation is only reported in Gateway National Recreation Area on the Coastal Plain of New York and at Roosevelt-Vanderbilt National Historic Sites in Hyde Park, NY.
States/Provinces: NY
Federal Lands: NPS (Gateway) (ROVA)

CONSERVATION STATUS
Rank: GNA (modified/managed) (23-Mar-2007)
Reasons: Plantations are not of conservation concern.

CLASSIFICATION INFORMATION
Status: Nonstandard
Confidence: 3 - Weak
Comments: Information not available.
Similar Associations: Information not available.
Related Concepts: Information not available.

SOURCES
Description Authors:
References: Eastern Ecology Working Group n.d., NRCS 2001

Figure F-10. Hardwood Plantation (AA point ROVA.69). 09/07/2006. NAD 1983 / UTM-18 easting 588657, northing 4624548.

Local Name: Mixed Pine Conifer Plantation (CEGL006313)

SYNONYMS

USNVC English Name: **Pine species Planted Forest**
USNVC Scientific Name: ***Pinus* spp. Planted Forest**
USNVC Identifier: **CEGL006313**

LOCAL INFORMATION

Environmental Description: This planted association occurs in a variety of environmental settings, but most examples occur on silty loam soils with underlying bedrock of Ordovician shale and siltstone with minor amounts of sandstone, Austin Glen Formation. Associated cultural communities include mowed lawn with trees, plus natural community associations that include Northeastern Dry Oak-Hickory Forest (CEGL006336), High Allegheny Rich Red Oak - Sugar Maple Forest (CEGL006125), Northeastern Oak - Red Maple Successional Forest (CEGL006506), and Northeastern Old Field (CEGL006107). Adjacent wetland associations include Red Maple / Tussock Sedge Wooded Marsh (CEGL006119).

Vegetation Description: The mixed conifer plantations at ROVA have several conifer species that dominate the tree canopy layer. However, since many conifer plantations are in decline within this park, vegetation from adjacent natural communities are gradually replacing the conifers. The tree canopy layer averages 76.7% cover and 24.7 meters in height. The most abundant species include a variety of conifers, including *Pinus strobus* (eastern white pine), *Tsuga canadensis* (eastern hemlock), *Picea glauca* (white spruce), *Juniperus virginiana* (eastern red-cedar), plus naturalized deciduous trees that occur within declining conifer plantations. These species include *Quercus rubra* (northern red oak), *Platanus occidentalis* (American sycamore), and the exotic *Robinia pseudoacacia* (black locust). The sparse tree subcanopy layer averages 10% cover and the most abundant species is *Tsuga canadensis* (eastern hemlock). The short shrub layer averages 36.7% cover and includes seedlings and saplings from the exotic *Acer platanoides* (Norway maple) as the most abundant species, plus *Prunus serotina* (black cherry), *Rubus occidentalis* (black raspberry) and *Fraxinus pennsylvanica* (green ash). The relatively dense vine layer averages 65% cover. The most abundant species is *Toxicodendron radicans* (eastern poison ivy), with lesser amounts of *Celastrus orbiculatus* (Oriental bittersweet), and *Parthenocissus quinquefolia* (Virginia creeper). The herbaceous layer averages 35% cover and is characterized by *Alliaria petiolata* (garlic mustard), *Athyrium filix-femina* (common ladyfern), *Dennstaedtia punctilobula* (eastern hayscented fern), *Eurybia divaricata* (white wood aster), *Fumaria officinalis* (drug fumitory), *Maianthemum canadense* (Canada mayflower), and *Thelypteris noveboracensis* (New York fern).

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Pinus strobus* (eastern white pine), *Tsuga canadensis* (eastern hemlock), and *Picea glauca* (white spruce)
Tree subcanopy	Needle-leaved tree	*Tsuga canadensis* (eastern hemlock)
Short shrub/sapling	Broad-leaved deciduous tree	*Acer platanoides* (Norway maple), *Prunus serotina* (black cherry)
Short shrub/sapling	Broad-leaved deciduous shrub	*Rubus occidentalis* (black raspberry)
Herb (field)	Vine	*Toxicodendron radicans* (eastern poison ivy)

Herb (field)	Fern and ally	*Dennstaedtia punctilobula* (eastern hayscented fern)

Characteristic Species: Mixed conifers including *Pinus strobus* (eastern white pine), *Tsuga canadensis* (eastern hemlock), and *Picea glauca* (white spruce).
Other Noteworthy Species: None.
Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
NY	S5*	B	1	Pine Plantation	Edinger et al. 2002

Local Range: These mixed conifer plantations were documented at all park units except for Roosevelt Farm and Forest.
Classification Comments: This association includes conifer plantations that were dominated by a mix of coniferous species, including pine (*Pinus* spp.), spruce (*Picea* spp.), eastern hemlock (*Tsuga canadensis*), and eastern red-cedar (*Juniperus virginiana*).
Other Comments: None.
Local Description Authors: Frederick C. Sechler, Jr.
Plots: Vanderbilt Mansion NHS (ROVA.16)
AA Points: Home of Franklin D. Roosevelt NHS (excluding Roosevelt Farm and Forest) (ROVA.71), Vanderbilt Mansion NHS (ROVA.37), Val-Kill (ROVA.104)
Roosevelt-Vanderbilt National Historic Site Inventory Notes: None.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Class	Forest and Woodland (1)
Subclass	Temperate Forest (1.C)
Formation	Cool Temperate Forest (1.C.2)
Division	Eastern North American Cool Temperate Forest (D008)
Macrogroup	Eastern North American Ruderal Forest and Plantation (M013)
Group	Northern and Central Conifer and Hardwood Plantation Group (G032)
Alliance*	*Pinus strobus* Planted Forest Alliance (A.98)
Alliance (English name)*	Eastern White Pine Planted Forest Alliance
Association	*Pinus* spp. Planted Forest
Association (English name)	Pine species Planted Forest
Ecological System(s)	Information not available.

* Alliance assignment as of 2007. All USNVC alliances are currently (2014) under review and revision.

GLOBAL DESCRIPTION

Concept Summary: These plantations consist of mature *Pinus strobus* (eastern white pine) or *Pinus sylvestris* (Scotch pine), with other conifers sometimes present in smaller amounts, planted in post-agricultural fields and pastures. Associated canopy conifers include *Pinus resinosa* (red pine), *Picea abies* (Norway spruce), *Picea pungens* (blue spruce), or *Larix decidua* (European larch). The understory varies widely in its degree of development and may be virtually absent. Northern hardwoods dominate the sapling and seedling layers in some areas; *Juniperus virginiana* (eastern red-cedar) is common in others. Cover is proportional to the degree of canopy break-up or opening that has occurred. Common hardwoods include *Prunus serotina* (black cherry), *Acer rubrum* (red maple), and *Fraxinus americana* (white ash). A tall-shrub layer may be present; common species (aside from smaller individuals of the hardwood saplings) include *Crataegus* (hawthorn) spp., *Hamamelis virginiana* (American witch-hazel), and *Lindera benzoin* (northern spicebush). Common short shrubs include *Viburnum recognitum* (smooth arrow-wood), *Vaccinium pallidum* (Blue Ridge blueberry), *Rubus hispidus* (bristly dewberry),

and *Rubus flagellaris* (northern dewberry). The species composition and abundance of the herbaceous layer vary widely due to variation in canopy tree species composition, stand stocking, and soil drainage. Herbaceous species include *Ageratina altissima* (white snakeroot), *Dryopteris intermedia* (intermediate woodfern), *Dryopteris carthusiana* (spinulose woodfern), *Oxalis stricta* (common yellow oxalis), *Potentilla simplex* (common cinquefoil), *Mitchella repens* (partridgeberry), *Galium aparine* (stickywilly), *Galium asprellum* (rough bedstraw), *Brachyelytrum erectum* (bearded shorthusk), *Veronica officinalis* (common gypsyweed), *Polystichum acrostichoides* (Christmas fern), *Maianthemum canadense* (Canada mayflower), *Trientalis borealis* (starflower), *Lycopodium clavatum* (running clubmoss), and *Lycopodium digitatum* (fan clubmoss). Graminoid and forb species associated with disturbed areas, such as *Agrostis stolonifera* (creeping bentgrass), *Dichanthelium clandestinum* (deertongue), *Dennstaedtia punctilobula* (eastern hayscented fern), and *Hypericum perforatum* (common St. Johnswort), are often dominant in these communities. Vines such as *Toxicodendron radicans* (eastern poison-ivy), *Smilax glauca* (cat greenbrier), *Smilax rotundifolia* (roundleaf greenbrier), *Vitis* (grape) spp., and *Parthenocissus quinquefolia* (Virginia creeper) may be present, but not abundant, in these plantations. Disturbance from silvicultural treatments and landscape fragmentation leaves these communities prone to invasion by exotic species, including *Lonicera tatarica* (Tatarian honeysuckle), *Berberis vulgaris* (common barberry), *Rosa multiflora* (multiflora rose), *Celastrus orbiculata* (Asian bittersweet), *Microstegium vimineum* (Nepalese browntop), and *Alliaria petiolata* (garlic mustard), which are locally abundant.

Environmental Description: These mature plantations are planted in post-agricultural fields and pastures. The trees are typically even-aged and regularly-spaced. Soils are usually moderately well-drained to well-drained and vary from sandy to loamy.

Vegetation Description: These plantations consist of mature *Pinus strobus* (eastern white pine) or *Pinus sylvestris* (Scotch pine), with other conifers sometimes present in smaller amounts, planted in post-agricultural fields and pastures. Associated canopy conifers include *Pinus resinosa* (red pine), *Picea abies* (Norway spruce), *Picea pungens* (blue spruce), or *Larix decidua* (European larch). The understory varies widely in its degree of development and may be virtually absent. Northern hardwoods dominate the sapling and seedling layers in some areas; *Juniperus virginiana* (eastern red-cedar) is common in others. Cover is proportional to the degree of canopy break-up or opening that has occurred. Common hardwoods include *Prunus serotina* (black cherry), *Acer rubrum* (red maple), and *Fraxinus americana* (white ash). A tall-shrub layer may be present; common species (aside from smaller individuals of the hardwood saplings) include *Crataegus* (hawthorn) spp., *Hamamelis virginiana* (American witch-hazel), and *Lindera benzoin* (northern spicebush). Common short shrubs include *Viburnum recognitum* (smooth arrow-wood), *Vaccinium pallidum* (Blue Ridge blueberry), *Rubus hispidus* (bristly dewberry), and *Rubus flagellaris* (northern dewberry). The species composition and abundance of the herbaceous layer vary widely due to variation in canopy tree species composition, stand stocking, and soil drainage. Herbaceous species include *Ageratina altissima* (white snakeroot), *Dryopteris intermedia* (intermediate woodfern), *Dryopteris carthusiana* (spinulose woodfern), *Oxalis stricta* (common yellow oxalis), *Potentilla simplex* (common cinquefoil), *Mitchella repens* (partridgeberry), *Galium aparine* (stickywilly), *Galium asprellum* (rough bedstraw), *Brachyelytrum erectum* (bearded shorthusk), *Veronica officinalis* (common gypsyweed), *Polystichum acrostichoides* (Christmas fern), *Maianthemum canadense* (Canada mayflower), *Trientalis borealis* (starflower), *Lycopodium clavatum* (running clubmoss), and *Lycopodium digitatum* (fan clubmoss). Graminoid and forb species associated with disturbed areas, such as

Agrostis stolonifera (creeping bentgrass), *Dichanthelium clandestinum* (deertongue), *Dennstaedtia punctilobula* (eastern hayscented fern), and *Hypericum perforatum* (common St. Johnswort), are often dominant in these communities. Vines such as *Toxicodendron radicans* (eastern poison-ivy), *Smilax glauca* (cat greenbrier), *Smilax rotundifolia* (roundleaf greenbrier), *Vitis* (grape) spp., and *Parthenocissus quinquefolia* (Virginia creeper) may be present, but not abundant, in these plantations. Disturbance from silvicultural treatments and landscape fragmentation leaves these communities prone to invasion by exotic species, including *Lonicera tatarica* (Tatarian honeysuckle), *Berberis vulgaris* (common barberry), *Rosa multiflora* (multiflora rose), *Celastrus orbiculata* (Asian bittersweet), *Microstegium vimineum* (Nepalese browntop), and *Alliaria petiolata* (garlic mustard), which are locally abundant.

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Pinus strobus* (eastern white pine), *Pinus sylvestris* (Scotch pine)
Herb (field)	Forb	*Maianthemum canadense* (Canada mayflower), *Trientalis borealis* (starflower), *Veronica officinalis* (common gypsyweed)

Characteristic Species: *Pinus strobus* (eastern white pine), *Pinus sylvestris* (scotch pine), *Veronica officinalis* (common gypsyweed)

Other Noteworthy Species:

Species	GRank	Type	Note
Alliaria petiolata (garlic mustard)	-	plant	exotic
Berberis vulgaris (common barberry)	-	plant	exotic
Celastrus orbiculata (Asian bittersweet)	-	plant	exotic
Hypericum perforatum (common St. Johnswort)	-	plant	exotic
Lonicera tatarica (Tatarian honeysuckle)	-	plant	exotic
Microstegium vimineum (Nepalese browntop)	-	plant	exotic
Picea abies (Norway spruce)	-	plant	exotic
Pinus sylvestris (Scotch pine)	-	plant	exotic
Rosa multiflora (multiflora rose)	-	plant	exotic

USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: Mixed pine plantations are common throughout the northeastern United States.
States/Provinces: NJ, NY, PA, VT
Federal Lands: NPS (Allegheny Portage Railroad, Delaware Water Gap, Fort Necessity, Friendship Hill, Johnstown Flood, Marsh-Billings-Rockefeller, Upper Delaware); USFWS (Erie, Iroquois)

CONSERVATION STATUS

Rank: GNA (modified/managed) (1-Dec-2004)
Reasons: Information not available.

CLASSIFICATION INFORMATION

Status: Standard
Confidence: 3 - Weak
Comments: This type is intended for plantations of mixed pines or pine mixed with other non-native planted conifers.
Similar Associations:

- *Pinus strobus* Planted Forest (CEGL007178)--monotypic white pine.

Related Concepts: Information not available.

SOURCES

Description Authors: S.C. Gawler

References: Eastern Ecology Working Group n.d., Perles et al. 2006a, Perles et al. 2006b

Figure F-11. Mixed Pine Conifer Plantation (AA point ROVA.37). 08/31/2006. NAD 1983 / UTM-18 easting 588226, northing 4627521.

Local Name: Norway Spruce Plantation (CEGL007167)

SYNONYMS

USNVC English Name: **Norway Spruce Planted Forest**
USNVC Scientific Name: ***Picea abies* Planted Forest**
USNVC Identifier: **CEGL007167**

LOCAL INFORMATION

Environmental Description: This planted association occurs in a variety of environmental settings, but most occur on silty loam soils with underlying bedrock of Ordovician shale and siltstone with minor amounts of sandstone, Austin Glen Formation. Adjacent associations vary greatly from cultural communities such as Mowed Lawn with Trees and Hardwood Plantation (CEGL006613) to associations such as Northeastern Oak - Red Maple Successional Forest (CEGL006506), Semi-rich Northern Hardwood Forest (CEGL006211), and Central Appalachian Hemlock - Chestnut Oak Forest (CEGL006923). One example of this type occurred adjacent to wetland associations Red Maple - Blackgum Basin Swamp (CEGL006014) and Southern New England / Northern Piedmont Red Maple Seepage Swamp (CEGL006406).

Vegetation Description: This association is characterized by planted conifers, but since many conifer plantations are in decline within this park, vegetation from adjacent natural communities are gradually replacing the conifers. In one example, an emergent tree layer was documented with 30 meter tall invasive *Robinia pseudoacacia* (black locust). The tree canopy layer was present in all examples, averaging 64% cover and 25.2 meters in height. The most abundant species is the planted and exotic species *Picea abies* (Norway spruce), and associated naturalized trees from adjacent associations include *Quercus rubra* (northern red oak), *Fraxinus americana* (white ash), *Platanus occidentalis* (American sycamore), and *Fagus grandifolia* (American beech). The tree subcanopy layer averages 29% cover and 15.5 meters in height. The most abundant species most abundant species is *Picea abies* (Norway spruce), along with naturalized *Acer saccharum* (sugar maple). The sparse tall shrub layer averages 9.4% cover and 3.2 meters in height. The most abundant species is *Lindera benzoin* (northern spicebush), along with minor amounts of regenerating *Picea abies* (Norway spruce). The short shrub layer averages 12% cover and the most abundant species include *Lindera benzoin* (northern spicebush), plus regenerating *Acer saccharum* (sugar maple) and exotic *Acer platanoides* (Norway maple). The vine layer averages 24.4% cover and is characterized by *Toxicodendron radicans* (eastern poison ivy), *Celastrus orbiculata* (Asian bittersweet), and *Parthenocissus quinquefolia* (Virginia creeper). The sparse herbaceous layer averages 5.4% cover and is dominated by exotic *Alliaria petiolata* (garlic mustard), along with minor amounts of *Dryopteris intermedia* (intermediate woodfern).

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy/subcanopy	Needle-leaved deciduous tree	*Picea abies* (Norway spruce)
Tree canopy	Broad-leaved deciduous tree	*Quercus rubra* (northern red oak), *Fraxinus americana* (white ash)
Tree subcanopy	Broad-leaved deciduous tree	*Acer saccharum* (sugar maple)
Tall shrub/sapling	Broad-leaved deciduous shrub	*Lindera benzoin* (northern spicebush)
Herb (field)	Forb	*Alliaria petiolata* (garlic mustard)

Characteristic Species: *Picea abies* (Norway spruce).

Other Noteworthy Species: None.

Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
NY	SNA	=	1	Spruce/Fir Plantation	Edinger et al. 2002

Local Range: This spruce/fir plantation was documented at Roosevelt Farm and Forest and Vanderbilt Mansion NHS, but may occur in other areas of the park.
Classification Comments: This association was used to classify spruce-fir plantations with *Picea abies* (Norway spruce) as the dominant species.
Other Comments: None.
Local Description Authors: Frederick C. Sechler, Jr.
Plots: Vanderbilt Mansion NHS (ROVA.49)
AA Points: Roosevelt Farm and Forest (ROVA.132, ROVA.155, ROVA.210), Home of Franklin D. Roosevelt NHS (excluding Roosevelt Farm and Forest) (ROVA.68), Vanderbilt Mansion (ROVA.7, ROVA.29).
Roosevelt-Vanderbilt National Historic Site Inventory Notes: None.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Class	Forest and Woodland (1)
Subclass	Temperate Forest (1.C)
Formation	Cool Temperate Forest (1.C.2)
Division	Eastern North American Cool Temperate Forest (D008)
Macrogroup	Eastern North American Ruderal Forest and Plantation (M013)
Group	Northern and Central Conifer and Hardwood Plantation Group (G032)
Alliance*	*Picea abies* Planted Forest Alliance (A.91)
Alliance (English name)*	Norway Spruce Planted Forest Alliance
Association	*Picea abies* Planted Forest
Association (English name)	Norway Spruce Planted Forest
Ecological System(s)	Semi-natural / Altered Vegetation and Conifer Plantations (CES203.074)

* Alliance assignment as of 2007. All USNVC alliances are currently (2014) under review and revision.

GLOBAL DESCRIPTION

Concept Summary: These plantation forests are dominated by the exotic species *Picea abies* (Norway spruce), which makes up 70-100% of the canopy. The understory is typically sparse with little, if any, spruce regeneration. Hardwood regeneration and herbaceous species composition tend to reflect the pre-plantation forest types. In the Southeast this occurs as experimental plantations.
Environmental Description: Information not available.
Vegetation Description: These plantation forests are dominated by the exotic species *Picea abies* (Norway spruce), which makes up 70-100% of the canopy. The understory is typically sparse with little, if any, spruce regeneration. Hardwood regeneration and herbaceous species composition tend to reflect the pre-plantation forest types.
Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Picea abies* (Norway spruce)

Characteristic Species: *Picea abies* (Norway spruce)
Other Noteworthy Species:

Species	GRank	Type	Note
Picea abies (Norway spruce)	-	plant	exotic

USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: Information not available.
States/Provinces: DE, ME, NC, NJ, NY, PA, VA?, VT
Federal Lands: NPS (C&O Canal?, Great Smoky Mountains?, Marsh-Billings-Rockefeller, Roosevelt-Vanderbilt); USFWS (Aroostook, Erie, Iroquois, Supawna Meadows)

CONSERVATION STATUS

Rank: GNA (cultural) (8-Aug-2000)
Reasons: This community represents vegetation which has been planted in its current location by humans and/or is treated with annual tillage, modified conservation tillage, or other intensive management or manipulation. It is not a conservation priority and does not receive a conservation rank.

CLASSIFICATION INFORMATION

Status: Standard
Confidence: 2 - Moderate
Comments: Information not available.
Similar Associations: Information not available.
Related Concepts:

- IF3b. Plantation (Hardwood or Conifer) (Allard 1990) B

SOURCES

Description Authors: S.C. Gawler
References: Allard 1990, NRCS 2004, Southeastern Ecology Working Group n.d.

Figure F-12. Norway Spruce Plantation (AA point ROVA.29). 08/31/2006. NAD 1983 / UTM-18 easting 588148, northing 4627386.

Local Name: Red Pine Plantation (CEGL007177)

SYNONYMS

USNVC English Name: **Red Pine Planted Forest**
USNVC Scientific Name: ***Pinus resinosa* Planted Forest**
USNVC Identifier: **CEGL007177**

LOCAL INFORMATION

Environmental Description: This planted association occurs in a variety of environmental settings, but most occur on silt loam soils with underlying bedrock of Ordovician shale and siltstone with minor amounts of sandstone, Austin Glen Formation. Adjacent associations include cultural communities such as Hardwood Plantation (CEGL006613), upland associations that include Northeastern Modified Successional Forest (CEGL006599), Dry, Rich Oak - Hickory Forest (CEGL006236), Northeastern Oak - Red Maple Successional Forest (CEGL006506), and Norway Spruce Plantation (CEGL007167). Adjacent wetland associations include Southern New England / Northern Piedmont Red Maple Seepage Swamp (CEGL006406).

Vegetation Description: This association is characterized by planted conifers, but since many conifer plantations are in decline within this park, vegetation from adjacent natural communities are gradually replacing the conifers. The tree canopy layer averages 75% cover and 24 meters in height. The layer is dominated by *Pinus resinosa* (red pine), with *Picea abies* (Norway spruce) as an associated species. The tree subcanopy layer averages 30% cover and 12 meters in height. The most abundant species include *Carya glabra* (pignut hickory) and *Acer saccharum* (sugar maple). The shrub layers are extremely sparse with very little vegetation. The sparse vine layer has *Toxicodendron radicans* (eastern poison ivy) as the most abundant species. The sparse herbaceous layer averages 8% cover and is dominated by *Dennstaedtia punctilobula* (eastern hayscented fern), with lesser amounts of *Maianthemum canadense* (Canada mayflower).

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Needle-leaved deciduous tree	*Pinus resinosa* (red pine)
Tree subcanopy	Broad-leaved deciduous tree	*Carya glabra* (pignut hickory), *Acer saccharum* (sugar maple)
Herb (field)	Vine	*Toxicodendron radicans* (eastern poison ivy)
Herb (field)	Fern and ally	*Dennstaedtia punctilobula* (eastern hayscented fern)

Characteristic Species: *Pinus resinosa*
Other Noteworthy Species: None.
Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
NY	SNA			Pine Plantation	Edinger et al. 2002.

Local Range: This pine plantation type dominated by *Pinus resinosa* (red pine) was only documented at Roosevelt Farm and Forest.
Classification Comments: This association was used to classify pine plantations dominated by *Pinus resinosa* (red pine).
Other Comments: None.
Local Description Authors: Frederick C. Sechler, Jr.

Plots: None.
AA Points: Roosevelt Farm and Forest (ROVA.163, ROVA.165).
Roosevelt-Vanderbilt National Historic Site Inventory Notes: None.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Class	Forest and Woodland (1)
Subclass	Temperate Forest (1.C)
Formation	Cool Temperate Forest (1.C.2)
Division	Eastern North American Cool Temperate Forest (D008)
Macrogroup	Eastern North American Ruderal Forest and Plantation (M013)
Group	Northern and Central Conifer and Hardwood Plantation Group (G032)
Alliance*	*Pinus resinosa* Planted Forest Alliance (A.97)
Alliance (English name)*	Red Pine Planted Forest Alliance
Association	*Pinus resinosa* Planted Forest
Association (English name)	Red Pine Planted Forest
Ecological System(s)	Semi-natural / Altered Vegetation and Conifer Plantations (CES203.074)

* Alliance assignment as of 2007. All USNVC alliances are currently (2014) under review and revision.

GLOBAL DESCRIPTION

Concept Summary: Plantations of *Pinus resinosa* (red pine) occur in various settings and soil types. *Pinus resinosa* (red pine) makes up 80-100% of the canopy. In older stands, or in canopy gaps, native regeneration includes hardwoods such as *Acer rubrum* (red maple), *Acer saccharum* (sugar maple), and *Fagus grandifolia* (American beech), as well as the conifers *Pinus strobus* (eastern white pine), *Picea rubens* (red spruce), and/or *Tsuga canadensis* (eastern hemlock). *Acer pensylvanicum* (striped maple) may be present as a small tree. Shrubs and herbs are typically few.
Environmental Description: Plantations of *Pinus resinosa* (red pine) occur in various settings and soil types.
Vegetation Description: *Pinus resinosa* (red pine) makes up 80-100% of the canopy. In older stands, or in canopy gaps, native regeneration includes hardwoods such as *Acer rubrum* (red maple), *Acer saccharum* (sugar maple), and *Fagus grandifolia* (American beech), as well as conifers *Pinus strobus* (eastern white pine), *Picea rubens* (red spruce), and/or *Tsuga canadensis* (eastern hemlock). *Acer pensylvanicum* (striped maple) may be present as a small tree. Shrubs and herbs are typically few.
Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Pinus resinosa* (red pine)

Characteristic Species: *Pinus resinosa* (red pine)
Other Noteworthy Species: Information not available.
USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: Information not available.
States/Provinces: DE, MD, ME, NC, NY, VA, VT, WV
Federal Lands: NPS (Marsh-Billings-Rockefeller); USFS (George Washington, Monongahela); USFWS (Aroostook, Moosehorn)

CONSERVATION STATUS

Rank: GNA (cultural) (8-Aug-2000)

Reasons: This community represents vegetation which has been planted in its current location by humans and/or is treated with annual tillage, modified conservation tillage, or other intensive management or manipulation. It is not a conservation priority and does not receive a conservation rank.

CLASSIFICATION INFORMATION

Status: Standard
Confidence: 2 - Moderate
Comments: In the southern portion of the range, these plantations are known from the Laurel Fork area of the Warm Springs Ranger District; in New England, they are scattered and generally small.
Similar Associations: Information not available.
Related Concepts:

- Coniferous Plantation (Fleming and Moorhead 1996) ?
- IF3b. Plantation (Hardwood or Conifer) (Allard 1990) B

SOURCES

Description Authors: S.C. Gawler
References: Allard 1990, Fleming and Coulling 2001, Fleming and Moorhead 1996, Southeastern Ecology Working Group n.d.

Figure F-13. Red Pine Plantation (AA point ROVA.165). 06/24/2008. NAD 1983 / UTM-18 easting 590608, northing 4623915.

Local Name: White Pine Plantation (CEGL007178)

SYNONYMS

USNVC English Name: **Eastern White Pine Planted Forest**
USNVC Scientific Name: ***Pinus strobus* Planted Forest**
USNVC Identifier: **CEGL007178**

LOCAL INFORMATION

Environmental Description: This planted association occurs in a variety of environmental settings, but most occur on silty loam soils with underlying bedrock of Ordovician shale and siltstone with minor amounts of sandstone, Austin Glen Formation. Adjacent associations include a variety of cultural communities, plus upland associations such as White Pine - Hemlock Dry-Mesic Coniferous Forest (CEGL006328), Hemlock - Northern Hardwood Forest (CEGL006109), Semi-rich Northern Hardwood Forest (CEGL006211), Hemlock - Beech - Oak Forest (CEGL006088), and Northeastern Oak - Red Maple Successional Forest (CEGL006506). Adjacent wetland associations include Red Maple / Tussock Sedge Wooded Marsh (CEGL006119) and Southern New England / Northern Piedmont Red Maple Seepage Swamp (CEGL006406).

Vegetation Description: This association includes conifer plantations that are dominated by *Pinus strobus* (eastern white pine). However, since many pine plantations are in decline within this park, vegetation from adjacent natural communities are gradually replacing the conifers in some areas. The tree canopy layer averages 65.5% cover and 26.9 meters in height. The most abundant species is *Pinus strobus* (eastern white pine), plus regenerating hardwood species that include *Fraxinus americana* (white ash) and *Quercus alba* (white oak). The tree subcanopy layer averages 43.7% cover and 14.3 meters in height. The most abundant species include regenerating deciduous tree species *Acer saccharum* (sugar maple), *Betula lenta* (sweet birch), and *Ostrya virginiana* (hophornbeam). The tall shrub layer averages 16.8% cover and 3.1 meters in height. The most abundant species include regenerating *Acer saccharum* (sugar maple), plus *Rubus allegheniensis* (Allegheny blackberry) and *Ostrya virginiana* (hophornbeam). The short shrub layer averages 10.1% cover and includes saplings and seedlings of *Acer saccharum* (sugar maple), plus *Viburnum acerifolium* (mapleleaf viburnum). The sparse vine layer averaged 5.4% cover and includes *Parthenocissus quinquefolia* (Virginia creeper) as the most abundant species. The relatively sparse herbaceous layer averaged 20% cover and is characterized by *Aralia nudicaulis* (wild sarsaparilla), *Dennstaedtia punctilobula* (eastern hayscented fern), *Maianthemum canadense* (Canada mayflower), and *Dryopteris intermedia* (intermediate woodfern).

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Pinus strobus* (eastern white pine)
Tree subcanopy	Broad-leaved deciduous tree	*Acer saccharum* (sugar maple)
Tall shrub/sapling	Broad-leaved deciduous tree	*Rubus alleghaniensis* (Allegheny blackberry)
Short shrub/sapling	Broad-leaved deciduous tree	*Acer saccharum* (sugar maple)
Short shrub/sapling	Broad-leaved deciduous shrub	*Viburnum acerifolium* (mapleleaf viburnum)
Herb (field)	Vine	*Parthenocissus quinquefolia* (Virginia creeper)

Herb (field)	Forb	*Aralia nudicaulis* (wild sarsaparilla)
Herb (field)	Fern and ally	*Dennstaedtia punctilobula* (eastern hayscented fern)

Characteristic Species: *Pinus strobus* (eastern white pine)
Other Noteworthy Species: None.
Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
NY	S5*	B	1	Pine Plantation	Edinger et al. 2002

Local Range: This association was documented most frequently at Roosevelt Farm and Forest and less frequent at Home of Franklin D. Roosevelt NHS (excluding Roosevelt Farm and Forest). One occurrence of this plantation was also recorded at Vanderbilt Mansion NHS.
Classification Comments: This association was used to classify pine plantations with *Pinus strobus* (eastern white pine) as the dominant species.
Other Comments: None.
Local Description Authors: Frederick C. Sechler, Jr.
Plots: Roosevelt Farm and Forest (ROVA.69, ROVA.102, ROVA.103)
AA Points: Roosevelt Farm and Forest (ROVA.129, ROVA.134, ROVA.150, ROVA.195), Vanderbilt Mansion NHS (ROVA.10), Home of Franklin D. Roosevelt NHS (excluding Roosevelt Farm and Forest) (ROVA.46, ROVA.58, ROVA.95).
Roosevelt-Vanderbilt National Historic Site Inventory Notes: None.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Class	Forest and Woodland (1)
Subclass	Temperate Forest (1.C)
Formation	Cool Temperate Forest (1.C.2)
Division	Eastern North American Cool Temperate Forest (D008)
Macrogroup	Eastern North American Ruderal Forest and Plantation (M013)
Group	Northern and Central Conifer and Hardwood Plantation Group (G032)
Alliance*	*Pinus strobus* Planted Forest Alliance (A.98)
Alliance (English name)*	Eastern White Pine Planted Forest Alliance
Association	*Pinus strobus* Planted Forest
Association (English name)	Eastern White Pine Planted Forest
Ecological System(s)	Semi-natural / Altered Vegetation and Conifer Plantations (CES203.074)

* Alliance assignment as of 2007. All USNVC alliances are currently (2014) under review and revision.

GLOBAL DESCRIPTION

Concept Summary: This white pine plantation type is found throughout the northeastern and midwestern United States and adjacent Canada. Stands contain plantations of *Pinus strobus* (eastern white pine) that are maintained for the extraction of forest products. Some have been planted as reclamation projects (e.g., following strip-mining). At maturity, the tree canopy is usually dense and contains a monospecific layer of *Pinus strobus* (eastern white pine). *Pinus resinosa* (red pine) or *Pinus virginiana* (Virginia pine) is occasionally present in small amounts. In older stands or gaps, regenerating trees may include *Fagus grandifolia* (American beech), *Acer saccharum* (sugar maple), *Acer rubrum* (red maple), and *Prunus serotina* (black cherry); *Robinia pseudoacacia* (black locust) and *Betula lenta* (sweet birch) are occasionally present. *Acer pensylvanicum* (striped maple) and *Ostrya virginiana* (hophornbeam) are common small trees. The shrub layer is typically sparse and mostly consists of smaller individuals of the tree species. The field layer varies from sparse to absent; it may be locally well-developed in small

openings, with variable composition. In some stands, mosses may be abundant. Susceptibility to a variety of pests or diseases, including white pine blister rust (*Cronartium ribicola*) and southern pine beetle (*Dendroctonus frontalis*), has had some impact on its commercial use.
Environmental Description: Stands contain plantations of *Pinus strobus* (eastern white pine) that are maintained for the extraction of forest products. The type does well on a variety of soils. Some have been planted on strip-mine reclamation sites.
Vegetation Description: The tree canopy at maturity is usually dense and contains a monospecific layer of *Pinus strobus* (eastern white pine). *Pinus resinosa* (red pine) or *Pinus virginiana* (Virginia pine) is occasionally present in small amounts. In older stands or gaps, regenerating trees may include *Fagus grandifolia* (American beech), *Acer saccharum* (sugar maple), *Acer rubrum* (red maple), and *Prunus serotina* (black cherry); *Robinia pseudoacacia* (black locust) and *Betula lenta* (sweet birch) are occasionally present. *Acer pensylvanicum* (striped maple) and *Ostrya virginiana* (hophornbeam) are common small trees. The shrub layer is typically sparse and mostly consists of smaller individuals of the tree species. The field layer varies from sparse to absent; it may be locally well-developed in small openings, with variable composition. In some stands, mosses may be abundant.
Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Pinus strobus* (eastern white pine)

Characteristic Species: *Pinus strobus* (eastern white pine)
Other Noteworthy Species: Information not available.
USFWS Wetland System: Not applicable.

DISTRIBUTION
Range: This white pine plantation type is found throughout the northeastern and midwestern United States and adjacent Canada.
States/Provinces: DE, GA, IN, KY, MD, NC, NH, NJ, NY, PA, SC, TN, VA, VT, WV
Federal Lands: BIA (Eastern Band of Cherokee); NPS (Antietam?, Blue Ridge Parkway, Booker T. Washington, C&O Canal?, Catoctin Mountain?, Chattahoochee River, Chickamauga-Chattanooga, Indiana Dunes, Marsh-Billings-Rockefeller, Monocacy?, New River Gorge, Roosevelt-Vanderbilt, Valley Forge); USFS (Chattahoochee, Chattahoochee (Southern Blue Ridge), Cherokee, Daniel Boone, George Washington, Jefferson, Nantahala, Pisgah, Sumter, Sumter (Mountains)); USFWS (Chesapeake Marshlands, Supawna Meadows)

CONSERVATION STATUS
Rank: GNA (cultural) (8-Aug-2000)
Reasons: This community represents vegetation which has been planted in its current location by humans and/or is treated with annual tillage, modified conservation tillage, or other intensive management or manipulation. It is not a conservation priority and does not receive a conservation rank.

CLASSIFICATION INFORMATION
Status: Standard
Confidence: 2 - Moderate
Comments: There was much planting of white pine from the 1930s into the 1950s, but there has been very little planting since then (P. Manion pers. comm. 2001). On the Daniel Boone National Forest of Kentucky, *Pinus strobus* (eastern white pine) plantings are of limited extent and are related to wildlife plantings. In the southern part of this type's range, there has been some

damage from southern pine beetle (*Dendroctonus frontalis*). These plantations have been observed in the Peters Mountain area (James River Ranger District) and various other sites in the George Washington and Jefferson national forests.

Similar Associations:

- *Pinus* spp. Planted Forest (CEGL006313)
- *Pinus strobus* Successional Forest (CEGL007944)

Related Concepts:

- IF3b. Plantation (Hardwood or Conifer) (Allard 1990) B
- Unclassified Clearcut Regeneration (Fleming and Moorhead 2000)

SOURCES

Description Authors: D. Faber-Langendoen, mod. S.C. Gawler

References: Allard 1990, Fleming and Coulling 2001, Fleming and Moorhead 2000, NRCS 2004, Reschke 1990, Southeastern Ecology Working Group n.d., TDNH unpubl. data, Vanderhorst 2001a, Vanderhorst 2001b, Vanderhorst et al. 2007

Figure F-14. White Pine Plantation (AA point ROVA.195). 07/11/2008. NAD 1983 / UTM-18 easting 590412, northing 4624580.

Local Name: Central Appalachian Hemlock - Chestnut Oak Forest (CEGL006923)

SYNONYMS

USNVC English Name: **Eastern Hemlock - Chestnut Oak - Sweet Birch Forest**
USNVC Scientific Name: ***Tsuga canadensis - Quercus prinus - Betula lenta* Forest**
USNVC Identifier: **CEGL006923**

LOCAL INFORMATION

Environmental Description: This dry-acidic hemlock-northern hardwood forest association typically occurs on mid to high slopes with moderate to very stony substrates. The soils consist primarily of silt and sandy loams on underlying bedrock comprised of Ordovician shale and siltstone with minor amounts of sandstone in the Austin Glen Formation. This hemlock-northern hardwood type is closely associated with other hemlock dominated associations in the park. Adjacent upland associations include High Allegheny Rich Red Oak - Sugar Maple Forest (CEGL006125), Dry, Rich Oak - Hickory Forest (CEGL006236), White Pine - Hemlock Dry-Mesic Coniferous Forest (CEGL006328), Northeastern Oak - Red Maple Successional Forest (CEGL006506), Hemlock - Northern Hardwood Forest (CEGL006109) and Hemlock - Beech - Oak Forest (CEGL006088). Adjacent wetland associations occurring at the base of this hemlock-northern hardwood forest type include Red Maple - Blackgum Basin Swamp (CEGL006014).
Vegetation Description: The tree canopy averages 78.3% percent cover and 27.1 meters in height. Characteristic species include *Quercus prinus* (chestnut oak), *Tsuga canadensis* (eastern hemlock), plus *Quercus rubra* (northern red oak), *Acer saccharum* (sugar maple), *Quercus alba* (white oak), *Quercus coccinea* (scarlet oak) and *Carya glabra* (pignut hickory). The tree subcanopy layer averages 46% cover and 14.2 meters in height. Characteristic species include species found in the canopy such as *Tsuga canadensis* (eastern hemlock) and *Acer saccharum* (sugar maple), plus *Betula lenta* (sweet birch) and *Fagus grandifolia* (American beech). The sparse tall shrub layer averages 10.7% cover and 4.3 meters in height. The most abundant species, in addition to species found in the canopy and subcanopy, include *Hamamelis virginiana* (American witchhazel) and *Ostrya virginiana* (hophornbeam). The short shrub layer averages 10.8% cover and characteristic species include *Viburnum acerifolium* (mapleleaf viburnum), *Quercus prinus* (chestnut oak), *Hamamelis virginiana* (American witchhazel) and *Vaccinium pallidum* (Blue Ridge blueberry). The very sparse herbaceous layer averages 6.8% cover and is characterized by *Dryopteris marginalis* (marginal woodfern), *Maianthemum canadense* (Canada mayflower), and *Carex pensylvanica* (Pennsylvania sedge). The very sparse non-vascular layer averages 2.2% cover with *Leucobryum glaucum* (leucobryum moss) characterizing the layer.
Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy/subcanopy	Broad-leaved deciduous tree	*Quercus prinus* (chestnut oak), *Quercus rubra* (northern red oak), *Acer saccharum* (sugar maple)
Tree canopy/subcanopy	Needle-leaved coniferous tree	*Tsuga canadensis* (eastern hemlock)
Tall shrub/sapling	Broad-leaved deciduous shrub	*Ostrya virginiana* (hophornbeam), *Hamamelis virginiana* (American witchhazel)
Short shrub/sapling	Broad-leaved deciduous tree	*Acer saccharum* (sugar maple)

Short shrub/sapling	Broad-leaved deciduous shrub	*Viburnum acerifolium* (mapleleaf viburnum), *Vaccinium pallidum* (Blue Ridge blueberry)
Herb (field)	Forb	*Dryopteris marginalis* (marginal woodfern), *Maianthemum canadense* (Canada mayflower), *Carex pensylvanica* (Pennsylvania sedge)

Characteristic Species: *Quercus prinus* (chestnut oak), *Tsuga canadensis* (eastern hemlock), *Hamamelis virginiana* (American witchhazel), *Viburnum acerifolium* (mapleleaf viburnum), and *Dryopteris marginalis* (marginal woodfern).
Other Noteworthy Species: None.
Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
NY	SNR			Hemlock-Northern Hardwood Forest	Edinger et al. 2002

Local Range: This association is found most commonly within unit Roosevelt Farm and Forest, where the largest area of hemlock-northern hardwood forest is concentrated. This association was less commonly documented at both Home of Franklin D. Roosevelt NHS (excluding Roosevelt Farm and Forest) and Val-Kill.
Classification Comments: This association is classified with hemlock-northern hardwood forests with a suite of species including *Tsuga canadensis* (eastern hemlock) and a significant amount of *Quercus prinus* (chestnut oak) occurring on rocky mid to high sloped areas.
Other Comments: None.
Local Description Authors: Frederick C. Sechler, Jr.
Plots: Roosevelt Farm and Forest (ROVA.105, ROVA.116, ROVA.137), Home of Franklin D. Roosevelt NHS (excluding Roosevelt Farm and Forest) (ROVA.20), and Val-Kill (ROVA.36).
AA Points: Roosevelt Farm and Forest (ROVA.131, ROVA.135, ROVA.137, ROVA.140, ROVA.160, ROVA.189, ROVA.197. ROVA.206, ROVA.208), Home of Franklin D. Roosevelt NHS (excluding Roosevelt Farm and Forest) (ROVA.96, ROVA.97).
Roosevelt-Vanderbilt National Historic Site Inventory Notes: None.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Class	Forest and Woodland (1)
Subclass	Temperate Forest (1.C)
Formation	Cool Temperate Forest (1.C.2)
Division	Eastern North American Cool Temperate Forest (D008)
Macrogroup	Northern Mesic Hardwood and Conifer Forest (M014)
Group	Northern Hardwood – Hemlock - White Pine Forest Group (G163)
Alliance*	*Tsuga canadensis - Liriodendron tulipifera* Forest Alliance (A.413)
Alliance (English name)*	Eastern Hemlock - Tuliptree Forest Alliance
Association	*Tsuga canadensis - Quercus prinus - Betula lenta* Forest
Association (English name)	Eastern Hemlock - Chestnut Oak - Sweet Birch Forest
Ecological System(s)	Central Appalachian Dry Oak-Pine Forest (CES202.591)

* Alliance assignment as of 2007. All USNVC alliances are currently (2014) under review and revision.

GLOBAL DESCRIPTION

Concept Summary: This association is a hemlock - mixed oak forest which often occurs on steep northeastern to northwestern exposures. It ranges from the New Jersey Highlands south to the Blue Ridge, Ridge and Valley, Cumberlands, and Piedmont provinces (Maryland, West

Virginia, and Virginia). Occurrences in West Virginia are known from the Bluestone River Gorge and are likely elsewhere. Stands occur at elevations from 150 m to about 750 m (500-2500 feet) on moderately to very steep, sheltered slopes. Northerly aspects and middle slope positions prevail among documented examples. Some sites are "boulderfields" with up to 60% cover by large rocks. Geologic substrate is variable. Soils are usually very stony to extremely stony sandy loams, consistently oligotrophic, with very low pH and base status. Stands of this association are typically floristically depauperate and generally dominated by variable combinations of *Quercus prinus* (chestnut oak) and *Tsuga canadensis* (eastern hemlock). *Betula lenta* (sweet birch) and, less commonly, *Quercus velutina* (black oak), *Quercus coccinea* (scarlet oak), and *Quercus rubra* (northern red oak) are major overstory associates, each attaining codominance in a subset of stands. *Quercus alba* (white oak), *Acer rubrum* (red maple), *Liriodendron tulipifera* (tuliptree), *Pinus strobus* (eastern white pine), *Sassafras albidum* (sassafras), and *Fagus grandifolia* (American beech) are minor overstory associates. Small trees and shrubs can be absent or sparse due to dense shading by hemlock, with *Hamamelis virginiana* (American witch-hazel) most consistently providing moderate cover. Less frequently, *Kalmia latifolia* (mountain laurel), *Rhododendron maximum* (great laurel), and *Viburnum acerifolium* (mapleleaf viburnum) are shrub components. At some New Jersey sites, a single dense stratum or multiple open strata of ericaceous species can develop, including *Rhododendron maximum* (great laurel), *Kalmia latifolia* (mountain laurel), *Gaylussacia baccata* (black huckleberry), and *Vaccinium pallidum* (Blue Ridge blueberry). The herb layer of this community is typically very sparse or absent; typical scattered species include *Maianthemum canadense* (Canada mayflower), *Dennstaedtia punctilobula* (eastern hayscented fern), *Chimaphila maculata* (striped prince's pine), *Deschampsia flexuosa* (wavy hairgrass), *Carex swanii* (Swan's sedge), and *Aralia nudicaulis* (wild sarsaparilla).

Environmental Description: Stands occur at elevations from 150 m to about 750 m (500-2500 feet) on moderately to very steep, sheltered slopes. Northern to northwestern aspects and middle slope positions prevail among documented examples. Some sites are "boulderfields" with up to 60% cover by large rocks; some appear above or below cliff bands. Geologic substrate is variable but includes shales and sandstone. Soils are usually very stony to extremely stony sandy loams, consistently oligotrophic, with very low pH and base status. Soils in eight West Virginia plots in the environs of Bluestone National Scenic River are described as dry to somewhat moist, well-drained, stone-free to very stony sandy loam, silt loam, sandy silt loam, and sandy clay loam; they tested extremely to medium acidic (mean pH = 4.4) with relatively high levels of organic matter, estimated N release, S, Al, B, and Fe and relatively low levels of Ca, Cu, K, Mg, Mn, P, and Zn compared to average values in the area.

Vegetation Description: This association is a hemlock - mixed oak forest dominated by *Tsuga canadensis* (eastern hemlock) in association with species of *Quercus* (oak) and other deciduous trees indicative of relatively dry, infertile soils. Stands are typically floristically depauperate and generally dominated by variable combinations of *Quercus prinus* (chestnut oak) and *Tsuga canadensis* (eastern hemlock). *Betula lenta* (sweet birch) and, less commonly, *Quercus velutina* (black oak), *Quercus coccinea* (scarlet oak), *Quercus alba* (white oak), and *Quercus rubra* (northern red oak) are major overstory associates, each attaining codominance in a subset of stands. *Acer rubrum* (red maple), *Liriodendron tulipifera* (tuliptree), *Pinus strobus* (eastern white pine), *Sassafras albidum* (sassafras), and *Fagus grandifolia* (American beech) are very minor overstory associates. *Oxydendrum arboreum* (sourwood) and *Acer saccharum* (sugar maple), along with overstory species, may be present in the subcanopy. Small trees and shrubs are often

absent or sparse due to dense shading by hemlock, with *Hamamelis virginiana* (American witch-hazel) most consistently providing moderate cover. Less frequently, *Kalmia latifolia* (mountain laurel), *Rhododendron maximum* (great laurel), *Vaccinium pallidum* (Blue Ridge blueberry), *Amelanchier arborea* (common serviceberry), and *Viburnum acerifolium* (mapleleaf viburnum) are shrub components. At some New Jersey sites, a single dense stratum or multiple open strata of ericaceous species can develop, including *Rhododendron maximum* (great laurel), *Kalmia latifolia* (mountain laurel), *Gaylussacia baccata* (black huckleberry), and *Vaccinium pallidum* (Blue Ridge blueberry). The herb layer of this community is typically very sparse or absent with scattered individuals of a few species; typical species vary somewhat with geography and include *Maianthemum canadense* (Canada mayflower), *Dennstaedtia punctilobula* (eastern hayscented fern), *Dioscorea quaternata* (fourleaf yam), *Chimaphila maculata* (striped prince's pine), *Deschampsia flexuosa* (wavy hairgrass), *Dryopteris marginalis* (marginal woodfern), *Chimaphila maculata* (striped prince's pine), *Carex swanii* (Swan's sedge), *Eurybia divaricata* (white wood aster), *Goodyera pubescens* (downy rattlesnake plantain), *Gaultheria procumbens* (eastern teaberry), *Mitchella repens* (partridgeberry), *Monotropa hypopithys* (pinesap), *Monotropa uniflora* (Indian pipe), *Parthenocissus quinquefolia* (Virginia creeper), and *Aralia nudicaulis* (wild sarsaparilla). In nine West Virginia plots, vascular plant richness ranged from 16 to 43 (mean = 26.5) species per 400-square-meter plot.

Most Abundant Species:

Stratum	Lifeform	Species
Tree (canopy & subcanopy)	Needle-leaved tree	*Tsuga canadensis* (eastern hemlock)
Tree (canopy & subcanopy)	Broad-leaved deciduous tree	*Quercus prinus* (chestnut oak)
Tree subcanopy	Broad-leaved deciduous tree	*Betula lenta* (sweet birch)
Tall shrub/sapling	Broad-leaved deciduous shrub	*Hamamelis virginiana* (American witch-hazel)
Tall shrub/sapling	Broad-leaved evergreen shrub	*Rhododendron maximum* (great laurel)
Short shrub/sapling	Broad-leaved deciduous shrub	*Gaylussacia baccata* (black huckleberry), *Vaccinium pallidum* (Blue Ridge blueberry)

Characteristic Species: *Chimaphila maculata* (striped prince's pine), *Quercus prinus* (chestnut oak), *Tsuga canadensis* (eastern hemlock)

Other Noteworthy Species: Information not available.

USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: This association ranges from the New Jersey Highlands south to the Blue Ridge, Ridge and Valley, and Piedmont provinces of Pennsylvania, Maryland, and Virginia and the Cumberlands in West Virginia.

States/Provinces: MD, NJ, NY, PA, VA, WV

Federal Lands: NPS (Allegheny Portage Railroad, Bluestone, C&O Canal?, Catoctin Mountain, Delaware Water Gap, Monocacy?, Shenandoah); USFS (George Washington)

CONSERVATION STATUS

Rank: G3 (4-Oct-2006)

Reasons: While this association does not appear to be intrinsically rare, it occurs in small patches in very specific habitats, and its viability is critically threatened by the spread of hemlock woolly adelgid.

CLASSIFICATION INFORMATION

Status: Standard

Confidence: 2 - Moderate

Comments: The original description was based on A. Windisch's (1993) Picatinny Arsenal Hemlock-Mixed Oak-(Heath) Cool Sub-Mesic forest description (TcQf). An expanded circumscription is based on analysis of data from 20 Maryland and Virginia plots, data from Delaware Water Gap, and nine West Virginia plots.
Similar Associations: Information not available.
Related Concepts:

- Picatinny Arsenal Hemlock-Mixed Oak-(Heath) Cool Sub-Mesic forest description (TcQf) (Windisch 1993) F

SOURCES
Description Authors: A. Windisch, mod. S.C. Gawler and G.P. Fleming
References: Eastern Ecology Working Group n.d., Fike 1999, Perles et al. 2007, Vanderhorst et al. 2008. Windisch 1993

Figure F-15. Central Appalachian Hemlock - Chestnut Oak Forest (plot ROVA.105). 06/06/2007. NAD 1983 / UTM-18 easting 589793, northing 4624124.

Local Name: Hemlock - Beech - Oak Forest (CEGL006088)

SYNONYMS

USNVC English Name: **Eastern Hemlock - American Beech - Northern Red Oak Forest**
USNVC Scientific Name: ***Tsuga canadensis - Fagus grandifolia - Quercus rubra* Forest**
USNVC Identifier: **CEGL006088**

LOCAL INFORMATION

Environmental Description: This NVC type is one of four associations attributed to hemlock-northern hardwood forest. This association typically occurs on fairly dry mid-slopes with silt loam soils and underlying bedrock of Ordovician shale and sandstone with minor amounts of sandstone from the Austin Glen Formation. This association is closely related to other hemlock-northern hardwood forest types, and sometimes occurs in close proximity to them separated only by topographic features. Adjacent upland associations include High Allegheny Rich Red Oak - Sugar Maple Forest (CEGL006125), Dry, Rich Oak - Hickory Forest (CEGL006236), Hemlock / White Pine - Red Oak - Mixed Hardwood Forest (CEGL006566), and Red Oak - Northern Hardwood Forest (CEGL006173). Adjacent wetland associations include Red Maple - Blackgum Basin Swamp (CEGL006014).

Vegetation Description: The tree canopy averages 74.1% percent cover and 26.7 meters in height. Characteristic species include *Tsuga canadensis* (eastern hemlock), *Quercus rubra* (northern red oak), *Quercus alba* (white oak), *Acer saccharum* (sugar maple), *Betula lenta* (sweet birch) and *Fagus grandifolia* (American beech). The tree subcanopy layer averages 36.6% cover and 14.1 meters in height. The most abundant species are species found in the canopy layer plus *Ostrya virginiana* (hophornbeam). The tall shrub layer is sparse, averaging 13% cover and 3.2 meters in height. The most abundant species are regenerating canopy/subcanopy species along with *Hamamelis virginiana* (American witchhazel). The sparse short shrub layer averages 8% cover and is characterized by *Viburnum acerifolium* (mapleleaf viburnum), plus saplings from canopy species *Acer saccharum* (sugar maple), *Fagus grandifolia* (American beech), *Betula lenta* (sweet birch), and *Quercus rubra* (northern red oak). The sparse herbaceous layer averages 10.5% cover. The most abundant species include *Aralia nudicaulis* (wild sarsaparilla), *Collinsonia canadensis* (richweed), and *Microstegium vimineum* (Japanese stiltgrass).

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy/subcanopy	Broad-leaved deciduous tree	*Quercus rubra* (northern red oak), *Quercus alba* (white oak), *Acer saccharum* (sugar maple), and *Betula lenta* (sweet birch)
Tree canopy/subcanopy	Needle-leaved tree	*Tsuga canadensis* (eastern hemlock)
Tall shrub/sapling	Broad-leaved deciduous shrub	*Hamamelis virginiana* (American witchhazel)
Short shrub/sapling	Broad-leaved deciduous tree	*Acer saccharum* (sugar maple), *Fagus grandifolia* (American beech), *Betula lenta* (sweet birch)
Short shrub/sapling	Broad-leaved deciduous shrub	*Viburnum acerifolium* (mapleleaf viburnum)

Herb (field)	Forb	*Aralia nudicaulis* (wild sarsaparilla)

Characteristic Species: *Tsuga canadensis* (eastern hemlock), *Quercus rubra* (northern red oak), *Betula lenta* (sweet birch), *Hamamelis virginiana* (American witchhazel), *Viburnum acerifolium* (mapleleaf viburnum), and *Aralia nudicaulis* (wild sarsaparilla).
Other Noteworthy Species: None.
Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
NY	S4*	B	1	Hemlock-Northern Hardwood Forest	Edinger et al. 2002

Local Range: This NVC type is one of four associations attributed to hemlock-northern hardwood forests occurring at ROVA. This association was most common at Roosevelt Farm and Forest, but was also documented at Home of Franklin D. Roosevelt NHS (excluding Roosevelt Farm and Forest), Val-Kill and Vanderbilt Mansion NHS.
Classification Comments: This association was classified for hemlock-northern hardwood forests that contain significant amounts of *Quercus* sp. (oak) and *Betula lenta* (sweet birch).
Other Comments: None.
Local Description Authors: Frederick C. Sechler, Jr.
Plots: Roosevelt Farm and Forest (ROVA.93, ROVA.96), Home of Franklin D. Roosevelt NHS (excluding Roosevelt Farm and Forest) (ROVA.61), Val-Kill (ROVA.30, ROVA.31, ROVA.40)
AA Points: Roosevelt Farm and Forest (ROVA.145, ROVA.146, ROVA.147, ROVA.158, ROVA.170, ROVA.171, ROVA.178, ROVA.185, ROVA.186, ROVA.187, ROVA.188, ROVA.190, ROVA.196, ROVA.202, ROVA.211), Vanderbilt Mansion NHS (ROVA.32, ROVA.39).
Roosevelt-Vanderbilt National Historic Site Inventory Notes: None.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Class	Forest and Woodland (1)
Subclass	Temperate Forest (1.C)
Formation	Cool Temperate Forest (1.C.2)
Division	Eastern North American Cool Temperate Forest (D008)
Macrogroup	Northern Mesic Hardwood and Conifer Forest (M014)
Group	Northern Hardwood – Hemlock - White Pine Forest Group (G163)
Alliance*	*Tsuga canadensis* - *Betula alleghaniensis* Forest Alliance (A.412)
Alliance (English name)*	Eastern Hemlock - Yellow Birch Forest Alliance
Association	*Tsuga canadensis* - *Fagus grandifolia* - *Quercus rubra* Forest
Association (English name)	Eastern Hemlock - American Beech - Northern Red Oak Forest
Ecological System(s)	Appalachian (Hemlock)-Northern Hardwood Forest (CES202.593)
	Laurentian-Acadian Pine-Hemlock-Hardwood Forest (CES202.563)

* Alliance assignment as of 2007. All USNVC alliances are currently (2014) under review and revision.

GLOBAL DESCRIPTION

Concept Summary: This association comprises dry-mesic hemlock-mixed hardwood forests of the northeastern United States. It occurs on dry to dry-mesic, nutrient-poor, well-drained, often stony sandy loams or loamy sands over acidic bedrock. The canopy is a mixture of *Tsuga canadensis* (eastern hemlock), with *Fagus grandifolia* (American beech) and/or *Quercus rubra* (northern red oak) in variable proportions depending on soil (site) and disturbance characteristics. The overstory can range from mostly coniferous to mostly deciduous; drier sites tend to have more abundant beech or oak, and cooler sites tend to have more abundant hemlock.

Associated tree species include *Betula lenta* (sweet birch) (sometimes replaced by *Betula papyrifera* (paper birch) at the northern end of this type's range), *Pinus strobus* (eastern white pine), and *Acer rubrum* (red maple). Shrubs are often sparse but locally abundant and, in addition to saplings of canopy species, include *Hamamelis virginiana* (American witch-hazel), *Acer pensylvanicum* (striped maple), *Viburnum acerifolium* (mapleleaf viburnum), *Kalmia latifolia* (mountain laurel), and in the south *Ilex montana* (mountain holly). Though heaths may be present, they are rarely prominent. The herb layer is generally sparse but usually includes several of the following: *Mitchella repens* (partridgeberry), *Lycopodium digitatum* (fan clubmoss), *Lycopodium obscurum* (rare clubmoss), *Lycopodium annotinum* (stiff clubmoss), *Epifagus virginiana* (beechdrops), *Gaultheria procumbens* (eastern teaberry), *Maianthemum canadense* (Canada mayflower), *Trientalis borealis* (starflower), *Medeola virginiana* (Indian cucumber), *Aralia nudicaulis* (wild sarsaparilla), *Uvularia sessilifolia* (sessileleaf bellwort), *Pteridium aquilinum* (western brackenfern), *Dryopteris intermedia* (intermediate woodfern), *Monotropa uniflora* (Indian pipe), and occasionally *Lycopodium dendroideum* (tree groundpine), *Coptis trifolia* (threeleaf goldthread), and *Dennstaedtia punctilobula* (eastern hayscented fern).

Environmental Description: This forest occurs on dry to dry-mesic, nutrient-poor, well-drained, often stony sandy loams or loamy sands. Underlying bedrock is acidic. In Virginia, it occupies extremely acidic (mean pH = 3.8), infertile silt loams on mesic to submesic valley sideslopes and broad, convex ridges at elevations from 1000-1200 m. In New England, it is a common forest type found on dry-mesic acidic soils on various landscape settings.

Vegetation Description: The canopy is a mixture of *Tsuga canadensis* (eastern hemlock) with *Fagus grandifolia* (American beech) and/or *Quercus rubra* (northern red oak) in variable proportions depending on soil (site) and disturbance characteristics; drier sites tend to have more abundant beech or oak and cooler sites tend to have more abundant hemlock. Associated tree species include *Betula lenta* (sweet birch) (sometimes replaced by *Betula papyrifera* (paper birch) at the northern end of this type's range), *Pinus strobus* (eastern white pine), and *Acer rubrum* (red maple). Shrubs are often sparse but locally abundant and, in addition to saplings of canopy species, include *Hamamelis virginiana* (American witch-hazel), *Acer pensylvanicum* (striped maple), *Viburnum acerifolium* (mapleleaf viburnum), *Kalmia latifolia* (mountain laurel), and in the south *Ilex montana* (mountain holly). Though heaths may be present, they are rarely prominent. The herb layer is generally sparse but usually includes several of the following: *Mitchella repens* (partridgeberry), *Lycopodium digitatum* (fan clubmoss), *Lycopodium obscurum* (rare clubmoss), *Lycopodium annotinum* (stiff clubmoss), *Epifagus virginiana* (beechdrops), *Gaultheria procumbens* (eastern teaberry), *Maianthemum canadense* (Canada mayflower), *Trientalis borealis* (starflower), *Medeola virginiana* (Indian cucumber), *Aralia nudicaulis* (wild sarsaparilla), *Uvularia sessilifolia* (sessileleaf bellwort), *Dryopteris intermedia* (intermediate woodfern), *Monotropa uniflora* (Indian pipe), and occasionally *Lycopodium dendroideum* (tree groundpine), *Coptis trifolia* (threeleaf goldthread), and *Dennstaedtia punctilobula* (eastern hayscented fern).

Most Abundant Species:

Stratum	Lifeform	Species
Tree (canopy & subcanopy)	Needle-leaved tree	*Tsuga canadensis* (eastern hemlock)
Tree canopy	Broad-leaved deciduous tree	*Fagus grandifolia* (American beech), *Quercus rubra* (northern red oak)
Tree subcanopy	Broad-leaved deciduous tree	*Acer rubrum* (red maple), *Betula lenta* (sweet birch)

Tall shrub/sapling	Broad-leaved deciduous shrub	*Acer pensylvanicum* (striped maple), *Hamamelis virginiana* (American witch-hazel), *Viburnum acerifolium* (mapleleaf viburnum)
Tall shrub/sapling	Broad-leaved evergreen shrub	*Kalmia latifolia* (mountain laurel)
Herb (field)	Forb	*Aralia nudicaulis* (wild sarsaparilla), *Trientalis borealis* (starflower)

Characteristic Species: *Betula lenta* (sweet birch), *Dryopteris intermedia* (intermediate woodfern), *Fagus grandifolia* (American beech), *Quercus rubra* (northern red oak), *Tsuga canadensis* (eastern hemlock)
Other Noteworthy Species: Information not available.
USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: This association is widespread in southern New England and ranges south locally in the northern Piedmont and high Allegheny Mountains to Virginia and West Virginia. In Virginia, the type is confined to the Allegheny Mountain / Laurel Fork area in northwestern Highland County.
States/Provinces: CT, MA, ME, NH, NY, PA, RI, VA:S1, VT
Federal Lands: NPS (Marsh-Billings-Rockefeller, Saint-Gaudens, Roosevelt-Vanderbilt, Upper Delaware); USFS (George Washington)

CONSERVATION STATUS

Rank: G4G5 (26-Jun-1998)
Reasons: This community type is widely distributed in the northern part of its range. Its long-term viability is threatened by pathogens associated with its two dominant canopy trees.

CLASSIFICATION INFORMATION

Status: Standard
Confidence: 2 - Moderate
Comments: At least in the southern portion of this type's range, the *Tsuga canadensis* (eastern hemlock) component of this community type appears to have been heavily reduced by past disturbances because of this species' commercial timber value and its vulnerability to fire.
Similar Associations:

- *Pinus strobus - Quercus (rubra, velutina) - Fagus grandifolia* Forest (CEGL006293)
- *Quercus rubra - Acer saccharum - Fagus grandifolia / Viburnum acerifolium* Forest (CEGL006173)
- *Tsuga canadensis - (Betula alleghaniensis) - Picea rubens / Cornus canadensis* Forest (CEGL006129)
- *Tsuga canadensis - Betula alleghaniensis - Acer saccharum / Dryopteris intermedia* Forest (CEGL006109)
- *Tsuga canadensis - Fagus grandifolia - (Acer saccharum)* Great Lakes Forest (CEGL005042)
- *Tsuga canadensis - Fagus grandifolia - Quercus (prinus, alba)* Forest (CEGL006474)

Related Concepts:

- *Fagus grandifolia - Tsuga canadensis / Dryopteris intermedia* Forest (Fleming and Coulling 2001) =
- *Fagus grandifolia / Dryopteris intermedia* Association (Fleming and Moorhead 1996) =
- CNE dry transitional forest on sandy / gravelly soils (Rawinski 1984) ?
- CNE mesic conifer [transition] forest on acidic bedrock/till (Rawinski 1984) B
- CNE mesic hardwood forest on acidic bedrock/till (Rawinski 1984) B

- Central New England mesic conifer forest on acidic bedrock / till (Rawinski 1984) B
- Eastern Hemlock: 23 (Eyre 1980) B
- Hemlock Forest (Thompson 1996) B

SOURCES

Description Authors: G. Fleming and P. Coulling, mod. S.L. Neid and S.C. Gawler

References: Eastern Ecology Working Group n.d., Edinger et al. 2002, Enser 1999, Eyre 1980, Fike 1999, Fleming and Coulling 2001, Fleming and Moorhead 1996, Fleming et al. 2001, Gawler 2002, Metzler and Barrett 2001, NRCS 2004, Rawinski 1984, Reschke 1990, Sperduto and Nichols 2004, Swain and Kearsley 2001, Thompson 1996, Thompson and Sorenson 2000, VDNH 2003

Figure F-16. Hemlock - Beech - Oak Forest (plot ROVA.61). 09/30/2003. NAD 1983 / UTM-18 easting 588086, northing 4624362.

Local Name: Hemlock - Northern Hardwood Forest (CEGL006109)

SYNONYMS

USNVC English Name: **Eastern Hemlock - Yellow Birch - Sugar Maple / Intermediate Woodfern Forest**

USNVC Scientific Name: ***Tsuga canadensis - Betula alleghaniensis - Acer saccharum / Dryopteris intermedia* Forest**

USNVC Identifier: **CEGL006109**

LOCAL INFORMATION

Environmental Description: This densely shaded hemlock-northern hardwood forest occurs on moderately steep, and moderately to very stony silt loam, and silty clay loam soils. The underlying bedrock consists of Ordovician shale and siltstone within minor amounts of sandstone from the Austin Glen Formation. Adjacent upland associations include Red Oak - Northern Hardwood Forest (CEGL006173), Successional Tree-of-Heaven Forest (CEGL007191), Mesic Sugar Maple - Ash - Oak - Hickory Forest (CEGL006046), Hemlock - Beech - Oak Forest (CEGL006088), Traprock Ridge (CEGL006002), Central Appalachian Hemlock - Chestnut Oak Forest (CEGL006923), and Semi-rich Northern Hardwood Forest (CEGL006211). Adjacent wetland associations include Northeastern Buttonbush Shrub Swamp (CEGL006069) and Southern New England / Northern Piedmont Red Maple Seepage Swamp (CEGL006406).

Vegetation Description: The tree canopy averages 82.2% percent cover and 25.8 meters in height. Characteristic species include *Acer saccharum* (sugar maple), *Tsuga canadensis* (eastern hemlock), *Fagus grandifolia* (American beech), *Fraxinus americana* (white ash), *Carya ovata* (shagbark hickory), and *Betula alleghaniensis* (yellow birch). The tree subcanopy layer averages 40.1% cover and 14.3 meters in height. The most abundant species in this layer in addition to the dominant canopy species, include *Ostrya virginiana* (hophornbeam) and *Tilia americana* (American basswood). The sparse tall shrub layer averages 15.9% cover and 3.4 meters in height. This layer contains *Hamamelis virginiana* (American witchhazel) as the most abundant species, along with several regenerating canopy/subcanopy species such as *Acer saccharum* (sugar maple), *Tsuga canadensis* (eastern hemlock), and *Ostrya virginiana* (hophornbeam). The short shrub layer averages 12.9% cover and the most abundant species include saplings and seedlings of *Acer saccharum* (sugar maple), plus *Lindera benzoin* (northern spicebush), and *Viburnum acerifolium* (mapleleaf viburnum). The sparse herbaceous layer averages 18.1% cover. The most abundant species in this layer include *Alliaria petiolata* (garlic mustard), *Polystichum acrostichoides* (Christmas fern), *Maianthemum canadense* (Canada mayflower), *Dryopteris intermedia* (intermediate woodfern), and *Dryopteris marginalis* (marginal woodfern).

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy/subcanopy	Broad-leaved deciduous tree	*Acer saccharum* (sugar maple),
Tree canopy/subcanopy	Needle-leaved tree	*Tsuga canadensis* (eastern hemlock)
Tall shrub/sapling	Broad-leaved deciduous shrub	*Hamamelis virginiana* (American witchhazel)
Short shrub/sapling	Broad-leaved deciduous tree	*Acer saccharum* (sugar maple)
Short shrub/sapling	Broad-leaved deciduous shrub	*Lindera benzoin* (northern spicebush), and *Viburnum acerifolium* (mapleleaf viburnum)
Herb (field)	Forb	*Alliaria petiolata* (garlic mustard)

Herb (field)	Fern and fern ally	*Polystichum acrostichoides* (Christmas fern)

Characteristic Species: *Acer saccharum* (sugar maple), *Tsuga canadensis* (eastern hemlock), *Betula alleghaniensis* (yellow birch), *Ostrya virginiana* (hophornbeam), and *Hamamelis virginiana* (American witchhazel).
Other Noteworthy Species: None.
Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
NY	S4*	B	1	Hemlock-Northern Hardwood Forest	Edinger et al. 2002

Local Range: This is one of four hemlock-northern hardwood forests NVC types that occur within the park. Overall, this association occurs fairly commonly at Home of Franklin D. Roosevelt NHS (excluding Roosevelt Farm and Forest), and is uncommon at Roosevelt Farm and Forest.
Classification Comments: This association is used to classify hemlock-northern hardwood forests with a greater percentage of northern hardwood species (i.e., *Acer saccharum*, *Betula alleghaniensis*) than *Quercus* sp. (oak). Most examples of this association did not contain *Quercus* spp. (oak), or contained oak species in small amounts.
Other Comments: None.
Local Description Authors: Frederick C. Sechler, Jr.
Plots: Roosevelt Farm and Forest (ROVA.135), Home of Franklin D. Roosevelt NHS (excluding Roosevelt Farm and Forest) (ROVA.25, ROVA.65, ROVA.77).
AA Points: Home of Franklin D. Roosevelt NHS (excluding Roosevelt Farm and Forest (ROVA.47, ROVA.48, ROVA.59, ROVA.66, ROVA.94), Roosevelt Farm and Forest (ROVA.177, ROVA.181).
Roosevelt-Vanderbilt National Historic Site Inventory Notes: None.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Class	Forest and Woodland (1)
Subclass	Temperate Forest (1.C)
Formation	Cool Temperate Forest (1.C.2)
Division	Eastern North American Cool Temperate Forest (D008)
Macrogroup	Northern Mesic Hardwood and Conifer Forest (M014)
Group	Northern Hardwood – Hemlock - White Pine Forest Group (G163)
Alliance*	*Tsuga canadensis - Betula alleghaniensis* Forest Alliance (A.412)
Alliance (English name)*	Eastern Hemlock - Yellow Birch Forest Alliance
Association	*Tsuga canadensis - Betula alleghaniensis - Acer saccharum / Dryopteris intermedia* Forest
Association (English name)	Eastern Hemlock - Yellow Birch - Sugar Maple / Intermediate Woodfern Forest
Ecological System(s)	Appalachian (Hemlock)-Northern Hardwood Forest (CES202.593)

* Alliance assignment as of 2007. All USNVC alliances are currently (2014) under review and revision.

GLOBAL DESCRIPTION

Concept Summary: This association comprises hemlock - northern hardwood forests of the northeastern United States. This forest is associated with cool, dry-mesic to mesic sites and acidic soils, often on rocky, north-facing slopes. Soils can have a thick, poorly decomposed duff layer over sandy loams. *Tsuga canadensis* (eastern hemlock) is characteristic and usually dominant in the coniferous to mixed canopy. While hemlock generally forms at least 50% of the

canopy, in some cases it may be as low as 25% relative dominance. Hardwood codominants include *Betula alleghaniensis* (yellow birch) or *Acer saccharum* (sugar maple), with *Fagus grandifolia* (American beech) common but not usually abundant in all but the very southern portion of the range of this type. *Betula lenta* (sweet birch) may replace *Betula alleghaniensis* (yellow birch) in some areas. *Ostrya virginiana* (hophornbeam) may be present as a small tree. *Quercus* (oak) spp. and *Pinus strobus* (eastern white pine) tend to be absent or, if present, only occur with low abundance. The shrub layer may be dense to fairly open and often includes *Viburnum acerifolium* (mapleleaf viburnum) and *Acer pensylvanicum* (striped maple) in addition to *Tsuga canadensis* (eastern hemlock) regeneration. Herbs may be sparse, particularly in dense shade, but include *Dryopteris intermedia* (intermediate woodfern), *Medeola virginiana* (Indian cucumber), *Oxalis montana* (mountain woodsorrel), *Mitchella repens* (partridgeberry), *Maianthemum canadense* (Canada mayflower), *Uvularia sessilifolia* (sessileleaf bellwort), *Polystichum acrostichoides* (Christmas fern), *Trientalis borealis* (starflower), *Huperzia lucidula* (shining clubmoss), *Eurybia divaricata* (white wood aster), *Oclemena acuminata* (whorled wood aster), *Dennstaedtia punctilobula* (eastern hayscented fern), and *Thelypteris noveboracensis* (New York fern). Nonvascular plants may be well-developed, often characterized by the liverwort *Bazzania trilobata*. Diagnostic characteristics of this forest are the presence of *Betula alleghaniensis* (yellow birch) and *Acer saccharum* (sugar maple) and a lack of abundant *Quercus* (oak) spp., *Pinus strobus* (eastern white pine), or *Betula lenta* (sweet birch).

Environmental Description: This forest is associated with cool, dry-mesic to mesic sites and acidic soils, often on rocky, north-facing slopes. Soils can have a thick, poorly decomposed duff layer over sandy loams. In the southern part of the range, stands often occur in deep, sheltered ravines and along high-gradient mountain streams.

Vegetation Description: *Tsuga canadensis* (eastern hemlock) is dominant and forms at least 50% of the canopy. *Betula alleghaniensis* (yellow birch) can be codominant, with *Fagus grandifolia* (American beech) and *Acer saccharum* (sugar maple) common but not usually abundant in all but the very southern portion of the range for this type. At the southern end of the range (in Virginia and Maryland), *Liriodendron tulipifera* (tuliptree) may be an important overstory associate. The shrub layer may be dense to fairly open and often includes *Viburnum acerifolium* (mapleleaf viburnum) and *Acer pensylvanicum* (striped maple) in addition to *Tsuga canadensis* (eastern hemlock) regeneration. Herbs may be sparse, particularly in dense shade, but often include *Dryopteris intermedia* (intermediate woodfern), *Medeola virginiana* (Indian cucumber), *Oxalis montana* (mountain woodsorrel), *Mitchella repens* (partridgeberry), *Maianthemum canadense* (Canada mayflower), *Trientalis borealis* (starflower), *Huperzia lucidula* (shining clubmoss), *Eurybia divaricata* (white wood aster), and *Thelypteris noveboracensis* (New York fern). Nonvascular plants may be well-developed, often characterized by the liverwort *Bazzania trilobata*. Diagnostic characteristics of this forest are the presence of *Betula alleghaniensis* (yellow birch) and *Acer saccharum* (sugar maple) and a lack of abundant *Quercus* (oak) spp., *Pinus strobus* (eastern white pine), or *Betula lenta* (sweet birch).

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Tsuga canadensis* (eastern hemlock)
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Acer pensylvanicum* (striped maple), *Viburnum acerifolium* (mapleleaf viburnum)
Herb (field)	Forb	*Maianthemum canadense* (Canada mayflower)

Characteristic Species: *Betula alleghaniensis* (yellow birch), *Carex albicans* (whitetinge sedge), *Dryopteris intermedia* (intermediate woodfern), *Huperzia lucidula* (shining clubmoss), *Maianthemum canadense* (Canada mayflower), *Medeola virginiana* (Indian cucumber), *Mitchella repens* (partridgeberry), *Oclemena acuminata* (whorled wood aster), *Thelypteris noveboracensis* (New York fern), *Tsuga canadensis* (eastern hemlock)
Other Noteworthy Species: Information not available.
USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: This community is generally distributed in large patches from New Hampshire south through Pennsylvania, becoming more local in the north Atlantic Piedmont and restricted to local patches at higher elevations of the Central Appalachians in Maryland, West Virginia, and Virginia. In Virginia it is restricted to the northwestern part of the state, where occurrences are rather local but sometimes extensive.
States/Provinces: CT, MA, MD, NH, NJ:S3, NY, PA, RI, VA:S3, VT, WV?
Federal Lands: NPS (Catoctin Mountain?, Delaware Water Gap, Johnstown Flood, Marsh-Billings-Rockefeller, Roosevelt-Vanderbilt, Shenandoah, Upper Delaware); USFS (Finger Lakes, George Washington, Green Mountain); USFWS (Erie, Iroquois)

CONSERVATION STATUS

Rank: G4? (31-Dec-1997)
Reasons: This association has a very large geographic distribution and occurs in large patches in the northern part of its range. All stands of this community are now highly threatened by the exotic insect pest hemlock woolly adelgid (*Adelges tsugae*), which causes decline and eventual mortality in *Tsuga canadensis* (eastern hemlock).

CLASSIFICATION INFORMATION

Status: Standard
Confidence: 2 - Moderate
Comments: Many stands of this vegetation type in the national forests and Shenandoah National Park have been devastated during the past decade by adelgid-caused tree mortality. In some cases, 100% of the canopy hemlocks have been killed, littering the forest floor with downed wood and stimulating massive increases in understory growth, particularly of *Betula* (birch) spp. and *Acer pensylvanicum* (striped maple). Since there is no practical treatment for the adelgid on a landscape level, one can only hope that natural pathogens will emerge to keep the adelgid in check before all of our examples of this community are severely degraded or lost.
Similar Associations:

- *Betula alleghaniensis - (Tsuga canadensis) / Rhododendron maximum / (Leucothoe fontanesiana)* Forest (CEGL007861)
- *Quercus rubra - Acer saccharum - Fagus grandifolia / Viburnum acerifolium* Forest (CEGL006173)
- *Tsuga canadensis - (Betula alleghaniensis) - Picea rubens / Cornus canadensis* Forest (CEGL006129)
- *Tsuga canadensis - (Betula alleghaniensis, Quercus rubra) / Ilex montana / Rhododendron catawbiense* Forest (CEGL008513)
- *Tsuga canadensis - Fagus grandifolia - Quercus (prinus, alba)* Forest (CEGL006474)
- *Tsuga canadensis - Fagus grandifolia - Quercus rubra* Forest (CEGL006088)

Related Concepts:

- *Betula alleghaniensis - Tsuga canadensis / Dryopteris intermedia - Huperzia lucidula* Forest (Coulling and Rawinski 1999) F
- *Tsuga canadensis - Betula (alleghaniensis, lenta) / Dryopteris intermedia* Forest (Fleming and Coulling 2001) =
- *Tsuga canadensis - Betula lenta - Betula alleghaniensis* Association (Fleming and Moorhead 1996) F
- *Tsuga canadensis / Dryopteris intermedia / Bazzania trilobata* Association (Rawinski et al. 1994) F
- CNE dry transitional forest on sandy / gravelly soils (Rawinski 1984) ?
- CNE mesic conifer [transition] forest on acidic bedrock/till (Rawinski 1984) B
- CNE mesic hardwood forest on acidic bedrock/till (Rawinski 1984) B
- Eastern Hemlock: 23 (Eyre 1980) B
- Hemlock - Yellow Birch: 24 (Eyre 1980) B
- Hemlock Forest (Thompson 1996) B
- Mesic Hemlock-Hardwood Forest (Breden 1989) B

SOURCES

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

References: Breden 1989, Breden et al. 2001, Coulling and Rawinski 1999, Eastern Ecology Working Group n.d., Edinger et al. 2002, Enser 1993, Eyre 1980, Fike 1999, Fleming and Coulling 2001, Fleming and Moorhead 1996, Fleming et al. 2001, Gawler 2002, Harrison 2004, Metzler and Barrett 2001, NAP pers. comm. 1998, NRCS 2004, Rawinski 1984, Rawinski et al. 1994, Smith 1983, Sperduto 2000a, Swain and Kearsley 2001, Thompson 1996, Thompson and Sorenson 2000, VDNH 2003, Young et al. 2006

Figure F-17. Hemlock - Northern Hardwood Forest (AA point ROVA.59). 09/06/2006. NAD 1983 / UTM-18 easting 588107, northing 4624428.

Local Name: Hemlock / White Pine - Red Oak - Mixed Hardwood Forest (CEGL006566)

SYNONYMS

USNVC English Name:	**Northern Red Oak - Eastern Hemlock - Tuliptree / American Witch-hazel Forest**
USNVC Scientific Name:	***Quercus rubra - Tsuga canadensis - Liriodendron tulipifera / Hamamelis virginiana* Forest**
USNVC Identifier:	**CEGL006566**

LOCAL INFORMATION

Environmental Description: This fairly mesic hemlock-northern hardwood forest association typically occurs on mid-slopes with moderately stony substrates. The soils consist of a variety of loams, including silty loams, clay loams, and channery silt loam on underlying bedrock comprised of Ordovician shale and siltstone with minor amounts of sandstone from the Austin Glen Formation. This hemlock-northern hardwood forest type is closely associated with High Allegheny Rich Red Oak - Sugar Maple Forest (CEGL006125) due to the significant presence of *Liriodendron tulipifera* (tuliptree) in both types. Additional adjacent upland associations with this type include Semi-rich Northern Hardwood Forest (CEGL006211), Dry, Rich Oak - Hickory Forest (CEGL006236), Hemlock - Beech - Oak Forest (CEGL006088), and Red Oak - Northern Hardwood Forest (CEGL006173). Adjacent wetland associations occurring at the base of this hemlock-northern hardwood forest type include Southern New England / Northern Piedmont Red Maple Seepage Swamp (CEGL006406) and Red Maple / Tussock Sedge Wooded Marsh (CEGL006119).

Vegetation Description: The tree canopy averages 75.5% percent cover and 30.0 meters in height. Characteristic species include *Tsuga canadensis* (eastern hemlock), *Quercus rubra* (northern red oak), *Acer saccharum* (sugar maple), *Betula lenta* (sweet birch), *Liriodendron tulipifera* (tuliptree), *Quercus coccinea* (scarlet oak), and *Acer rubrum* (red maple). The tree subcanopy layer averages 50% cover and 16.9 meters in height. Characteristic species, in addition to species found in the canopy layer, include *Fagus grandifolia* (American beech). An exotic species, *Ailanthus altissima* (tree of heaven), also occurs in the tree subcanopy layer. The tall shrub layer averages 19.4% cover and 4.6 meters in height. The dominant species are those that occur in the canopy layers, plus *Ostrya virginiana* (hophornbeam) and *Hamamelis virginiana* (American witchhazel). The short shrub layer averages 29.8% cover and is characterized by *Viburnum acerifolium* (mapleleaf viburnum), regeneration of *Acer saccharum* (sugar maple), *Lindera benzoin* (northern spicebush), and the exotic *Euonymus alata* (winged burning bush). The sparse vine layer averages 3.7% cover with *Parthenocissus quinquefolia* (Virginia creeper) and *Toxicodendron radicans* (eastern poison ivy) as the most abundant species. The herbaceous layer averages 25.3% cover and is characterized by *Aralia nudicaulis* (wild sarsaparilla), *Alliaria petiolata* (garlic mustard), *Eurybia divaricata* (white wood aster), *Maianthemum canadense* (Canada mayflower), and *Polystichum acrostichoides* (Christmas fern).

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy/subcanopy	Broad-leaved deciduous tree	*Quercus rubra* (northern red oak), *Quercus alba* (white oak), *Acer*

		saccharum (sugar maple), and *Liriodendron tulipifera* (tuliptree)
Tree canopy/subcanopy	Needle-leaved coniferous tree	*Tsuga canadensis* (eastern hemlock)
Tall shrub/sapling	Broad-leaved deciduous shrub	*Ostrya virginiana* (hophornbeam), *Hamamelis virginiana* (American witchhazel)
Short shrub/sapling	Broad-leaved deciduous tree	*Acer saccharum* (sugar maple)
Short shrub/sapling	Broad-leaved deciduous shrub	*Viburnum acerifolium* (mapleleaf viburnum), *Lindera benzoin* (northern spicebush)
Herb (field)	Forb	*Aralia nudicaulis* (wild sarsaparilla) *Alliaria petiolata* (garlic mustard), *Eurybia divaricata* (white wood aster)

Characteristic Species: *Tsuga canadensis* (eastern hemlock), *Liriodendron tulipifera* (tuliptree), *Ostrya virginiana* (hophornbeam), *Lindera benzoin* (northern spicebush), *Aralia nudicaulis* (wild sarsaparilla).

Other Noteworthy Species: None.

Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
NY	SNR			Hemlock-Northern Hardwood Forest	Edinger et al. 2002

Local Range: This association is one of four NVC types that are attributable to hemlock-northern hardwood forests at Roosevelt-Vanderbilt National Historic Sites. This association occurs commonly at both Vanderbilt Mansion NHS and Roosevelt Farm and Forest, where it is closely associated with Allegheny Rich Red Oak - Sugar Maple Forest (CEGL006125)

Classification Comments: This association was used to classify hemlock-northern hardwood forests with a species assemblage that includes *Tsuga canadensis* (eastern hemlock), *Liriodendron tulipifera* (tuliptree), *Quercus rubra* (northern red oak), *Ostrya virginiana* (hophornbeam), and *Lindera benzoin* (northern spicebush).

Other Comments: None.

Local Description Authors: Frederick C. Sechler, Jr.

Plots: Roosevelt Farm and Forest (ROVA.100, ROVA.107, ROVA.108, ROVA.124, ROVA.130, ROVA.131, ROVA.134), and Vanderbilt Mansion NHS (ROVA.50).

AA Points: Roosevelt Farm and Forest (ROVA.143, ROVA.144, ROVA.159, ROVA.161,), Vanderbilt Mansion NHS (ROVA.28, ROVA.5).

Roosevelt-Vanderbilt National Historic Site Inventory Notes: None.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Class	Forest and Woodland (1)
Subclass	Temperate Forest (1.C)
Formation	Cool Temperate Forest (1.C.2)
Division	Eastern North American Cool Temperate Forest (D008)
Macrogroup	Northern Mesic Hardwood and Conifer Forest (M014)
Group	Northern Hardwood – Hemlock - White Pine Forest Group (G163)
Alliance*	*Tsuga canadensis - Liriodendron tulipifera* Forest Alliance (A.413)
Alliance (English name)*	Eastern Hemlock - Tuliptree Forest Alliance
Association	*Quercus rubra - Tsuga canadensis - Liriodendron tulipifera / Hamamelis virginiana* Forest

Association (English name) Northern Red Oak - Eastern Hemlock - Tuliptree / American Witch-hazel Forest
Ecological System(s) Appalachian (Hemlock)-Northern Hardwood Forest (CES202.593)
* Alliance assignment as of 2007. All USNVC alliances are currently (2014) under review and revision.

GLOBAL DESCRIPTION

Concept Summary: This closed-canopy, dry-mesic deciduous forest occurs on deep, moist to well-drained loams and silt loams on northern and eastern midslopes and coves. The canopy is dominated by a variety of oaks, hickories and conifers, including *Quercus rubra* (northern red oak), *Acer saccharum* (sugar maple), *Fagus grandifolia* (American beech), *Quercus alba* (white oak), *Quercus velutina* (black oak), *Betula lenta* (sweet birch), *Carya alba* (mockernut hickory), *Fraxinus americana* (white ash), and *Liriodendron tulipifera* (tuliptree), with notable presence of *Tsuga canadensis* (eastern hemlock) and/or *Pinus strobus* (eastern white pine). The subcanopy and shrub layer consists of *Ostrya virginiana* (hophornbeam), *Carpinus caroliniana* (American hornbeam), *Kalmia latifolia* (mountain laurel), *Hamamelis virginiana* (American witch-hazel), *Vaccinium pallidum* (Blue Ridge blueberry), *Amelanchier laevis* (Allegheny serviceberry), *Lindera benzoin* (northern spicebush), *Viburnum acerifolium* (mapleleaf viburnum), and *Viburnum recognitum* (smooth arrow-wood). The herbaceous layer is characterized by *Maianthemum racemosum* (feathery false lily of the valley), *Gaultheria procumbens* (eastern teaberry), *Mitchella repens* (partridgeberry), *Chimaphila maculata* (striped prince's pine), *Thelypteris noveboracensis* (New York fern), *Dennstaedtia punctilobula* (eastern hayscented fern), *Maianthemum canadense* (Canada mayflower), and *Podophyllum peltatum* (mayapple).

Environmental Description: This vegetation occurs on deep, moist to well-drained loams and silt loams on northern and eastern midslopes and coves. Soils may be rocky, and slopes may be steep.

Vegetation Description: The canopy has a notable presence of *Tsuga canadensis* (eastern hemlock) and/or *Pinus strobus* (eastern white pine). Sharing dominance with these conifers is a variety of oaks and hickories including *Quercus rubra* (northern red oak), *Acer saccharum* (sugar maple), *Fagus grandifolia* (American beech), *Quercus alba* (white oak), *Quercus velutina* (black oak), *Betula lenta* (sweet birch), *Carya alba* (mockernut hickory), *Fraxinus americana* (white ash), *Liriodendron tulipifera* (tuliptree). The subcanopy and shrub layer consists of *Ostrya virginiana* (hophornbeam), *Carpinus caroliniana* (American hornbeam), *Kalmia latifolia* (mountain laurel), *Hamamelis virginiana* (American witch-hazel), *Amelanchier laevis* (Allegheny serviceberry), *Lindera benzoin* (northern spicebush), *Viburnum acerifolium* (mapleleaf viburnum), and *Viburnum recognitum* (smooth arrow-wood). The herbaceous layer is characterized by *Maianthemum racemosum* (feathery false lily of the valley), *Gaultheria procumbens* (eastern teaberry), *Maianthemum canadense* (Canada mayflower), and *Podophyllum peltatum* (mayapple).

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Pinus strobus* (eastern white pine), *Tsuga canadensis* (eastern hemlock)
Tree canopy	Broad-leaved deciduous tree	*Liriodendron tulipifera* (tuliptree), *Quercus rubra* (northern red oak)
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Hamamelis virginiana* (American witch-hazel)
Herb (field)	Dwarf-shrub	*Gaultheria procumbens* (eastern teaberry)
Herb (field)	Forb	*Maianthemum racemosum* (feathery false lily of the valley), *Podophyllum peltatum* (mayapple)

Characteristic Species: *Hamamelis virginiana* (American witch-hazel), *Liriodendron tulipifera* (tuliptree), *Pinus strobus* (eastern white pine), *Quercus rubra* (northern red oak), *Tsuga canadensis* (eastern hemlock)
Other Noteworthy Species: Information not available.
USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: This vegetation occurs in New Jersey and Pennsylvania and may occur in adjacent states.
States/Provinces: NJ, NY, PA
Federal Lands: NPS (Morristown)

CONSERVATION STATUS

Rank: G4? (29-Sep-2004)
Reasons: Within its range, this community type occurs extensively in suitable habitats. Occurrences are subject to compositional modification by outbreaks of hemlock woolly adelgid (*Adelges tsugae*), an exotic insect pest that causes decline and eventual mortality of *Tsuga canadensis* (eastern hemlock).

CLASSIFICATION INFORMATION

Status: Standard
Confidence: 2 - Moderate
Comments: Information not available.
Similar Associations:

- *Quercus rubra - Acer saccharum - Liriodendron tulipifera* Forest (CEGL006125)
- *Tsuga canadensis - Fagus grandifolia - Quercus (prinus, alba)* Forest (CEGL006474)

Related Concepts:

- Mixed Hemlock - Hardwoods community (Ehrenfeld 1977) =

SOURCES

Description Authors: L.A. Sneddon
References: Anderson et al. 1998, Eastern Ecology Working Group n.d., Ehrenfeld 1977, Fike 1999

Figure F-18. Hemlock / White Pine - Red Oak - Mixed Hardwood Forest (plot ROVA.108). 07/03/2007. NAD 1983 / UTM-18 easting 590441, northing 4623709.

Local Name: High Allegheny Rich Red Oak - Sugar Maple Forest (CEGL006125)

SYNONYMS

USNVC English Name: **Northern Red Oak - Sugar Maple - Tuliptree Forest**
USNVC Scientific Name: ***Quercus rubra - Acer saccharum - Liriodendron tulipifera* Forest**
USNVC Identifier: **CEGL006125**

LOCAL INFORMATION

Environmental Description: This association occurs mainly on midslopes that have a varying degree of steepness occurring throughout the four units of the park. The enriched soils vary from site to site but are typically sandy loam, loam, gravelly loam, very gravelly loam, and channery silt loam. The underlying bedrock is Ordovician shale and siltstone with minor amounts of sandstone from the Austin Glen formation. Adjacent upland associations include Hemlock / White Pine - Red Oak - Mixed Hardwood Forest (CEGL006566), Northeastern Old Field (CEGL006107), Norway Spruce Plantation (CEGL007167), White Pine - Hemlock Dry-Mesic Coniferous Forest (CEGL006328), Hemlock - Northern Hardwood Forest (CEGL006109), and Semi-rich Northern Hardwood Forest (CEGL006211). In addition, a forested seep association Skunk-cabbage - Orange Jewelweed Seep (CEGL006567) also occurs adjacent to this forest type.

Vegetation Description: The tree canopy averages 74.6% and 27.7 meters in height and is characterized by *Liriodendron tulipifera* (tuliptree), *Acer saccharum* (sugar maple), and *Quercus rubra* (northern red oak), with minor associates including *Quercus alba* (white oak), *Quercus coccinea* (scarlet oak), *Tilia americana* (American basswood), and *Betula lenta* (sweet birch). The tree subcanopy layer averaged 45.6% cover and 15.4 meters in height. The most abundant species, besides the same species in the canopy layer, include *Carya ovata* (shagbark hickory), *Fagus grandifolia* (American beech), and *Ostrya virginiana* (hophornbeam). The tall shrub layer averages 29.2% cover and 3.1 meters in height. The most abundant species include *Lindera benzoin* (northern spicebush), *Acer saccharum* (sugar maple), and *Hamamelis virginiana* (American witchhazel). The short shrub layer averages 33.2% cover and is heavily dominated by *Lindera benzoin* (northern spicebush), with associates *Acer saccharum* (sugar maple), *Viburnum acerifolium* (mapleleaf viburnum), and exotic *Berberis thunbergii* (Japanese barberry). The vine layer averages 9.1% cover with *Toxicodendron radicans* (eastern poison ivy) and *Parthenocissus quinquefolia* (Virginia creeper) being the dominant species. The herbaceous layer averages 26.8% cover and the most abundant species include *Alliaria petiolata* (garlic mustard), *Polystichum acrostichoides* (Christmas fern), *Asarum canadense* (Canadian wildginger), *Thelypteris noveboracensis* (New York fern), *Eurybia divaricata* (white wood aster), and *Ageratina altissima* (white snakeroot).

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Liriodendron tulipifera* (tuliptree)
Tree canopy/subcanopy	Broad-leaved deciduous tree	*Quercus rubra* (northern red oak), *Acer saccharum* (sugar maple)
Tree subcanopy	Broad-leaved deciduous tree	*Ostrya virginiana* (hophornbeam)

Tall shrub/sapling	Broad-leaved deciduous shrub	*Lindera benzoin* (northern spicebush), *Hamamelis virginiana* (American witchhazel)
Short shrub/sapling	Broad-leaved deciduous shrub	*Lindera benzoin* (northern spicebush), *Acer saccharum* (sugar maple), *Viburnum acerifolium* (mapleleaf viburnum)
Herb (field)	Vine/liana	*Toxicodendron radicans* (eastern poison ivy)
Herb (field)	Forb	*Alliaria petiolata* (garlic mustard), *Asarum canadense* (Canadian wildginger)
Herb (field)	Fern and fern ally	*Polystichum acrostichoides* (Christmas fern), *Thelypteris noveboracensis* (New York fern)

Characteristic Species: *Liriodendron tulipifera* (tuliptree), *Acer saccharum* (sugar maple), *Quercus rubra* (northern red oak), and *Lindera benzoin* (northern spicebush).
Other Noteworthy Species: None.
Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
NY	S2S3*	B	1	Oak-Tuliptree Forest	Edinger et al. 2002

Local Range: This forest type occurs as a state-wide significant occurrence at Vanderbilt Mansion NHS where numerous very large "older-growth" trees were documented. This association also occurs commonly throughout the other three units of the park.
Classification Comments: This association was used to classify upland forest types with the combination of characteristic species *Liriodendron tulipifera* (tuliptree), *Acer saccharum* (sugar maple), *Quercus rubra* (northern red oak), and *Lindera benzoin* (northern spicebush).
Other Comments: None.
Local Description Authors: Frederick C. Sechler, Jr.
Plots: Roosevelt Farm and Forest (ROVA.121, ROVA.122, ROVA.128, ROVA.129, ROVA.141), Home of Franklin D. Roosevelt NHS (excluding Roosevelt Farm and Forest) (ROVA.68), Val-Kill (ROVA.38, ROVA.39), Vanderbilt Mansion NHS (ROVA.45, ROVA.46, ROVA.47, ROVA.51, ROVA.52, ROVA.53, ROVA.64).
AA Points: Vanderbilt Mansion NHS (ROVA.1, ROVA.17, ROVA.21, ROVA.27), Roosevelt Farm and Forest (ROVA.149, ROVA.172, ROVA.183, ROVA.191, ROVA.203), Val-Kill (ROVA.101, ROVA.102, ROVA.103, ROVA.105), Home of Franklin D. Roosevelt NHS (excluding Roosevelt Farm and Forest) (ROVA.41, ROVA.51, ROVA.52, ROVA.53).
Roosevelt-Vanderbilt National Historic Site Inventory Notes: None.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Class	Forest and Woodland (1)
Subclass	Temperate Forest (1.C)
Formation	Cool Temperate Forest (1.C.2)
Division	Eastern North American Cool Temperate Forest (D008)
Macrogroup	Northern Mesic Hardwood and Conifer Forest (M014)
Group	Northern Hardwood – Hemlock - White Pine Forest Group (G163)
Alliance*	*Quercus rubra - (Acer saccharum)* Forest Alliance (A.251)

Alliance (English name)*	Northern Red Oak - (Sugar Maple) Forest Alliance
Association	*Quercus rubra - Acer saccharum - Liriodendron tulipifera* Forest
Association (English name)	Northern Red Oak - Sugar Maple - Tuliptree Forest
Ecological System(s)	Appalachian (Hemlock)-Northern Hardwood Forest (CES202.593)

* Alliance assignment as of 2007. All USNVC alliances are currently (2014) under review and revision.

GLOBAL DESCRIPTION

Concept Summary: This red oak - sugar maple community is found primarily in the Allegheny Plateau and Appalachian Mountains of the United States, as well as on the northern Piedmont north to the Hudson Valley, with possible extensions east and west of those areas. It is typically found in coves, on moist north- and east-facing slopes and on well-drained flats. Soils are slightly acidic and of intermediate fertility. The closed-canopy tree layer is dominated by a mixture of oaks, primarily *Quercus alba* (white oak) and *Quercus rubra* (northern red oak), with other hardwoods including *Acer saccharum* (sugar maple), *Acer rubrum* (red maple), and *Liriodendron tulipifera* (tuliptree). *Carya ovata* (shagbark hickory), *Carya alba* (mockernut hickory), *Nyssa sylvatica* (blackgum), and *Quercus velutina* (black oak) are possible associates. *Carya* (hickory) spp. may share dominance in some stands. Dominance by *Acer rubrum* (red maple) or *Liriodendron* (tuliptree) may indicate a past disturbance history. A wide variety of more mesic associates, such as *Betula alleghaniensis* (yellow birch), *Betula lenta* (sweet birch), *Fagus grandifolia* (American beech), *Fraxinus americana* (white ash), and *Tilia americana* (American basswood) could occur but are negligible in dominance. In addition to *Acer saccharum* (sugar maple) reproduction, some understory species may include *Carpinus caroliniana* (American hornbeam), *Cercis canadensis* (eastern redbud), *Cornus florida* (flowering dogwood), and *Ostrya virginiana* (hophornbeam). Shrub and vine species include *Amelanchier laevis* (Allegheny serviceberry), *Amelanchier arborea* (common serviceberry), *Cornus* (dogwood) spp., *Hamamelis virginiana* (American witch-hazel), *Lindera benzoin* (northern spicebush), *Viburnum acerifolium* (mapleleaf viburnum), *Viburnum recognitum* (smooth arrow-wood), and *Vitis riparia* (riverbank grape). Ericaceous shrubs, such as *Kalmia latifolia* (mountain laurel), *Vaccinium angustifolium* (lowbush blueberry) and *Vaccinium pallidum* (Blue Ridge blueberry), may also be present but are not abundant. The ground layer species are highly variable but include *Caulophyllum thalictroides* (blue cohosh), *Ageratina altissima* (white snakeroot), *Dennstaedtia punctilobula* (eastern hayscented fern), *Podophyllum peltatum* (mayapple), *Maianthemum racemosum* (feathery false lily of the valley), *Medeola virginiana* (Indian cucumber), *Thelypteris noveboracensis* (New York fern), *Dryopteris marginalis* (marginal woodfern), *Dryopteris intermedia* (intermediate woodfern), *Actaea* (baneberry) spp., and *Uvularia sessilifolia* (sessileleaf bellwort). Exotic species, including *Rosa multiflora* (multiflora rose) and *Alliaria petiolata* (garlic mustard), may be present in the shrub and herb layers of disturbed stands.

Environmental Description: Throughout the range, stands are typically found in coves, on moist north- and east-facing slopes, and on well-drained flats. Soils are slightly acidic and of intermediate fertility (Anderson 1982, Reschke 1990, Fike 1999). In the Catoctin Mountains of Maryland, sites occupied by this community are often covered by bouldery colluvium weathered from metabasalt bedrock. Soils collected from these sites are strongly acidic (mean pH = 4.8) but have moderately high calcium and magnesium levels, typical of soils weathered from iron- and aluminum-rich mafic bedrock.

Vegetation Description: Stands of this red oak - sugar maple forest contain a closed-canopy tree layer. *Acer saccharum* (sugar maple), *Liriodendron tulipifera* (tuliptree), *Quercus alba* (white oak), and *Quercus rubra* (northern red oak) are the leading dominants. *Acer rubrum* (red

maple), *Carya ovata* (shagbark hickory), *Carya alba* (mockernut hickory), *Nyssa sylvatica* (blackgum), and *Quercus velutina* (black oak) are associates on various sites. *Liriodendron tulipifera* (tuliptree) dominance may indicate a past disturbance history, and *Carya* (hickory) spp. may share dominance in some stands. A wide variety of more mesic associates, such as *Betula alleghaniensis* (yellow birch), *Betula lenta* (sweet birch), *Fagus grandifolia* (American beech), and *Fraxinus americana* (white ash), may occur but are negligible in dominance. In addition to *Acer saccharum* (sugar maple) reproduction, understory species may include *Carpinus caroliniana* (American hornbeam), *Cercis canadensis* (eastern redbud), and *Ostrya virginiana* (hophornbeam). Shrub and vine species include *Amelanchier laevis* (Allegheny serviceberry), *Amelanchier arborea* (common serviceberry), *Cornus* (dogwood) spp., *Hamamelis virginiana* (American witch-hazel), *Lindera benzoin* (northern spicebush), *Viburnum acerifolium* (mapleleaf viburnum), *Viburnum recognitum* (smooth arrow-wood), and *Vitis riparia* (riverbank grape). Ericaceous shrubs such as *Kalmia latifolia* (mountain laurel), *Vaccinium angustifolium* (lowbush blueberry) and *Vaccinium pallidum* (Blue Ridge blueberry) may also be present. The ground layer species are highly variable but include *Caulophyllum thalictroides* (blue cohosh), *Dennstaedtia punctilobula* (eastern hayscented fern), *Podophyllum peltatum* (mayapple), *Maianthemum racemosum* (feathery false lily of the valley), *Medeola virginiana* (Indian cucumber), *Thelypteris noveboracensis* (New York fern), and *Uvularia sessilifolia* (sessileleaf bellwort). At the southern end of the type's range in the Catoctin Mountains of Maryland, *Liriodendron tulipifera* (tuliptree) and *Quercus rubra* (northern red oak) are the leading overstory dominants, with *Acer saccharum* (sugar maple) common in both the overstory and understory. Minor tree associates include *Fraxinus americana* (white ash), *Tilia americana* (American basswood), *Quercus alba* (white oak), *Betula lenta* (sweet birch), *Fagus grandifolia* (American beech), and *Acer rubrum* (red maple). *Lindera benzoin* (northern spicebush) and *Hamamelis virginiana* (American witch-hazel) are the most constant and abundant species in a rather open shrub layer. The most constant herbs in eight plot samples are *Arisaema triphyllum* (Jack in the pulpit), *Brachyelytrum erectum* (bearded shorthusk), *Carex digitalis* (slender woodland sedge), *Erythronium americanum* (dogtooth violet), *Eurybia divaricata* (white wood aster), *Galium triflorum* (fragrant bedstraw), *Pilea pumila* (Canadian clearweed), *Polystichum acrostichoides* (Christmas fern), *Thalictrum thalictroides* (rue-anemone), *Uvularia sessilifolia* (sessileleaf bellwort), *Viola pubescens* (downy yellow violet), and *Viola sororia* (common blue violet). Many other species occur at lower constancies.

Most Abundant Species:

Stratum	Lifeform	Species
Tree (canopy & subcanopy)	Broad-leaved deciduous tree	*Acer rubrum* (red maple), *Acer saccharum* (sugar maple)
Tree canopy	Broad-leaved deciduous tree	*Quercus alba* (white oak), *Quercus rubra* (northern red oak)
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Viburnum acerifolium* (mapleleaf viburnum)
Short shrub/sapling	Broad-leaved deciduous shrub	*Vaccinium pallidum* (Blue Ridge blueberry)
Herb (field)	Forb	*Podophyllum peltatum* (mayapple)
Herb (field)	Fern or fern ally	*Dennstaedtia punctilobula* (eastern hayscented fern)

Characteristic Species: *Acer saccharum* (sugar maple), *Carex pensylvanica* (Pennsylvania sedge), *Carpinus caroliniana* (American hornbeam), *Caulophyllum thalictroides* (blue cohosh), *Liriodendron tulipifera* (tuliptree), *Vaccinium angustifolium* (lowbush blueberry), *Vaccinium pallidum* (Blue Ridge blueberry).

Other Noteworthy Species: Information not available.

USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: This red oak - sugar maple community is found primarily in the Allegheny Plateau and Appalachian Mountain regions of the United States, with possible extensions east and west of those areas, ranging from southeastern New York and New Jersey to Pennsylvania, Maryland, West Virginia, and southeastern Ohio.

States/Provinces: CT, MD, NJ, NY, OH, PA, WV?

Federal Lands: NPS (Allegheny Portage Railroad, Catoctin Mountain, Delaware Water Gap, Fort Necessity, Friendship Hill, Upper Delaware); USFS (Wayne); USFWS (Erie)

CONSERVATION STATUS

Rank: G4? (2-Oct-2006)

Reasons: This community is reported as a matrix or large-patch type in every ecoregion where it occurs. Despite covering large areas, high-quality stands are probably rare because of widespread historical impacts and ongoing susceptibility to exotics weeds.

CLASSIFICATION INFORMATION

Status: Standard

Confidence: 2 - Moderate

Comments: According to Anderson (1982) in Ohio, where this community is found in the southeastern unglaciated plateau region, it is differentiated from the oak-maple type, *Quercus alba - Quercus rubra - Quercus prinus - Acer saccharum / Lindera benzoin* Forest (CEGL002059), and the Appalachian oak forest type, *Quercus prinus - Quercus (alba, coccinea, velutina) / Viburnum acerifolium - (Kalmia latifolia)* Forest (CEGL005023), by the substantial presence (over 20% canopy or basal area) of *Liriodendron tulipifera* (tuliptree) and insignificant amounts of *Fagus grandifolia* (American beech) or other mesic tree species. This type concept may overlap considerably with that of the oak-maple type, *Quercus alba - Quercus rubra - Quercus prinus - Acer saccharum / Lindera benzoin* Forest (CEGL002059). Braun (1950, e.g., p. 140) reports stands similar to this type in the Shawnee Hills and Mammoth Cave area of Kentucky, as well as other Interior Low Plateau sites. In New York, this type is reported primarily from the southeastern part of the State (Reschke 1990). In the mid-Atlantic states, this type is differentiated from *Quercus (alba, rubra, velutina) / Cornus florida / Viburnum acerifolium* Forest (CEGL006336) by somewhat more mesic conditions, a higher non-oak canopy component, and the absence of *Quercus prinus* (chestnut oak).

Similar Associations:

- *Fagus grandifolia - Quercus alba - Quercus rubra* Forest (CEGL006377)
- *Quercus alba - (Quercus rubra, Acer saccharum, Fagus grandifolia) / Aesculus flava* Forest (CEGL007233)--is a related type to the south and west.
- *Quercus alba - Quercus rubra - Quercus prinus - Acer saccharum / Lindera benzoin* Forest (CEGL002059)
- *Quercus prinus - Quercus (alba, coccinea, velutina) / Viburnum acerifolium - (Kalmia latifolia)* Forest (CEGL005023)
- *Quercus rubra - Acer saccharum - Tilia americana var. heterophylla - Aesculus flava - (Cladrastis kentukea)* Forest (CEGL007698)
- *Quercus rubra - Acer saccharum / Ostrya virginiana / Cardamine concatenata* Forest (CEGL008517)--related vegetation occurring on calcareous substrates at low elevations in the Ridge and Valley province of Virginia and Maryland.

- *Quercus rubra - Tsuga canadensis - Liriodendron tulipifera / Hamamelis virginiana* Forest (CEGL006566)

Related Concepts:

- Dry-Mesic Inland Mixed Oak Forest, mixed oak-hardwood type (Breden 1989) ?

SOURCES

Description Authors: D. Faber-Langendoen, mod. E. Largay, S.C. Gawler, G.P. Fleming

References: Anderson 1982, Braun 1950, Breden 1989, Breden et al. 2001, Eastern Ecology Working Group n.d., Fike 1999, Fleming 1999, Lundgren 2001, Metzler and Barrett 2001, Reschke 1990

Figure F-19. High Allegheny Rich Red Oak - Sugar Maple Forest (plot ROVA.46). 09/24/2003. NAD 1983 / UTM-18 easting 587839, northing 4627993.

Local Name: Mesic Sugar Maple - Ash - Oak - Hickory Forest (CEGL006046)

SYNONYMS

USNVC English Name: **Sugar Maple - Northern Red Oak / Round-lobe Liverleaf Forest**

USNVC Scientific Name: ***Acer saccharum* - *Quercus rubra* / *Hepatica nobilis* var. *obtusa* Forest**

USNVC Identifier: **CEGL006046**

LOCAL INFORMATION

Environmental Description: This closed canopy transition forest is located on moderately to very stony substrates. Soils are varied forms of loamy soils and also silty clays. The underlying bedrock is Ordovician, shale and siltstone with minor amounts of sandstone from the Austin Glen formation. Adjacent upland communities include Hemlock-Northern Hardwood Forest (CEGL006109), Successional Tree-of-Heaven Forest (CEGL007191), Hemlock - Beech - Oak Forest (CEGL006088), High Allegheny Rich Red Oak - Sugar Maple Forest (CEGL006125). Adjacent wetland communities include Southern New England / Northern Piedmont Red Maple Seepage Swamp (CEGL006406).

Vegetation Description: The tree canopy averages 74.3% cover and 22.2 meters in height. The canopy and subcanopy of this early-successional forest is dominated by *Quercus rubra* (northern red oak), *Quercus alba* (white oak), *Quercus coccinea* (scarlet oak), *Acer saccharum* (sugar maple), *Fraxinus americana* (white ash), *Carya glabra* (pignut hickory), *Carya ovata* (shagbark hickory), and *Quercus prinus* (chestnut oak). The subcanopy averages 51.4% cover and 15.5 meters in height. The subcanopy is characterized by *Acer saccharum* (sugar maple), *Ostrya virginiana* (hophornbeam), and *Ulmus americana* (American elm). The tall shrub cover averages 18.9% and 3.1 meters in height and is characterized by *Ostrya virginiana* (hophornbeam) and *Hamamelis virginiana* (American witchhazel). The short shrub layer averages 22. 1% cover and characteristic species include *Viburnum acerifolium* (mapleleaf viburnum), *Acer saccharum* (sugar maple), *Ostrya virginiana* (hophornbeam), and *Hamamelis virginiana* (American witchhazel). The herbaceous layer averages 19.7% cover and is characterized by *Dryopteris marginalis* (marginal woodfern), *Ageratina altissima* (white snakeroot), *Carex pensylvanica* (Pennsylvania sedge), *Alliaria petiolata* (garlic mustard), *Desmodium nudiflorum* (nakedflower ticktrefoil), *Polystichum acrostichoides* (Christmas fern), and *Eurybia divaricata* (white wood aster).

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy/subcanopy	Broad-leaved deciduous tree	*Quercus rubra* (northern red oak) *Quercus alba* (white oak) *Acer saccharum* (sugar maple)
Tall shrub/sapling	Broad-leaved deciduous shrub	*Ostrya virginiana* (hophornbeam) *Hamamelis virginiana* (American witchhazel)
Herb (field)	Graminoid	*Carex pensylvanica* (Pennsylvania sedge)
Herb (field)	Forb	*Alliaria petiolata* (Garlic mustard), *Desmodium nudiflorum*

		(nakedflower ticktrefoil), *Eurybia divaricata* (white wood aster)
Herb (field)	Fern or fern ally	*Polystichum acrostichoides* (Christmas fern)

Characteristic Species: *Quercus rubra* (northern red oak), *Quercus alba* (white oak), *Carya glabra* (pignut hickory), *Carya ovata* (shagbark hickory), *Ostrya virginiana* (hophornbeam), *Hamamelis virginiana* (American witchhazel), *Viburnum acerifolium* (mapleleaf viburnum), and *Carex pensylvanica* (Pennsylvania sedge).
Other Noteworthy Species: None.
Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
NY	S4*	I	1	Appalachian Oak-Hickory Forest	Edinger et al. 2002

Local Range: This association is present within units Home of Franklin D. Roosevelt NHS (excluding Roosevelt Farm and Forest) and Vanderbilt Mansion NHS, and could be present elsewhere in the park.
Classification Comments: This association was used exclusively to classify Appalachian oak-hickory forests with a combination of canopy species *Acer saccharum* (sugar maple), *Fraxinus americana* (white ash), *Quercus* spp. (oak), and *Carya* spp. (hickory), and a semi-rich understory.
Other Comments: None.
Local Description Authors: Frederick C. Sechler, Jr.
Plots: Home of Franklin D. Roosevelt NHS (excluding Roosevelt Farm and Forest) (ROVA.9)
AA Points: Home of Franklin D. Roosevelt NHS (excluding Roosevelt Farm and Forest) (ROVA.45, ROVA.65, ROVA.84, ROVA.85, ROVA.86), Vanderbilt Mansion NHS (ROVA.24).
Roosevelt-Vanderbilt National Historic Site Inventory Notes: None.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Class	Forest and Woodland (1)
Subclass	Temperate Forest (1.C)
Formation	Cool Temperate Forest (1.C.2)
Division	Eastern North American Cool Temperate Forest (D008)
Macrogroup	Northern Mesic Hardwood and Conifer Forest (M014)
Group	Northern Hardwood – Hemlock - White Pine Forest Group (G163)
Alliance*	*Quercus rubra - (Acer saccharum)* Forest Alliance (A.251)
Alliance (English name)*	Northern Red Oak - (Sugar Maple) Forest Alliance
Association	*Acer saccharum - Quercus rubra / Hepatica nobilis* var. *obtusa* Forest
Association (English name)	Sugar Maple - Northern Red Oak / Round-lobe Liverleaf Forest
Ecological System(s)	Appalachian (Hemlock)-Northern Hardwood Forest (CES202.593)

* Alliance assignment as of 2007. All USNVC alliances are currently (2014) under review and revision.

GLOBAL DESCRIPTION

Concept Summary: These are forests of well-drained to moist and often on very rocky slopes. *Fraxinus americana* (white ash) and *Acer saccharum* (sugar maple) are common in the tree canopy, with *Quercus rubra* (northern red oak), *Carya ovata* (shagbark hickory), *Carya glabra* (pignut hickory), *Carya ovalis* (red hickory), *Quercus velutina* (black oak), *Tilia americana* (American basswood), *Betula lenta* (sweet birch), and *Quercus alba* (white oak) as associates. *Tsuga canadensis* (eastern hemlock) can be occasional. *Ostrya virginiana* (hophornbeam) and

Carpinus caroliniana (American hornbeam) can form a prominent subcanopy. The shrub layer includes *Hamamelis virginiana* (American witch-hazel), *Viburnum acerifolium* (mapleleaf viburnum), *Viburnum recognitum* (smooth arrow-wood), *Cornus florida* (flowering dogwood), *Corylus cornuta* (beaked hazelnut), and *Lindera benzoin* (northern spicebush). The herb layer is often quite diverse with *Carex platyphylla* (broadleaf sedge), *Carex pedunculata* (longstalk sedge), *Carex blanda* (eastern woodland sedge), *Carex laxiflora* (broad looseflower sedge), *Actaea rubra* (red baneberry), *Polygonatum pubescens* (hairy Solomon's seal), *Phegopteris hexagonoptera* (broad beechfern), *Viola rotundifolia* (roundleaf yellow violet), *Thalictrum dioicum* (early meadowrue), *Hepatica nobilis* var. *obtusa* (roundlobe hepatica), *Thalictrum thalictroides* (rue-anemone), *Festuca subverticillata* (nodding fescue), *Actaea pachypoda* (white baneberry), *Viola sororia* (common blue violet), *Arabis* (rockcress) spp., *Packera obovata* (roundleaf ragwort), and *Arisaema triphyllum* (Jack in the pulpit).

Environmental Description: These are forests of well-drained to moist and often on very rocky slopes.

Vegetation Description: *Fraxinus americana* (white ash) and *Acer saccharum* (sugar maple) are common in the tree canopy, with *Quercus rubra* (northern red oak), *Carya ovata* (shagbark hickory), *Carya glabra* (pignut hickory), *Carya ovalis* (red hickory), *Quercus velutina* (black oak), *Tilia americana* (American basswood), *Betula lenta* (sweet birch), and *Quercus alba* (white oak) as associates. *Tsuga canadensis* (eastern hemlock) can be occasional. *Ostrya virginiana* (hophornbeam) and *Carpinus caroliniana* (American hornbeam) can form a prominent subcanopy. The shrub layer includes *Hamamelis virginiana* (American witch-hazel), *Viburnum acerifolium* (mapleleaf viburnum), *Viburnum recognitum* (smooth arrow-wood), *Cornus florida* (flowering dogwood), *Corylus cornuta* (beaked hazelnut), and *Lindera benzoin* (northern spicebush). The herb layer is often quite diverse with *Carex platyphylla* (broadleaf sedge), *Carex pedunculata* (longstalk sedge), *Carex blanda* (eastern woodland sedge), *Carex laxiflora* (broad looseflower sedge), *Actaea rubra* (red baneberry), *Polygonatum pubescens* (hairy Solomon's seal), *Phegopteris hexagonoptera* (broad beechfern), *Viola rotundifolia* (roundleaf yellow violet), *Thalictrum dioicum* (early meadowrue), *Hepatica nobilis* var. *obtusa* (roundlobe hepatica), *Thalictrum thalictroides* (rue-anemone), *Festuca subverticillata* (nodding fescue), *Actaea pachypoda* (white baneberry), *Viola sororia* (common blue violet), *Arabis* (rockcress) spp., *Packera obovata* (roundleaf ragwort), and *Arisaema triphyllum* (Jack in the pulpit).

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Acer saccharum* (sugar maple), *Fraxinus americana* (white ash)
Tree subcanopy	Broad-leaved deciduous tree	*Carpinus caroliniana* (American hornbeam), *Ostrya virginiana* (hophornbeam)
Shrub/sapling (tall & short)	Broad-leaved deciduous tree	*Cornus florida* (flowering dogwood)
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Corylus cornuta* (beaked hazelnut), *Hamamelis virginiana* (American witch-hazel), *Lindera benzoin* (northern spicebush), *Viburnum acerifolium* (mapleleaf viburnum), *Viburnum recognitum* (smooth arrow-wood)

Characteristic Species: *Acer saccharum* (sugar maple), *Arisaema triphyllum* (Jack in the pulpit), *Fraxinus americana* (white ash), *Hepatica nobilis* var. *obtusa* (roundlobe hepatica)

Other Noteworthy Species: Information not available.

USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: Currently described from central and southern New England in Connecticut, Massachusetts, and New Hampshire.
States/Provinces: CT, MA, NH, NY, VT
Federal Lands: NPS (Roosevelt-Vanderbilt, Weir Farm)

CONSERVATION STATUS

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

CLASSIFICATION INFORMATION

Status: Standard
Confidence: 3 - Weak
Comments: Information not available.
Similar Associations:

- *Carya (glabra, ovata)* - *Fraxinus americana* - *Quercus* spp. Forest (CEGL006236)

Related Concepts:

- *Acer saccharum / Hepatica americana* Community (Metzler and Barrett 1996) =
- CNE mesic hardwood forest on acidic bedrock/till (Rawinski 1984) B
- SNE dry rich forest on acidic/circumneutral bedrock or till (Rawinski 1984) ?

SOURCES

Description Authors: Eastern Ecology Group
References: Damman and Kershner 1977, Eastern Ecology Working Group n.d., Metzler and Barrett 1996, Metzler and Barrett 2001, Metzler and Barrett 2004, NRCS 2004, Rawinski 1984, Sperduto 1997a, Swain and Kearsley 2001, Thompson and Sorenson 2000

Figure F-20. Mesic Sugar Maple - Ash - Oak - Hickory Forest (AA point ROVA.85). 09/08/2006. NAD 1983 / UTM-18 easting 587997, northing 4624090.

Local Name: Red Oak - Northern Hardwood Forest (CEGL006173)

SYNONYMS

USNVC English Name: **Northern Red Oak - Sugar Maple - American Beech / Mapleleaf Viburnum Forest**

USNVC Scientific Name: ***Quercus rubra - Acer saccharum - Fagus grandifolia / Viburnum acerifolium Forest***

USNVC Identifier: **CEGL006173**

LOCAL INFORMATION

Environmental Description: This closed canopy transition forest is located on moderately to very stony substrates. Soils are varied forms of loamy soils and silty clays. The underlying bedrock is Ordovician, shale and siltstone with minor amounts of sandstone from the Austin Glen formation. Adjacent upland associations include Hemlock-Northern Hardwood Forest (CEGL006109), Successional Tree-of-Heaven Forest (CEGL007191), Hemlock - Beech - Oak Forest (CEGL006088), and High Allegheny Rich Red Oak - Sugar Maple Forest (CEGL006125). Adjacent wetland associations include Southern New England / Northern Piedmont Red Maple Seepage Swamp (CEGL006406).

Vegetation Description: The tree canopy averages 67.3% cover and 28 meters in height. Characteristic species include *Quercus rubra* (northern red oak), *Quercus alba* (white oak), *Acer saccharum* (sugar maple), *Quercus prinus* (chestnut oak), *Betula lenta* (sweet birch), *Quercus coccinea* (scarlet oak), *Tsuga canadensis* (eastern hemlock), and *Fagus grandifolia* (American beech). The tree subcanopy averages 50.9% cover and 15.6 meters in height and is characterized by species found in the canopy plus *Ostrya virginiana* (hophornbeam). The tall shrub layer averages 24.1% cover and 4.2 meters in height. The most abundant species include *Hamamelis virginiana* (American witchhazel), *Ostrya virginiana* (hophornbeam) and *Acer saccharum* (sugar maple). The relatively sparse short shrub layer averages 20.6% cover and is characterized by *Viburnum acerifolium* (mapleleaf viburnum), *Ostrya virginiana* (hophornbeam) and *Hamamelis virginiana* (American witchhazel). The sparse herbaceous layer averages 12.1% cover and is dominated by *Alliaria petiolata* (garlic mustard), *Polystichum acrostichoides* (Christmas fern), *Carex pensylvanica* (Pennsylvania sedge), and *Eurybia divaricata* (white wood aster).

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Quercus rubra* (northern red oak), *Quercus alba* (white oak), *Acer saccharum* (sugar maple)
Tree subcanopy	Broad-leaved deciduous tree	*Ostrya virginiana* (hophornbeam)
Tall shrub/sapling	Broad-leaved deciduous shrub	*Hamamelis virginiana* (American witchhazel)
Short shrub/sapling	Broad-leaved deciduous shrub	*Viburnum acerifolium* (mapleleaf viburnum)
Herb (field)	Graminoid	*Carex pensylvanica* (Pennsylvania sedge)
Herb (field)	Forb	*Alliaria petiolata* (garlic mustard)
Herb (field)	Fern and fern ally	*Polystichum acrostichoides* (Christmas fern)

Characteristic Species: *Quercus rubra* (northern red oak), *Acer saccharum* (sugar maple), and *Viburnum acerifolium* (mapleleaf viburnum)
Other Noteworthy Species: None.
Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
NY	S4*	B	1	Beech-Maple Mesic Forest	Edinger et al. 2002

Local Range: This association is very common at Home of Franklin D. Roosevelt NHS (including Roosevelt Farm and Forest), and present at Val-Kill. This type was not documented at Vanderbilt Mansion NHS, but it is possible it may occur there.
Classification Comments: This association was used to classify beech-maple mesic forests with a significant amount of *Quercus* spp. (oak) in the canopy/subcanopy layers.
Other Comments: None.
Local Description Authors: Frederick C. Sechler, Jr.
Plots: Home of Franklin D. Roosevelt (ROVA.22, ROVA.24, ROVA.82), Roosevelt Farm and Forest (ROVA.111, ROVA.123, ROVA.145, ROVA.147).
AA Points: Roosevelt Farm and Forest (ROVA.157, ROVA.169, ROVA.180, ROVA.214, ROVA.216), Home of Franklin D. Roosevelt NHS (excluding Roosevelt Farm and Forest (ROVA.64, ROVA.78, ROVA.79, ROVA.80, ROVA.81), Val-Kill (ROVA.113).
Roosevelt-Vanderbilt National Historic Site Inventory Notes: None.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Class	Forest and Woodland (1)
Subclass	Temperate Forest (1.C)
Formation	Cool Temperate Forest (1.C.2)
Division	Eastern North American Cool Temperate Forest (D008)
Macrogroup	Northern Mesic Hardwood and Conifer Forest (M014)
Group	Northern Hardwood – Hemlock - White Pine Forest Group (G163)
Alliance*	*Quercus rubra - (Acer saccharum)* Forest Alliance (A.251)
Alliance (English name)*	Northern Red Oak - (Sugar Maple) Forest Alliance
Association	*Quercus rubra - Acer saccharum - Fagus grandifolia / Viburnum acerifolium* Forest
Association (English name)	Northern Red Oak - Sugar Maple - American Beech / Mapleleaf Viburnum Forest
Ecological System(s)	Laurentian-Acadian Pine-Hemlock-Hardwood Forest (CES201.563) Appalachian (Hemlock)-Northern Hardwood Forest (CES202.593)

* Alliance assignment as of 2007. All USNVC alliances are currently (2014) under review and revision.

GLOBAL DESCRIPTION

Concept Summary: Transitional between temperate and boreal regions, these mesic forests of oak and northern hardwoods, sometimes mixed with hemlock or pine, are distributed across the glaciated northeastern United States. They occur on slightly acidic, well-drained loamy and often rocky soils of intermediate fertility, most often positioned on midslopes and coves. Soil depth is often shallow, but some stands occur on deep tills. Most are at low to mid elevations, usually under 520 m (1700 feet), but in the southern portion of their distribution they may range up to 765 m (2500 feet). The deciduous-to-mixed canopy is mostly closed, and the lower layers are variable in extent. Tall shrubs are well-represented, although scattered, with occasional denser patches. Herbs are sparse and bryoids are nearly absent. Ericads and other dwarf-shrubs are also nearly absent, a characteristic that distinguishes this association from most other red oak forests in the Northeast. Canopy composition is a variable mixture of *Quercus rubra* (northern red oak)

(usually at least 30% of the canopy), *Fagus grandifolia* (American beech), *Acer saccharum* (sugar maple), *Acer rubrum* (red maple), and in some stands *Pinus strobus* (eastern white pine) or *Tsuga canadensis* (eastern hemlock). Conifers generally make up less than 20% of the canopy cover, and even in mixed stands the cover of deciduous trees exceeds that of conifers. Minor canopy associates include *Fraxinus americana* (white ash), *Tilia americana* (American basswood), *Betula lenta* (sweet birch), *Juglans cinerea* (butternut), and *Ulmus americana* (American elm). *Acer pensylvanicum* (striped maple) is common as a small tree; in the central and southern portions of the distribution, *Cornus florida* (flowering dogwood) and *Prunus serotina* (black cherry) are common small trees as well. *Corylus cornuta* (beaked hazelnut), *Viburnum acerifolium* (mapleleaf viburnum), and *Hamamelis virginiana* (American witch-hazel) are standard shrubs, with *Kalmia latifolia* (mountain laurel) and *Lindera benzoin* (northern spicebush) occasional in all but the northern portions of the range. Typical species in the herb layer include *Gaultheria procumbens* (eastern teaberry), *Maianthemum canadense* (Canada mayflower), *Aralia nudicaulis* (wild sarsaparilla), *Trientalis borealis* (starflower), *Uvularia sessilifolia* (sessileleaf bellwort), *Medeola virginiana* (Indian cucumber), *Brachyelytrum erectum* (bearded shorthusk), *Dryopteris intermedia* (intermediate woodfern), *Polystichum acrostichoides* (Christmas fern), *Dennstaedtia punctilobula* (eastern hayscented fern), *Pteridium aquilinum* (western brackenfern), and *Thelypteris noveboracensis* (New York fern). On more nutrient-rich soils, the herb layer may contain *Solidago caesia* (wreath goldenrod), *Caulophyllum thalictroides* (blue cohosh), *Dryopteris marginalis* (marginal woodfern), and *Eurybia divaricata* (white wood aster). This association is distinguished from northern hardwood forests by its greater amount of oak, from other oak forests by its greater prominence of northern hardwoods and lack of dwarf-shrub ericads, and from hemlock-hardwoods by the relatively low importance of hemlock.

Environmental Description: Transitional between temperate and boreal regions, these mesic forests of oak, beech, and maple are distributed across the glaciated northeastern United States. They occur on slightly acidic, well-drained loamy and often rocky soils of intermediate fertility, most often positioned on mid-slopes and coves. Soil depth is often shallow, but some occur on deep tills. Most are at low to mid elevations, usually under 520 m (1700 feet), but in the southern portion of their distribution they may range up to 760 m (2500 feet).

Vegetation Description: The deciduous-to-mixed canopy is mostly closed, and the lower layers are variable in extent. Tall shrubs are well represented, although scattered, with occasional denser patches. Herbs are sparse, and bryoids are nearly absent. Ericads and other dwarf-shrubs are also nearly absent, a characteristic that distinguishes this association from most other red oak forests in the Northeast. Canopy composition is a variable mixture of *Quercus rubra* (northern red oak) (usually at least 30% of the canopy), *Fagus grandifolia* (American beech), *Acer saccharum* (sugar maple), *Acer rubrum* (red maple), and, in some stands, *Pinus strobus* (eastern white pine) or *Tsuga canadensis* (eastern hemlock). In mixed stands, the cover of deciduous trees exceeds that of conifers. Minor canopy associates include *Fraxinus americana* (white ash), *Tilia americana* (American basswood), *Betula lenta* (sweet birch), *Juglans cinerea* (butternut), and *Ulmus americana* (American elm). *Acer pensylvanicum* (striped maple) is common as a small tree; in the central and southern portions of the distribution, *Cornus florida* (flowering dogwood) and *Prunus serotina* (black cherry) are common small trees as well. *Corylus cornuta* (beaked hazelnut), *Viburnum acerifolium* (mapleleaf viburnum), and *Hamamelis virginiana* (American witch-hazel) are standard shrubs, with *Kalmia latifolia* (mountain laurel) and *Lindera benzoin* (northern spicebush) occasional in all but the northern portions of the range. Typical species in

the herb layer include *Gaultheria procumbens* (eastern teaberry), *Maianthemum canadense* (Canada mayflower), *Aralia nudicaulis* (wild sarsaparilla), *Trientalis borealis* (starflower), *Uvularia sessilifolia* (sessileleaf bellwort), *Medeola virginiana* (Indian cucumber), *Brachyelytrum erectum* (bearded shorthusk), *Dryopteris intermedia* (intermediate woodfern), *Polystichum acrostichoides* (Christmas fern), *Dennstaedtia punctilobula* (eastern hayscented fern), *Pteridium aquilinum* (western brackenfern), and *Thelypteris noveboracensis* (New York fern). On more nutrient-rich soils, the herb layer may contain *Solidago caesia* (wreath goldenrod), *Caulophyllum thalictroides* (blue cohosh), and *Eurybia divaricata* (white wood aster).

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Acer saccharum* (sugar maple), *Fagus grandifolia* (American beech), *Quercus rubra* (northern red oak)
Tree subcanopy	Broad-leaved deciduous tree	*Acer pensylvanicum* (striped maple), *Cornus florida* (flowering dogwood), *Prunus serotina* (black cherry)
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Corylus cornuta* (beaked hazelnut), *Hamamelis virginiana* (American witch-hazel), *Viburnum acerifolium* (mapleleaf viburnum)
Herb (field)	Forb	*Aralia nudicaulis* (wild sarsaparilla), *Trientalis borealis* (starflower)
Herb (field)	Fern or fern ally	*Dennstaedtia punctilobula* (eastern hayscented fern)

Characteristic Species: *Acer pensylvanicum* (striped maple), *Acer rubrum* (red maple), *Aralia nudicaulis* (wild sarsaparilla), *Cornus florida* (flowering dogwood), *Corylus cornuta* (beaked hazelnut), *Dennstaedtia punctilobula* (eastern hayscented fern), *Hamamelis virginiana* (American witch-hazel), *Polystichum acrostichoides* (Christmas fern), *Prunus serotina* (black cherry), *Pteridium aquilinum* (western brackenfern), *Quercus rubra* (northern red oak), *Trientalis borealis* (starflower), *Viburnum acerifolium* (mapleleaf viburnum)
Other Noteworthy Species: Information not available.
USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: This association occurs in New England and adjacent Canada and in New Jersey.
States/Provinces: MA, ME:S4, NB, NH, NJ, NY, PA, RI, VT:S4
Federal Lands: NPS (Marsh-Billings-Rockefeller, Minute Man, Roosevelt-Vanderbilt); USFS (Finger Lakes); USFWS (Iroquois)

CONSERVATION STATUS

Rank: G4G5 (7-Dec-2005)
Reasons: This association is well-distributed in the northeastern U.S. in its large-patch setting.

CLASSIFICATION INFORMATION

Status: Standard
Confidence: 2 - Moderate
Comments: Information not available.
Similar Associations:

- *Acer saccharum - Betula alleghaniensis - Fagus grandifolia / Viburnum lantanoides* Forest (CEGL006252)

- *Acer saccharum - Betula alleghaniensis - Quercus rubra / Viburnum acerifolium* Forest (CEGL006943)
- *Acer saccharum - Pinus strobus / Acer pensylvanicum* Forest (CEGL005005)
- *Pinus strobus - Quercus (rubra, velutina) - Fagus grandifolia* Forest (CEGL006293)
- *Quercus rubra - Acer rubrum - Betula* spp. - *Pinus strobus* Forest (CEGL006506)
- *Quercus rubra - Acer saccharum - Tilia americana var. heterophylla - Aesculus flava - (Cladrastis kentukea)* Forest (CEGL007698)
- *Quercus rubra - Acer saccharum* Forest (CEGL002461)
- *Quercus rubra - Quercus alba - (Quercus velutina, Acer rubrum) / Viburnum acerifolium* Forest (CEGL002462)
- *Tsuga canadensis - Betula alleghaniensis - Acer saccharum / Dryopteris intermedia* Forest (CEGL006109)
- *Tsuga canadensis - Fagus grandifolia - Quercus rubra* Forest (CEGL006088)

Related Concepts:

- CNE mesic hardwood forest on acidic bedrock/till (Rawinski 1984) B
- Mesic Red Oak-Northern Hardwood Forest (Thompson 1996) ?
- Northern Red Oak: 55 (Eyre 1980) B

SOURCES

Description Authors: S.C. Gawler

References: Breden et al. 2001, Eastern Ecology Working Group n.d., Edinger et al. 2002, Eyre 1980, Gawler 2002, Metzler and Barrett 2001, NRCS 2004, Rawinski 1984, Sperduto 2000a, Swain and Kearsley 2001, Thompson 1996, Thompson and Sorenson 2000

Figure F-21. Red Oak - Northern Hardwood Forest (plot ROVA.111). 07/04/2007. NAD 1983 / UTM-18 easting 590403, northing 4624144.

Local Name: Semi-rich Northern Hardwood Forest (CEGL006211)

SYNONYMS

USNVC English Name: **Sugar Maple - (White Ash) / Jack-in-the-Pulpit Forest**
USNVC Scientific Name: ***Acer saccharum* - (*Fraxinus americana*) / *Arisaema triphyllum* Forest**
USNVC Identifier: **CEGL006211**

LOCAL INFORMATION

Environmental Description: This forest occurs at elevations ranging from 40 to 122 m (130-400 feet) on the slopes of narrow ravines, on level high ground, and on gently sloping hills. Soils are moderately deep to very deep, well-drained to very poorly drained channery silt loams, silt loams, and mucky silty clay loams with an underlying bedrock of Ordovician shale and siltstone with minor amounts of sandstone, Austin Glen Formation. Adjacent associations include Eastern White Pine Successional Forest (CEGL007944), Dry, Rich Oak - Hickory Forest (CEGL006236), Hemlock - Beech - Oak Forest (CEGL006088), White Pine - Hemlock Dry-Mesic Coniferous Forest (CEGL006328), Northeastern Old Field (CEGL006107), and Eastern Cattail Marsh (CEGL006153).

Vegetation Description: The closed tree canopy averages 70.8% cover and 27.2 meters in height. This layer is characterized by *Acer saccharum* (sugar maple), plus associated hardwood species that include *Fraxinus americana* (white ash), *Fagus grandifolia* (American beech), *Tilia americana* (American basswood), *Quercus alba* (white oak), and *Quercus coccinea* (scarlet oak). The tree canopy averages 38.7% cover and 15.2 meters in height and is strongly dominated by *Acer saccharum* (sugar maple), with *Fraxinus americana* (white ash) being co-dominant in certain areas. Other canopy associates include *Tilia americana* (American basswood), *Quercus alba* (white oak), *Acer rubrum* (red maple) and *Fagus grandifolia* (American beech). The tree subcanopy has averages 37.3% cover and is characterized by *Acer saccharum* (sugar maple), *Ostrya virginiana* (hophornbeam), and *Fagus grandifolia* (American beech). The tall shrub layer averages 12.1% cover and 3.5 meters in height and is characterized by *Hamamelis virginiana* (American witchhazel), *Acer saccharum* (sugar maple), *Fagus grandifolia* (American beech), and *Amelanchier arborea* (common serviceberry). The short shrub layer averages 34.6% cover and is characterized by *Acer saccharum* (sugar maple), *Lindera benzoin* (northern spicebush), *Berberis thunbergii* (Japanese barberry), and *Viburnum acerifolium* (mapleleaf viburnum). The vine layer averages 4.1% cover and is dominated by *Parthenocissus quinquefolia* (Virginia creeper) and *Toxicodendron radicans* (eastern poison ivy). The relatively sparse herbaceous layer averages 20.6% cover and is characterized by *Polystichum acrostichoides* (Christmas fern), *Maianthemum canadense* (Canada mayflower), *Amphicarpaea bracteata* (American hogpeanut), *Alliaria petiolata* (garlic mustard), and *Dennstaedtia punctilobula* (eastern hayscented fern).

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy/subcanopy	Broad-leaved deciduous tree	*Acer saccharum* (sugar maple)
		Fagus grandifolia (American beech)
Tree canopy	Broad-leaved deciduous tree	*Fraxinus americana* (white ash)
Tree subcanopy	Broad-leaved deciduous tree	*Ostrya virginiana* (hophornbeam)
Tall/short shrub/sapling	Broad-leaved deciduous tree	*Acer saccharum* (sugar maple)

Tall shrub/sapling	Broad-leaved deciduous shrub	*Hamamelis virginiana* (American witchhazel), *Fagus grandifolia* (American beech)
Herb (field)	Vine/Liana	*Parthenocissus quinquefolia* (Virginia creeper), *Toxicodendron radicans* (eastern poison ivy)
Herb (field)	Forb	*Maianthemum canadense* (Canada mayflower), *Amphicarpaea bracteata* (American hogpeanut)
Herb (field)	Fern or fern ally	*Polystichum acrostichoides* (Christmas fern)

Characteristic Species: *Acer saccharum* (sugar maple), *Arisaema triphyllum* (Jack in the pulpit), *Fagus grandifolia* (American beech), *Fraxinus americana* (white ash), and *Ostrya virginiana* (hophornbeam).
Other Noteworthy Species: None.
Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
NY	S4	B	1	Beech-Maple Mesic Forest	Edinger et al. 2002

Local Range: This beech-maple mesic forest type was documented in units, Home of Franklin D. Roosevelt NHS (including Roosevelt Farm and Forest), and to a lesser extent, Vanderbilt Mansion NHS.
Classification Comments: This association was used to classify beech-maple mesic forests with a semi-rich understory (i.e., *Polystichum acrostichoides* (Christmas fern), *Arisaema triphyllum* (Jack in the pulpit) and is distinguished from maple-basswood rich mesic forests by the lack of a significant amount of *Tilia americana* (American basswood) and a rich herbaceous layer.
Other Comments: None.
Local Description Authors: Frederick C. Sechler, Jr.
Plots: Roosevelt Farm and Forest (ROVA.91, ROVA.95, and ROVA.127).
AA Points: Home of Franklin D. Roosevelt NHS (excluding Roosevelt Farm and Forest (ROVA.42 ROVA.44), Roosevelt Farm and Forest (ROVA.130, ROVA.142, ROVA.156), Vanderbilt Mansion NHS (ROVA.22).
Roosevelt-Vanderbilt National Historic Site Inventory Notes: None.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Class	Forest and Woodland (1)
Subclass	Temperate Forest (1.C)
Formation	Cool Temperate Forest (1.C.2)
Division	Eastern North American Cool Temperate Forest (D008)
Macrogroup	Northern Mesic Hardwood and Conifer Forest (M014)
Group	Northern Hardwood – Hemlock - White Pine Forest Group (G163)
Alliance*	*Acer saccharum - Fraxinus americana - Tilia americana* Forest Alliance (A.217)
Alliance (English name)*	Sugar Maple - White Ash - American Basswood Forest Alliance
Association	*Acer saccharum - (Fraxinus americana) / Arisaema triphyllum* Forest
Association (English name)	Sugar Maple - (White Ash) / Jack-in-the-Pulpit Forest
Ecological System(s)	Laurentian-Acadian Northern Hardwoods Forest (CES201.564)

* Alliance assignment as of 2007. All USNVC alliances are currently (2014) under review and revision.

GLOBAL DESCRIPTION

Concept Summary: These are northern hardwood forests of slightly enriched soils in the northern Appalachian Mountains and adjacent northeastern United States and Canada. They occur at moderate elevations of 245 to 610 m (800-2000 feet) on slightly enriched soils, often silt loams derived from pelite or other subacidic bedrock. Ridge tops and slight concavities on hillslopes are both typical settings. They may occur as inclusions within typical northern hardwood forests or may occur over larger areas and be the locally dominant northern hardwood forest. The closed-canopy forest has sparse to moderate shrub cover, moderate herb cover, and may have local carpets of *Acer saccharum* (sugar maple) seedlings in the ground vegetation. Bryoids are a minor component of the forest floor. The canopy is dominated by *Acer saccharum* (sugar maple), frequently with *Fraxinus americana* (white ash) as an associate or even canopy codominant. Other associated hardwood species include *Betula alleghaniensis* (yellow birch) and *Betula lenta* (sweet birch). *Fagus grandifolia* (American beech) is often present but less abundant than in matrix northern hardwood forests. *Liriodendron tulipifera* (tuliptree) may occur in southern New England. Conifers are usually sparse. Shrubs can include *Cornus alternifolia* (alternate leaf dogwood), *Lindera benzoin* (northern spicebush), *Sambucus racemosa* (red elderberry), *Acer pensylvanicum* (striped maple), and *Ostrya virginiana* (hophornbeam). Typical herbs of this semi-rich type, which are scarce or absent from standard beech-birch-maple forests, include *Arisaema triphyllum* (Jack in the pulpit), *Viola rotundifolia* (roundleaf yellow violet), *Tiarella cordifolia* (heartleaf foamflower), *Actaea pachypoda* (white baneberry), *Osmunda claytoniana* (interrupted fern), *Osmunda cinnamomea* (cinnamon fern), *Carex laxiculmis* (spreading sedge), *Carex platyphylla* (broadleaf sedge), *Carex pedunculata* (longstalk sedge), *Eurybia divaricata* (white wood aster), *Botrychium* (grapefern) spp., and *Solidago flexicaulis* (zigzag goldenrod). These forests are intermediate in nutrient regime and composition between *Acer saccharum - Fraxinus americana - Tilia americana / Acer spicatum / Caulophyllum thalictroides* Forest (CEGL005008) and *Acer saccharum - Betula alleghaniensis - Fagus grandifolia / Viburnum lantanoides* Forest (CEGL006252). They are more depauperate than other communities of this alliance, for example lacking rich-soil indicators such as *Adiantum pedatum* (northern maidenhair), *Caulophyllum thalictroides* (blue cohosh), and *Tilia americana* (American basswood) that are typical of CEGL005008.

Environmental Description: These are northern hardwood forests of slightly enriched soils in the northern Appalachian Mountains and adjacent northeastern United States and Canada. They occur at moderate elevations of 245 to 610 m (800-2000 feet) on slightly enriched soils, often silt loams derived from pelite or other subacidic bedrock. Ridgetops and slight concavities on hillslopes are both typical settings.

Vegetation Description: The closed-canopy forest has sparse to moderate shrub cover, moderate herb cover, and may have local carpets of *Acer saccharum* (sugar maple) seedlings in the ground vegetation. Bryoids are a minor component of the forest floor. The canopy is dominated by *Acer saccharum* (sugar maple), with associated hardwood species including *Betula alleghaniensis* (yellow birch) and *Fraxinus americana* (white ash). *Fraxinus* (ash) may be a canopy codominant in some areas. *Fagus grandifolia* (American beech) is often present but less abundant than in matrix northern hardwood forests. Conifers are usually sparse. Shrubs can include *Cornus alternifolia* (alternate leaf dogwood), *Sambucus racemosa* (red elderberry), *Acer pensylvanicum* (striped maple), and *Ostrya virginiana* (hophornbeam). Typical herbs of this semi-rich type, which are scarce or absent from standard beech-birch-maple forests, include *Arisaema triphyllum* (Jack in the pulpit), *Viola rotundifolia* (roundleaf yellow violet), *Tiarella*

cordifolia (heartleaf foamflower), *Actaea pachypoda* (white baneberry), *Botrychium* (grapefern) spp., and *Solidago flexicaulis* (zigzag goldenrod).

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Acer saccharum* (sugar maple), *Fraxinus americana* (white ash)
Tree subcanopy	Broad-leaved deciduous tree	*Acer saccharum* (sugar maple)
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Acer pensylvanicum* (striped maple), *Cornus alternifolia* (alternate leaf dogwood), *Ostrya virginiana* (hophornbeam), *Sambucus racemosa* (red elderberry)
Herb (field)	Forb	*Arisaema triphyllum* (Jack in the pulpit)

Characteristic Species: *Acer saccharum* (sugar maple), *Arisaema triphyllum* (Jack in the pulpit)

Other Noteworthy Species: Information not available.

USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: This forest association occurs in New England west to New York and Ontario.

States/Provinces: CT, MA, ME, NB, NH, NY, ON, PA, RI, VT

Federal Lands: NPS (Marsh-Billings-Rockefeller, Saint-Gaudens, Roosevelt-Vanderbilt, Upper Delaware, Weir Farm)

CONSERVATION STATUS

Rank: G4 (7-Dec-2005)

Reasons: This association is fairly well-distributed in northern New England and adjacent Canada.

CLASSIFICATION INFORMATION

Status: Standard

Confidence: 2 - Moderate

Comments: This type is conceptually well understood, but not well documented in published sources. Additional characterization would be helpful.

Similar Associations:

- *Acer saccharum - Betula alleghaniensis - Fagus grandifolia / Viburnum lantanoides* Forest (CEGL006252)
- *Acer saccharum - Fraxinus americana - Tilia americana / Acer spicatum / Caulophyllum thalictroides* Forest (CEGL005008)

Related Concepts:

- Mesic Northern Hardwood Forest (Beech-Birch-Maple Forest)? (Thompson 1996) B
- Semi-rich northern hardwood forest (NAP pers. comm. 1998) ?
- Sugar Maple: 27 (Eyre 1980) B

SOURCES

Description Authors: S.C. Gawler, mod. L.A. Sneddon

References: Eastern Ecology Working Group n.d., Edinger et al. 2002, Eyre 1980, Gawler 2002, Metzler and Barrett 2001, Metzler and Barrett 2004, NAP pers. comm. 1998, NRCS 2004, Sperduto and Nichols 2004, Thompson 1996, Thompson and Sorenson 2000

Figure F-22. Semi-rich Northern Hardwood Forest (plot ROVA.91). 05/23/2007. NAD 1983 / UTM-18 easting 589285, northing 4624930.

Local Name: Sugar Maple - Ash - Basswood Northern Rich Mesic Forest (CEGL005008)

SYNONYMS

USNVC English Name: **Sugar Maple - White Ash - American Basswood / Mountain Maple / Blue Cohosh Forest**

USNVC Scientific Name: ***Acer saccharum - Fraxinus americana - Tilia americana / Acer spicatum / Caulophyllum thalictroides* Forest**

USNVC Identifier: **CEGL005008**

LOCAL INFORMATION

Environmental Description: This enriched forest is situated on nutrient rich soils on rolling terrain within units and Home of Franklin D. Roosevelt NHS (including Roosevelt Farm and Forest). The main associated soils include channery loamy till soils of the Nassau-Cardigan complex, hilly, and very rocky with underlying bedrock of Ordovician shale and siltstone with minor amounts of sandstone, Austin Glen Formation. These soils tend to be somewhat excessively drained. Adjacent associations include Traprock Ridge (CEGL006002), Red Oak - Northern Hardwood Forest (CEGL006173), Southern New England / Northern Piedmont Red Maple Seepage Swamp (CEGL006406), Hemlock - Beech - Oak Forest (CEGL006088), and Semi-rich Northern Hardwood Forest (CEGL006211).

Vegetation Description: This rich sugar maple-basswood forest has a closed canopy with rich indicators in the understory. The tree canopy layer averages 80% cover and 26.3 meters in height. Characteristic species include *Acer saccharum* (sugar maple), *Tilia americana* (American basswood), *Fraxinus americana* (white ash), *Quercus coccinea* (scarlet oak), *Quercus alba* (white oak), and *Fagus grandifolia* (American beech). The tree subcanopy layer averages 33.3% cover and 16.3 meters in height. This layer is characterized by *Acer spicatum* (mountain maple), *Acer saccharum* (sugar maple), *Ulmus americana* (American elm) and *Ostrya virginiana* (hophornbeam). The relatively sparse tall shrub layer averages 19.3% cover and 2.9 meters in height and is characterized by *Acer saccharum* (sugar maple), *Ostrya virginiana* (hophornbeam), and *Tilia americana* (American basswood). The short shrub layer is relatively sparse, averaging 23.7% cover. Characteristic species include saplings and seedlings of *Acer saccharum* (sugar maple), *Hamamelis virginiana* (American witchhazel), *Lindera benzoin* (northern spicebush), *Berberis thunbergii* (Japanese barberry), and *Viburnum acerifolium* (mapleleaf viburnum). The vine layer is sparse and includes *Parthenocissus quinquefolia* (Virginia creeper). The rich, diverse herbaceous layer averages 24% cover and is characterized by *Polystichum acrostichoides* (Christmas fern), *Alliaria petiolata* (garlic mustard), *Caulophyllum thalictroides* (blue cohosh), *Arisaema triphyllum* (Jack in the pulpit), *Dryopteris marginalis* (marginal woodfern), *Allium tricoccum* (wild leek), *Ageratina altissima* (white snakeroot), *Mitella diphylla* (twoleaf miterwort), and *Sanguinaria canadensis* (bloodroot).

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy/subcanopy	Broad-leaved deciduous tree	*Acer saccharum* (sugar maple)
Tree canopy	Broad-leaved deciduous tree	*Tilia americana* (American basswood)
Tree subcanopy	Broad-leaved deciduous tree	*Acer spicatum* (mountain maple)
Tall/short shrub/sapling	Broad-leaved deciduous tree	*Acer saccharum* (sugar maple)

Tall shrub/sapling	Broad-leaved deciduous shrub	*Ostrya virginiana* (hophornbeam)
Short shrub/sapling	Broad-leaved deciduous shrub	*Hamamelis virginiana* (American witchhazel)
Herb (field)	Vine/Liana	*Parthenocissus quinquefolia* (Virginia creeper)
Herb (field)	Forb	*Alliaria petiolata* (garlic mustard), *Caulophyllum thalictroides* (blue cohosh), *Arisaema triphyllum* (Jack in the pulpit)
Herb (field)	Fern or fern ally	*Polystichum acrostichoides* (Christmas fern), *Dryopteris marginalis* (marginal woodfern)
Herb (field)	Graminoid	*Allium tricoccum* (wild leek)

Characteristic Species: *Acer saccharum* (sugar maple), *Tilia americana* (American basswood), *Acer spicatum* (mountain maple), *Ostrya virginiana* (hophornbeam), *Caulophyllum thalictroides* (blue cohosh).

Other Noteworthy Species: None.

Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
NY	S3*	B	1	Maple-Basswood Rich Mesic Forest	Edinger et al. 2002

Local Range: This enriched forest is present at Home of Franklin D. Roosevelt NHS (including Roosevelt Farm and Forest), but may also occur at other units within the park.

Classification Comments: This NVC type is distinguished from Semi-rich Northern Hardwood Forest (CEGL006211) by the dominance of *Tilia americana* (American basswood) and the abundance of rich indicators such as *Caulophyllum thalictroides* (blue cohosh).

Other Comments: None.

Local Description Authors: Frederick C. Sechler, Jr.

Plots: Roosevelt Farm and Forest (ROVA.98).

AA Points: Home of Franklin D. Roosevelt NHS (excluding Roosevelt Farm and Forest) (ROVA.82, ROVA.83).

Roosevelt-Vanderbilt National Historic Site Inventory Notes: None.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Class	Forest and Woodland (1)
Subclass	Temperate Forest (1.C)
Formation	Cool Temperate Forest (1.C.2)
Division	Eastern North American Cool Temperate Forest (D008)
Macrogroup	Northern Mesic Hardwood and Conifer Forest (M014)
Group	Northern Hardwood – Hemlock - White Pine Forest Group (G163)
Alliance*	*Acer saccharum* - *Fraxinus americana* - *Tilia americana* Forest Alliance (A.217)
Alliance (English name)*	Sugar Maple - White Ash - American Basswood Forest Alliance
Association	*Acer saccharum* - *Fraxinus americana* - *Tilia americana / Acer spicatum / Caulophyllum thalictroides* Forest
Association (English name)	Sugar Maple - White Ash - American Basswood / Mountain Maple / Blue Cohosh Forest
Ecological System(s)	Laurentian-Acadian Northern Hardwoods Forest (CES201.564)

* Alliance assignment as of 2007. All USNVC alliances are currently (2014) under review and revision.

GLOBAL DESCRIPTION

Concept Summary: This rich sugar maple - white ash - basswood forest is found from the northeastern United States and Canada to the central Great Lakes area, south to the High Alleghenies of Virginia and West Virginia. Stands occur on nutrient-rich, mesic or wet-mesic settings on sloped to rolling terrain. Slope bottoms, where colluvium collects, are a common landscape position. The surface soils are deep sand, loamy sand, or loam and may be underlain by sandy clay loam to clay loam. The sites are somewhat poorly drained to well-drained and can have a water table 0.4-2 m below the surface. Small (<1 ha) seep areas that may occur within these forests have soils that are usually saturated. This forest community has a well-developed tree canopy composed of deciduous species. Shrubs are scattered, but the herbaceous stratum is generally extensive. Bryoids are only a minor component of the ground layer, which is predominantly nitrogen-rich sugar maple leaves. *Acer saccharum* (sugar maple) and *Fraxinus americana* (white ash) are the dominant trees; *Tilia americana* (American basswood) is frequent but not necessarily abundant. *Ostrya virginiana* (hophornbeam) is very common as a small tree. *Acer rubrum* (red maple), *Betula alleghaniensis* (yellow birch), *Fagus grandifolia* (American beech), and *Prunus serotina* (black cherry) are typical associates, in small amounts. *Ulmus rubra* (slippery elm) and *Juglans cinerea* (butternut) are occasional. Shrubs that may be found in this community include *Cornus alternifolia* (alternate leaf dogwood), *Viburnum lantanoides* (hobblebush), *Hamamelis virginiana* (American witch-hazel), *Dirca palustris* (eastern leatherwood), and *Lonicera canadensis* (American fly honeysuckle). The ground flora, including many spring ephemerals, is diverse and consists primarily of nutrient- and light-requiring species. Many of these flower and fruit early in the spring before the tree canopy has fully leafed out. Fern richness is often high. Various sedges are present (particularly the Laxiflorae). These forests are differentiated from less-rich northern hardwood forests, e.g., *Acer saccharum - Betula alleghaniensis - Fagus grandifolia / Viburnum lantanoides* Forest (CEGL006252), primarily by their abundant and diverse herbaceous layer, as well as by the greater prominence of sugar maple and ash in the canopy and reduced importance of beech.

Environmental Description: In Virginia, stands occur on nutrient-rich, mesic or, sometimes, wet-mesic situations on flat to rolling terrain. The surface soils are deep sand, loamy sand, or loam and underlain by sandy clay loam to clay loam. The sites are somewhat poorly drained to well-drained and can have a water table 0.4-2 m below the surface. In the northern Appalachian region, sites occur in enriched cove and concave slopes within northern hardwood forests. The elevation of known examples ranges from 115-830 m (380-2700 feet). Ground cover is deciduous litter, predominantly of nitrogen-rich sugar maple leaves.

Vegetation Description: This forest community has a well-developed tree canopy composed of deciduous species. Shrubs are scattered, but the herbaceous stratum is well-represented. *Acer saccharum* (sugar maple) and *Fraxinus americana* (white ash) are the dominant trees; *Tilia americana* (American basswood) is frequent but not necessarily abundant. *Ostrya virginiana* (hophornbeam) is very common as a small tree. *Quercus rubra* (northern red oak), *Acer rubrum* (red maple), *Betula alleghaniensis* (yellow birch), *Fagus grandifolia* (American beech), and *Prunus serotina* (black cherry) are typical associates. *Ulmus rubra* (slippery elm) and *Juglans cinerea* (butternut) are occasional. Shrubs that may be found in this community include *Cornus alternifolia* (alternate leaf dogwood), *Viburnum lantanoides* (hobblebush), *Hamamelis virginiana* (American witch-hazel), *Dirca palustris* (eastern leatherwood), and *Lonicera canadensis* (American fly honeysuckle). The ground flora, much of which is spring ephemerals, is diverse and consists primarily of nutrient- and light-requiring species. Many of these flower and fruit

early in the spring before the tree canopy has fully leafed out; *Dicentra cucullaria* (Dutchman's breeches), *Dicentra canadensis* (squirrel corn), *Hepatica* (hepatica) spp., *Asarum canadense* (Canadian wildginger), *Caulophyllum thalictroides* (blue cohosh), *Viola canadensis* (Canadian white violet), *Viola rotundifolia* (roundleaf yellow violet), *Actaea pachypoda* (white baneberry), *Osmorhiza claytonii* (Clayton's sweetroot), *Panax quinquefolius* (American ginseng), *Sanguinaria canadensis* (bloodroot), and *Erythronium americanum* (dogtooth violet) are typical. Fern richness is often high, with characteristic species including *Adiantum pedatum* (northern maidenhair), *Cystopteris bulbifera* (bulblet bladderfern), *Deparia acrostichoides* (silver false spleenwort), *Dryopteris goldiana* (Goldie's woodfern), *Dryopteris filix-mas* (male fern), *Dryopteris marginalis* (marginal woodfern), *Botrychium virginianum* (rattlesnake fern), *Athyrium filix-femina* (common ladyfern), *Phegopteris hexagonoptera* (broad beechfern), and, especially in seepy spots, *Matteuccia struthiopteris* (ostrich fern). Various sedges are present (particularly the Laxiflorae group) such as *Carex laxiflora* (broad looseflower sedge), *Carex platyphylla* (broadleaf sedge), *Carex plantaginea* (plantainleaf sedge), *Carex leptonervia* (nerveless woodland sedge), *Carex hitchcockiana* (Hitchcock's sedge), *Carex aestivalis* (summer sedge), *Carex davisii* (Davis' sedge), *Carex bebbii* (Bebb's sedge), and others. The herbaceous flora in seeps often contains *Calamagrostis canadensis* (bluejoint), *Carex scabrata* (eastern rough sedge), *Ageratina altissima* (white snakeroot), *Glyceria melicaria* (melic mannagrass), *Impatiens capensis* (jewelweed) (sometimes *Impatiens pallida* (pale touch-me-not) as well), and *Solidago flexicaulis* (zigzag goldenrod).

Most Abundant Species:

Stratum	Lifeform	Species
Tree (canopy & subcanopy)	Broad-leaved deciduous tree	*Acer saccharum* (sugar maple)
Tree canopy	Broad-leaved deciduous tree	*Fraxinus americana* (white ash)
Tree subcanopy	Broad-leaved deciduous tree	*Ostrya virginiana* (hophornbeam)
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Cornus alternifolia* (alternate leaf dogwood), *Dirca palustris* (eastern leatherwood), *Hamamelis virginiana* (American witch-hazel), *Lonicera canadensis* (American fly honeysuckle), *Viburnum lantanoides* (hobblebush)
Herb (field)	Fern or fern ally	*Adiantum pedatum* (northern maidenhair), *Botrychium virginianum* (rattlesnake fern)

Characteristic Species: *Acer saccharum* (sugar maple), *Adiantum pedatum* (northern maidenhair), *Allium tricoccum* (wild leek), *Botrychium virginianum* (rattlesnake fern), *Cardamine diphylla* (crinkleroot), *Caulophyllum thalictroides* (blue cohosh), *Claytonia caroliniana* (Carolina springbeauty), *Dryopteris goldiana* (Goldie's woodfern), *Fraxinus americana* (white ash), *Milium effusum* (American milletgrass), *Phlox stolonifera* (creeping phlox), *Tiarella cordifolia* (heartleaf foamflower), *Tilia americana* (American basswood), *Viola blanda* (sweet white violet), *Viola canadensis* (Canadian white violet)

Other Noteworthy Species:

Species	GRank	Type	Note
Cuscuta rostrata (beaked dodder)	-	plant	VA S2
Meleagris gallopavo (wild turkey)	-	animal	
Panax quinquefolius (American ginseng)	G3G4	plant	

USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: This forest association ranges generally from Ontario and New England west to Michigan and south to New Jersey and New York, with a discontinuous southward extension in the high Allegheny Mountains to western Virginia and eastern West Virginia.
States/Provinces: CT, MA, MD?, ME:S3, MI:S3, NB, NH, NJ:S2?, NY, ON, PA, RI, VA, VT:S4, WV
Federal Lands: NPS (Marsh-Billings-Rockefeller, Sleeping Bear Dunes, Upper Delaware); USFS (Finger Lakes, George Washington, Huron-Manistee, Huron?, Manistee, Ottawa, White Mountain)

CONSERVATION STATUS

Rank: G4? (28-Sep-2001)
Reasons: This community has a wide geographic distribution, but is locally distributed within its range due to specific requirements for mesic sites with fertile soils. In gentler topographic regions, many examples of this community have probably been destroyed for agriculture, and most remaining examples elsewhere have been altered by past logging. Consequently much of the remaining acreage is of variable quality.

CLASSIFICATION INFORMATION

Status: Standard
Confidence: 2 - Moderate
Comments: The attribution of this type to the Ridge and Valley subsection is based on the location of a single stand on the westernmost scarp slope of the Ridge Valley (east slope of Middle Mountain) at the Allegheny Front. The status of this association in Maryland is uncertain.
Similar Associations:

- *Acer saccharum - (Fraxinus americana) / Arisaema triphyllum* Forest (CEGL006211)
- *Acer saccharum - Betula alleghaniensis - (Tilia americana)* Forest (CEGL002457)
- *Acer saccharum - Betula alleghaniensis - Fagus grandifolia / Viburnum lantanoides* Forest (CEGL006252)
- *Acer saccharum - Fagus grandifolia - Betula* spp. / *Maianthemum canadense* Forest (CEGL005004)

Related Concepts:

- *Acer saccharum - Tilia americana - Fagus grandifolia / Caulophyllum thalictroides - Viola blanda - (Allium tricoccum)* Forest (Fleming and Coulling 2001) ?
- *Acer saccharum - Tilia americana / Caulophyllum thalictroides - Laportea canadensis* Association (Fleming and Moorhead 1996) ?
- Dry-Mesic Calcareous Forest (Breden 1989) B
- Mesic Northern Forest - Sugar Maple-Basswood (Chapman et al. 1989) =
- Rich Northern Hardwood Forest (Thompson 1996) =
- Rich northern hardwood forest (NAP pers. comm. 1998) ?
- SNE rich mesic forest (circumneutral to basic) (Rawinski 1984) ?
- Sugar Maple - Basswood: 26 (Eyre 1980) B
- Sugar maple-white ash-basswood-bluebead cove forest (CAP pers. comm. 1998) ?

SOURCES

Description Authors: D. Faber-Langendoen, mod. L. Sneddon, G. Fleming, S.C. Gawler

References: Breden 1989, Breden et al. 2001, CAP pers. comm. 1998, Chapman et al. 1989, Eastern Ecology Working Group n.d., Edinger et al. 2002, Eyre 1980, Fleming and Coulling 2001, Fleming and Moorhead 1996, Fleming et al. 2001, Gawler 2002, Harrison 2004, Metzler and Barrett 2001, Metzler and Barrett 2004, NAP pers. comm. 1998, Rawinski 1984, Sperduto 2000a, Swain and Kearsley 2001, Thompson 1996, Thompson and Sorenson 2000

Figure F-23. Sugar Maple - Ash - Basswood Northern Rich Mesic Forest (AA point ROVA.82). 09/08/2006. NAD 1983 / UTM-18 easting 587746, northing 4624600.

Local Name: White Pine - Hemlock Dry-Mesic Coniferous Forest (CEGL006328)

SYNONYMS

USNVC English Name: **Eastern White Pine - Eastern Hemlock Lower New England / Northern Piedmont Forest**

USNVC Scientific Name: ***Pinus strobus* - *Tsuga canadensis* Lower New England / Northern Piedmont Forest**

USNVC Identifier: **CEGL006328**

LOCAL INFORMATION

Environmental Description: This association typically occurs on mid-slopes on stony substrates with silt loam soils with underlying bedrock comprised of Ordovician shale and siltstone with minor amounts of sandstone, Austin Glen Formation. Adjacent associations include High Allegheny Rich Red Oak - Sugar Maple Forest (CEGL006125), Mesic Sugar Maple - Ash - Oak - Hickory Forest (CEGL006046), Early-Successional Aspen – Birch Woodland (CEGL006303), Central Appalachian Hemlock - Chestnut Oak Forest (CEGL006923), Hemlock - Beech - Oak Forest (CEGL006088), Semi-rich Northern Hardwood Forest (CEGL006211), and White Pine Plantation (CEGL007178).

Vegetation Description: The tree canopy layer averages 83.3% cover and 25 meters in height. The characteristic species include *Tsuga canadensis* (eastern hemlock) and *Pinus strobus* (eastern white pine), along with associated species including *Carya glabra* (pignut hickory), *Betula lenta* (sweet birch), *Quercus rubra* (northern red oak), *Quercus alba* (white oak), and *Carya ovata* (shagbark hickory). The tree subcanopy layer averages 40% cover and 14.7 meters in height. This layer is characterized by *Tsuga canadensis* (eastern hemlock), *Betula lenta* (sweet birch), *Carya glabra* (pignut hickory), and *Acer saccharum* (sugar maple). The tall shrub layer averages 15.7% cover and 3.1 meters in height. The most abundant species include *Hamamelis virginiana* (American witchhazel) and seedlings and saplings of *Acer saccharum* (sugar maple). The short shrub layer averages 17.3% cover. The most abundant species include saplings and seedlings of *Acer saccharum* (sugar maple), plus *Viburnum acerifolium* (mapleleaf viburnum). The relatively sparse herbaceous layer averages 16.7% cover and is characterized by *Aralia nudicaulis* (wild sarsaparilla), *Alliaria petiolata* (garlic mustard), *Polystichum acrostichoides* (Christmas fern), and *Eurybia divaricata* (white wood aster).

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy/subcanopy	Needle-leaved tree	*Tsuga canadensis* (eastern hemlock),
Tree canopy	Needle-leaved tree	*Pinus strobus* (eastern white pine)
Tree subcanopy	Broad-leaved deciduous tree	*Betula lenta* (sweet birch)
Tall shrub/sapling	Broad-leaved deciduous shrub	*Hamamelis virginiana* (American witchhazel)
Short shrub/sapling	Broad-leaved deciduous tree	*Acer saccharum* (sugar maple)
Short shrub/sapling	Broad-leaved deciduous shrub	*Viburnum acerifolium* (mapleleaf viburnum)
Herb (field)	Forb	*Aralia nudicaulis* (wild sarsaparilla), *Alliaria petiolata* (garlic mustard)
Herb (field)	Fern and ally	*Polystichum acrostichoides* (Christmas fern)

Characteristic Species: *Tsuga canadensis* (eastern hemlock), *Pinus strobus* (eastern white pine), *Hamamelis virginiana* (American witchhazel).
Other Noteworthy Species: None.
Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
NY	S4*	B	1	Hemlock-Northern Hardwood Forest	Edinger et al. 2002

Local Range: This association is uncommon at ROVA, but was documented at Roosevelt Farm and Forest, Home of Franklin D. Roosevelt NHS (excluding Roosevelt Farm and Forest), and Vanderbilt Mansion NHS. This association is the least common among the five hemlock-northern hardwood types due to the sporadic presence of native *Pinus strobus* (eastern white pine) in the park.
Classification Comments: This association was used to classify hemlock-northern hardwood forest types with naturalized *Pinus strobus* (eastern white pine) as a significant component of the tree canopy.
Other Comments: None.
Local Description Authors: Frederick C. Sechler, Jr.
Plots: Home of Franklin D. Roosevelt NHS (excluding Roosevelt Farm and Forest) (ROVA.10)
AA Points: Roosevelt Farm and Forest (ROVA.141), Vanderbilt Mansion NHS (ROVA.26).
Roosevelt-Vanderbilt National Historic Site Inventory Notes: None.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Class	Forest and Woodland (1)
Subclass	Temperate Forest (1.C)
Formation	Cool Temperate Forest (1.C.2)
Division	Eastern North American Cool Temperate Forest (D008)
Macrogroup	Northern Mesic Hardwood and Conifer Forest (M014)
Group	Northern Hardwood – Hemlock - White Pine Forest Group (G163)
Alliance*	*Pinus strobus - Tsuga canadensis* Forest Alliance (A.127)
Alliance (English name)*	Eastern White Pine - Eastern Hemlock Forest Alliance
Association	*Pinus strobus - Tsuga canadensis* Lower New England / Northern Piedmont Forest
Association (English name)	Eastern White Pine - Eastern Hemlock Lower New England / Northern Piedmont Forest
Ecological System(s)	Appalachian (Hemlock)-Northern Hardwood Forest (CES202.593)

* Alliance assignment as of 2007. All USNVC alliances are currently (2014) under review and revision.

GLOBAL DESCRIPTION

Concept Summary: This dry-mesic coniferous forest of usually sloping (moderately to steeply) sites is dominated by *Pinus strobus* (eastern white pine) and/or *Tsuga canadensis* (eastern hemlock). It can occur in somewhat sheltered ravines where *Tsuga canadensis* (eastern hemlock) is nearly monotypic in all layers. Other frequent tree species depend on geography and can include *Betula papyrifera* (paper birch), *Quercus rubra* (northern red oak), and *Acer rubrum* (red maple), with *Pinus rigida* (pitch pine), *Prunus serotina* (black cherry), *Quercus velutina* (black oak), *Carya alba* (mockernut hickory), *Betula lenta* (sweet birch), *Acer saccharum* (sugar maple), *Fraxinus americana* (white ash), *Betula alleghaniensis* (yellow birch), and *Betula populifolia* (gray birch) occurring less frequently. Although frequent, deciduous tree species generally occur with low abundance. Canopy cover is typically 80-90%. The subcanopy is often sparse but may extend up to 40% cover. *Acer pensylvanicum* (striped maple) is a common,

though rarely abundant, small tree. Shrubs are absent or sparse but when present may include *Hamamelis virginiana* (American witch-hazel), *Kalmia latifolia* (mountain laurel), *Rhododendron maximum* (great laurel), *Vaccinium angustifolium* (lowbush blueberry), and *Viburnum acerifolium* (mapleleaf viburnum). The herbaceous layer is generally not well-developed nor diverse and is generally characterized by *Gaultheria procumbens* (eastern teaberry), *Medeola virginiana* (Indian cucumber), *Polystichum acrostichoides* (Christmas fern), and *Thelypteris noveboracensis* (New York fern). Other herbaceous associates often include *Aralia nudicaulis* (wild sarsaparilla), *Uvularia sessilifolia* (sessileleaf bellwort), *Mitchella repens* (partridgeberry), *Trientalis borealis* (starflower), *Monotropa uniflora* (Indian pipe), *Dryopteris intermedia* (intermediate woodfern), *Dryopteris marginalis* (marginal woodfern), *Dryopteris carthusiana* (spinulose woodfern), *Polypodium virginianum* (rock polypody), and *Maianthemum canadense* (Canada mayflower). *Deschampsia flexuosa* (wavy hairgrass) and other grasses may be present in small openings and gaps. Nonvascular plants tend to be sparse but can include *Leucobryum albidum* (leucobryum moss) and *Polytrichum* (polytrichum moss) and *Dicranum* (dicranum moss) species. Soils are moderately to extremely well-drained (dry-mesic to mesic) loamy sands and sandy loams, often sandy, stony or bouldery. The major natural disturbance in this forest type is generally single-tree blowdowns.

Environmental Description: This dry-mesic coniferous forest is usually found on sloping (moderately to steeply) sites or in sheltered ravines. Soils are moderately to extremely well-drained (dry-mesic to mesic), loamy sands and sandy loams, often sandy, stony, or bouldery.

Vegetation Description: This coniferous forest type is dominated by *Pinus strobus* (eastern white pine) and/or *Tsuga canadensis* (eastern hemlock). Other frequent tree species depend on geography and can include *Betula papyrifera* (paper birch), *Quercus rubra* (northern red oak), and *Acer rubrum* (red maple), with *Pinus rigida* (pitch pine), *Prunus serotina* (black cherry), *Quercus velutina* (black oak), *Carya alba* (mockernut hickory), *Betula lenta* (sweet birch), *Acer saccharum* (sugar maple), *Fraxinus americana* (white ash), *Betula alleghaniensis* (yellow birch), and *Betula populifolia* (gray birch) occurring less frequently. Although frequent, deciduous tree species generally occur with low abundance. Canopy cover is typically 80-90%. The subcanopy is often sparse but may extend up to 40% cover. *Acer pensylvanicum* (striped maple) is a common, though rarely abundant, small tree. Shrubs are absent or sparse but when present may include *Hamamelis virginiana* (American witch-hazel), *Kalmia latifolia* (mountain laurel), *Rhododendron maximum* (great laurel), *Vaccinium angustifolium* (lowbush blueberry), and *Viburnum acerifolium* (mapleleaf viburnum). The herbaceous layer is generally not well-developed nor diverse and is generally characterized by *Gaultheria procumbens* (eastern teaberry), *Medeola virginiana* (Indian cucumber), *Polystichum acrostichoides* (Christmas fern), and *Thelypteris noveboracensis* (New York fern). Other herbaceous associates often include *Aralia nudicaulis* (wild sarsaparilla), *Uvularia sessilifolia* (sessileleaf bellwort), *Mitchella repens* (partridgeberry), *Trientalis borealis* (starflower), *Monotropa uniflora* (Indian pipe), *Dryopteris intermedia* (intermediate woodfern), *Dryopteris marginalis* (marginal woodfern), *Dryopteris carthusiana* (spinulose woodfern), *Polypodium virginianum* (rock polypody), and *Maianthemum canadense* (Canada mayflower). *Deschampsia flexuosa* (wavy hairgrass) and other grasses may be present in small openings and gaps. Nonvascular plants tend to be sparse but can include *Leucobryum albidum* (leucobryum moss) and *Polytrichum* (polytrichum moss) and *Dicranum* (dicranum moss) species.

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Pinus strobus* (eastern white pine), *Tsuga canadensis* (eastern hemlock)
Tall shrub/sapling	Broad-leaved deciduous shrub	*Hamamelis virginiana* (American witch-hazel)
Herb (field)	Fern or fern ally	*Polystichum acrostichoides* (Christmas fern), *Thelypteris noveboracensis* (New York fern)

Characteristic Species: *Acer pensylvanicum* (striped maple), *Gaultheria procumbens* (eastern teaberry), *Medeola virginiana* (Indian cucumber), *Pinus strobus* (eastern white pine), *Polystichum acrostichoides* (Christmas fern), *Thelypteris noveboracensis* (New York fern), *Tsuga canadensis* (eastern hemlock)
Other Noteworthy Species: Information not available.
USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: This association occurs in the northeastern United States and possibly adjacent Canada.
States/Provinces: CT, MA, ME, NH, NJ, NY, PA, QC?, RI, VT
Federal Lands: NPS (Delaware Water Gap, Saint-Gaudens, Roosevelt-Vanderbilt); USFWS (Assabet River, Great Meadows, Oxbow)

CONSERVATION STATUS

Rank: G5 (22-Mar-1999)
Reasons: Information not available.

CLASSIFICATION INFORMATION

Status: Standard
Confidence: 2 - Moderate
Comments: This association is differentiated from *Pinus strobus - Tsuga canadensis - Picea rubens* Forest (CEGL006324) by its lack of *Picea rubens* (red spruce).
Similar Associations:

- *Pinus strobus - Tsuga canadensis - Picea rubens* Forest (CEGL006324)
- *Pinus strobus - Tsuga canadensis / Acer pensylvanicum / Polystichum acrostichoides* Forest (CEGL006019)
- *Pinus strobus - Tsuga canadensis* Great Lakes Forest (CEGL002590)

Related Concepts:

- CNE dry transitional forest on sandy / gravelly soils (Rawinski 1984) ?
- CNE mesic conifer [transition] forest on acidic bedrock/till (Rawinski 1984) B
- Eastern Hemlock: 23 (Eyre 1980) B
- Hemlock Forest (Thompson 1996) B
- White Pine - Hemlock: 22 (Eyre 1980) B

SOURCES

Description Authors: S.L. Neid, mod. S.C. Gawler
References: Brown et al. 1982a, Eastern Ecology Working Group n.d., Edinger et al. 2002, Enser 1999, Eyre 1980, Fike 1999, Gawler 2002, Gordon 1937, Hough 1943, Hough and Forbes 1943, MENHP 1991, Metzler and Barrett 2001, NAP pers. comm. 1998, NRCS 2004, Rawinski 1984, Sperduto and Nichols 2004, Swain and Kearsley 2001, Thompson 1996, Thompson and Sorenson 2000

Figure F-24. White Pine - Hemlock Dry-Mesic Coniferous Forest (AA point ROVA.26). 08/31/2006. NAD 1983 / UTM-18 easting 587799, northing 4627171.

Local Name: Hemlock - Hardwood Swamp (CEGL006226)

SYNONYMS

USNVC English Name: **Eastern Hemlock - Yellow Birch / Common Winterberry / Peatmoss species Forest**

USNVC Scientific Name: ***Tsuga canadensis* - *Betula alleghaniensis* / *Ilex verticillata* / *Sphagnum* spp. Forest**

USNVC Identifier: **CEGL006226**

LOCAL INFORMATION

Environmental Description: This hemlock-hardwood swamp usually occurs in close association with hemlock-northern hardwood forests and mixed hardwood swamps. At Roosevelt Farm and Forest, this association occurs on low, shallow peat soils with underlying bedrock of Ordovician shale and siltstone with minor amounts of sandstone, Austin Glen Formation. Adjacent upland associations include Hemlock - Beech - Oak Forest (CEGL006088) and Sugar Maple - Ash - Basswood Northern Rich Mesic Forest (CEGL005008). An adjacent wetland association is Red Maple - Blackgum Basin Swamp (CEGL006014).

Vegetation Description: Only one example of this association was documented at ROVA. The tree canopy layer has 40% cover and averages 27 meters in height. Characteristic species include *Acer rubrum* (red maple) and *Tsuga canadensis* (eastern hemlock). The tree subcanopy layer has 55% cover and averages 18 meters in height. This layer is characterized by *Acer rubrum* (red maple), *Tsuga canadensis* (eastern hemlock), *Nyssa sylvatica* (black gum), *Betula alleghaniensis* (yellow birch), and *Ulmus americana* (American elm). The tall shrub layer has 40% cover and averages 2.8 meters in height. The layer is heavily dominated by *Vaccinium corymbosum* (highbush blueberry), plus lesser amounts of regenerating *Acer rubrum* (red maple) and *Betula alleghaniensis* (yellow birch). The moderately sparse short shrub layer averages 15% cover and is characterized by *Cephalanthus occidentalis* (common buttonbush) and *Rhododendron viscosum* (swamp azalea). The herbaceous layer averages 45% cover and is characterized by *Osmunda cinnamomea* (cinnamon fern), *Maianthemum canadense* (Canada mayflower), *Arisaema triphyllum* (Jack in the pulpit), *Coptis trifolia* (threeleaf goldthread), and *Trientalis borealis* (starflower). The moderately dense non-vascular layer is characterized by *Sphagnum* sp. (sphagnum).

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy/subcanopy	Needle-leaved tree	*Tsuga canadensis* (eastern hemlock)
Tree canopy/subcanopy	Broad-leaved deciduous tree	*Acer rubrum* (red maple)
Tall/short shrub/sapling	Broad-leaved deciduous shrub	*Vaccinium corymbosum* (highbush blueberry)
Short shrub/sapling	Broad-leaved deciduous shrub	*Cephalanthus occidentalis* (common buttonbush), *Rhododendron viscosum* (swamp azalea)
Herb (field)	Forb	*Maianthemum canadense* (Canada mayflower), *Arisaema triphyllum* (Jack in the pulpit)
Herb (field)	Fern and ally	*Osmunda cinnamomea* (cinnamon fern)

Characteristic Species: *Tsuga canadensis* (eastern hemlock), *Vaccinium corymbosum* (highbush blueberry), *Osmunda cinnamomea* (cinnamon fern)

Other Noteworthy Species: None.
Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
NY	S4*	B		Hemlock-Hardwood Swamp	Edinger et al. 2002

Local Range: This association was only documented as a small linear occurrence at Roosevelt Farm and Forest, and does not likely occur elsewhere at ROVA.
Classification Comments: This association was used to classify palustrine forests that contain a significant amount of *Tsuga canadensis* (eastern hemlock) along with smaller amounts of red maple (*Acer rubrum*) and yellow birch (*Betula alleghaniensis*) in the tree canopy layers.
Other Comments: None.
Local Description Authors: Frederick C. Sechler, Jr.
Plots: Roosevelt Farm and Forest (ROVA.97)
AA Points: None.
Roosevelt-Vanderbilt National Historic Site Inventory Notes: None.
None.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Class	Forest and Woodland (1)
Subclass	Temperate Forest (1.C)
Formation	Temperate Flooded and Swamp Forest (1.C.3)
Division	Eastern North American Flooded and Swamp Forest (D011)
Macrogroup	Northern and Central Swamp Forest (M030)
Group	Northern and Central Conifer and Hardwood Acidic Swamp Group (G045)
Alliance*	*Tsuga canadensis* Saturated Forest Alliance (A.201)
Alliance (English name)*	Eastern Hemlock Saturated Forest Alliance
Association	*Tsuga canadensis - Betula alleghaniensis / Ilex verticillata / Sphagnum* spp. Forest
Association (English name)	Eastern Hemlock - Yellow Birch / Common Winterberry / Peatmoss species Forest
Ecological System(s)	North-Central Appalachian Acidic Swamp (CES202.604)

* Alliance assignment as of 2007. All USNVC alliances are currently (2014) under review and revision.

GLOBAL DESCRIPTION

Concept Summary: These hemlock-hardwood swamps are common throughout most of New England, New York and Pennsylvania, mostly in glaciated areas south of spruce-fir forest regions. Most are mixed-canopy wetland forests, but in some may be strongly coniferous. They occur in poorly drained basins over bedrock or compacted till. "Pocket swamps," small isolated basins in upland forests, are one setting, and these swamps also occur adjacent to streams and lakes in larger basins. The acidic, organic soils remain saturated for most or all of the growing season; they may partially dry out, particularly in smaller basins. Canopy closure is nearly complete, and shrubs are sparse. The herbaceous layer may be well-developed, with ferns especially characteristic. Bryophyte cover varies, but is usually extensive. *Tsuga canadensis* (eastern hemlock) is either canopy dominant or is mixed with other trees including *Acer rubrum* (red maple), *Betula alleghaniensis* (yellow birch), *Pinus strobus* (eastern white pine), *Nyssa sylvatica* (blackgum), and *Fraxinus nigra* (black ash). Scattered shrubs include *Vaccinium corymbosum* (highbush blueberry), *Ilex verticillata* (common winterberry), *Lyonia ligustrina* (maleberry), *Nemopanthus mucronatus* (catberry), and *Viburnum nudum* var. *cassinoides* (withe-rod). *Osmunda cinnamomea* (cinnamon fern), *Osmunda regalis* (royal fern), and *Onoclea sensibilis* (sensitive fern) are prominent ferns; associated herbs include *Carex folliculata* (northern long sedge), *Carex trisperma* (threeseeded sedge), *Carex disperma* (softleaf sedge),

Maianthemum canadense (Canada mayflower), *Coptis trifolia* (threeleaf goldthread), *Dryopteris cristata* (crested woodfern), *Rubus pubescens* (dwarf red blackberry), and *Mitchella repens* (partridgeberry). Bryophytes include *Sphagnum girgensohnii* (Girgensohn's sphagnum), *Sphagnum palustre* (prairie sphagnum), and other *Sphagnum* (sphagnum) species, as well as *Pleurozium schreberi* (Schreber's big red stem moss) and *Bazzania trilobata*. These forests lack the species of more southerly affinity, such as *Rhododendron maximum* (great laurel) or *Liriodendron tulipifera* (tuliptree), that characterize hemlock swamps to the south, which are covered by *Tsuga canadensis / Rhododendron maximum / Sphagnum* spp. Forest (CEGL006279). Mixed expression of these swamps may be similar in canopy composition to *Betula alleghaniensis - Acer rubrum - (Tsuga canadensis, Abies balsamea) / Osmunda cinnamomea* Forest (CEGL006380); those are mineral-soil wetlands in seepage-influenced areas, typically at wetland-upland ecotones, and usually occur on slopes rather than in basins. *Acer rubrum - Nyssa sylvatica - Betula alleghaniensis / Sphagnum* spp. Forest (CEGL006014) is ecologically similar but is more strongly deciduous, with limited hemlock.

Environmental Description: These hemlock-hardwood swamps are common throughout most of New England, New York and Pennsylvania, mostly in glaciated areas south of spruce-fir forest regions. Most are mixed-canopy wetland forests, but in some may be strongly coniferous. They occur in poorly drained basins over bedrock or compacted till. "Pocket swamps," small isolated basins in upland forests, are one setting, and these swamps also occur adjacent to streams and lakes in larger basins. The acidic, organic soils remain saturated for most or all of the growing season; they may partially dry out, particularly in smaller basins.

Vegetation Description: Canopy closure is nearly complete, and shrubs are sparse. The herbaceous layer may be well-developed, with ferns especially characteristic. Bryophyte cover varies, but is usually extensive. *Tsuga canadensis* (eastern hemlock) is either canopy dominant or is mixed with other trees including *Acer rubrum* (red maple), *Betula alleghaniensis* (yellow birch), *Pinus strobus* (eastern white pine), *Nyssa sylvatica* (blackgum), and *Fraxinus nigra* (black ash). Scattered shrubs include *Vaccinium corymbosum* (highbush blueberry), *Ilex verticillata* (common winterberry), *Lyonia ligustrina* (maleberry), *Nemopanthus mucronatus* (catberry), and *Viburnum nudum* var. *cassinoides* (withe-rod). *Osmunda cinnamomea* (cinnamon fern), *Osmunda regalis* (royal fern), and *Onoclea sensibilis* (sensitive fern) are prominent ferns; associated herbs include *Carex folliculata* (northern long sedge), *Carex trisperma* (threeseeded sedge), *Carex disperma* (softleaf sedge), *Maianthemum canadense* (Canada mayflower), *Coptis trifolia* (threeleaf goldthread), *Dryopteris cristata* (crested woodfern), *Rubus pubescens* (dwarf red blackberry), and *Mitchella repens* (partridgeberry). Bryophytes include *Sphagnum girgensohnii* (Girgensohn's sphagnum), *Sphagnum palustre* (prairie sphagnum), and other *Sphagnum* (sphagnum) species, as well as *Pleurozium schreberi* (Schreber's big red stem moss) and *Bazzania trilobata*. These forests lack the species of more southerly affinity, such as *Rhododendron maximum* (great laurel) or *Liriodendron tulipifera* (tuliptree), that characterize hemlock swamps to the south.

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Tsuga canadensis* (eastern hemlock)
Tree canopy	Broad-leaved deciduous tree	*Acer rubrum* (red maple), *Betula alleghaniensis* (yellow birch)
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Ilex verticillata* (common winterberry), *Vaccinium corymbosum* (highbush blueberry)

Herb (field)	Fern or fern ally	*Onoclea sensibilis* (sensitive fern), *Osmunda cinnamomea* (cinnamon fern), *Osmunda regalis* (royal fern)
Nonvascular	Moss	*Sphagnum girgensohnii* (Girgensohn's sphagnum), *Sphagnum palustre* (prairie sphagnum)

Characteristic Species: *Betula alleghaniensis* (yellow birch), *Ilex verticillata* (common winterberry), *Sphagnum girgensohnii* (Girgensohn's sphagnum), *Sphagnum palustre* (prairie sphagnum), *Tsuga canadensis* (eastern hemlock)
Other Noteworthy Species: Information not available.
USFWS Wetland System: Palustrine

DISTRIBUTION

Range: This community occurs in glaciated areas ranging from New Jersey and Pennsylvania north through New York and New England to New Brunswick and possibly Nova Scotia, Canada.
States/Provinces: CT, MA, ME, MI, NB, NH, NJ:S2, NS?, NY, PA, RI, VT:S2
Federal Lands: NPS (Upper Delaware); USFWS (Erie, Iroquois)

CONSERVATION STATUS

Rank: G5 (1-Dec-1997)
Reasons: Information not available.

CLASSIFICATION INFORMATION

Status: Standard
Confidence: 2 - Moderate
Comments: Information not available.
Similar Associations:

- *Acer rubrum - Nyssa sylvatica - Betula alleghaniensis / Sphagnum* spp. Forest (CEGL006014)
- *Betula alleghaniensis - Acer rubrum - (Tsuga canadensis, Abies balsamea) / Osmunda cinnamomea* Forest (CEGL006380)
- *Betula alleghaniensis - Acer rubrum - Tsuga canadensis / Sphagnum* spp. Forest (CEGL006955)
- *Tsuga canadensis - Betula alleghaniensis* Saturated Forest (CEGL005003)
- *Tsuga canadensis / Rhododendron maximum / Sphagnum* spp. Forest (CEGL006279)

Related Concepts:

- Hardwood-Conifer Swamp (Breden 1989) B
- Hemlock - Yellow Birch: 24 (Eyre 1980) B
- Hemlock Swamp (Thompson 1996) ?
- Hemlock-hardwood swamp (Reschke 1990) ?
- Inland Atlantic white cedar swamp (Reschke 1990) B
- Northern New England basin swamp (Rawinski 1984) B
- Palustrine Needle-leaved Evergreen Forested Wetland (PFO4) (Cowardin et al. 1979) ?

SOURCES

Description Authors: J. Lundgren, mod. E. Largay
References: Breden 1989, Breden et al. 2001, Cowardin et al. 1979, Eastern Ecology Working Group n.d., Edinger et al. 2002, Eyre 1980, Fike 1999, Gawler 2002, Kost et al. 2007, Lundgren

2000, Metzler and Barrett 2001, Rawinski 1984, Reschke 1990, Sperduto 2000b, Swain and Kearsley 2001, Thompson 1996, Thompson and Sorenson 2000

Local Name: Red Maple - Blackgum Basin Swamp (CEGL006014)

SYNONYMS

USNVC English Name: **Red Maple - Blackgum - Yellow Birch / Peatmoss species Forest**

USNVC Scientific Name: ***Acer rubrum* - *Nyssa sylvatica* - *Betula alleghaniensis* / *Sphagnum* spp. Forest**

U. S. NVC Identifier: **CEGL006014**

LOCAL INFORMATION

Environmental Description: Small patches of this forested wetland are concentrated at Roosevelt Farm and Forest and Val-Kill where one occurrence was documented. Most of the swamps documented had a shallow layer of peat with *Sphagnum* spp., but at least one example contained more muck soil. This type occupies less total acreage at ROVA compared to the association Southern New England / Northern Piedmont Red Maple Seepage Swamp (CEGL006406). It is distinguished from CEGL006406 due to the significant presence of Nyssa sylvatica (black gum) and a typical shallow peat layer. Associated wetland associations include Hemlock - Hardwood Swamp (CEGL006226) and Red Maple / Tussock Sedge Wooded Marsh (CEGL006119). Adjacent upland associations include Red Oak - Northern Hardwood Forest (CEGL006173), Central Appalachian Hemlock - Chestnut Oak Forest (CEGL006923), and Hemlock - Beech - Oak Forest (CEGL006088).

Vegetation Description: The tree canopy averages 52.1% cover and 25.3 meters in height. Characteristic species of the tree canopy include *Acer rubrum* (red maple), *Nyssa sylvatica* (blackgum), and *Ulmus americana* (American elm). The tree subcanopy layer averages 38.1 % cover and 14.1 meters in height. The most abundant species in this layer are the same as the canopy layer, plus *Betula alleghaniensis* (yellow birch), *Fraxinus pennsylvanica* (green ash), and *Tsuga canadensis* (eastern hemlock). The tall shrub layer averages 52.6% cover and 3.3 meters in height. Species characteristic of this layer include *Vaccinium corymbosum* (highbush blueberry), *Ilex verticillata* (common winterberry), *Rhododendron viscosum* (swamp azalea), regenerating *Acer rubrum* (red maple), *Alnus incana* ssp. *rugosa* (speckled alder), and *Lindera benzoin* (northern spicebush). The short shrub layer averages 28.6% cover. The most abundant species in this layer include *Ilex verticillata* (common winterberry), *Vaccinium corymbosum* (highbush blueberry), *Fraxinus* sp. (ash), and *Viburnum dentatum* (southern arrowwood), along with regeneration of the canopy layer species. The relatively sparse vine layer averages 13.1% cover. Dominant species in this layer include *Smilax rotundifolia* (roundleaf greenbrier) and *Parthenocissus quinquefolia* (Virginia creeper). The herbaceous layer averages 37.7% cover and is characterized by *Osmunda cinnamomea* (cinnamon fern), *Carex stricta* (upright sedge), *Osmunda regalis* (royal fern), *Maianthemum canadense* (Canada mayflower), *Boehmeria cylindrica* (smallspike false nettle), *Coptis trifolia* (threeleaf goldthread), *Arisaema triphyllum* (Jack in the pulpit), and *Dryopteris intermedia* (intermediate woodfern). The non-vascular layer averages 2.4% cover is characterized by *Sphagnum* spp. (sphagnum).

Most Abundant Species:

Stratum	**Lifeform**	**Species**
Tree canopy/subcanopy	Broad-leaved deciduous tree	*Acer rubrum* (red maple), *Nyssa sylvatica* (blackgum), *Ulmus americana* (American elm)
Tree subcanopy	Broad-leaved deciduous tree	*Betula alleghaniensis* (yellow birch)

Tall/short shrub/sapling	Broad-leaved deciduous shrub	*Vaccinium corymbosum* (highbush blueberry), *Ilex verticillata* (common winterberry)
Herb (field)	Vine/liana	*Smilax rotundifolia* (roundleaf greenbrier), *Parthenocissus quinquefolia* (Virginia creeper)
Herb (field)	Forb	*Maianthemum canadense* (Canada mayflower), *Boehmeria cylindrica* (smallspike false nettle)
Herb (field)	Graminoid	*Carex stricta* (upright sedge)
Herb (field)	Fern and fern ally	*Osmunda cinnamomea* (cinnamon fern), *Osmunda regalis* (royal fern)
Nonvascular	Moss	*Sphagnum* sp. (sphagnum)

Characteristic Species: *Acer rubrum* (red maple), *Nyssa sylvatica* (blackgum), *Vaccinium corymbosum* (highbush blueberry), *Smilax rotundifolia* (roundleaf greenbrier), *Osmunda cinnamomea* (cinnamon fern), and *Sphagnum* sp. (sphagnum).
Other Noteworthy Species: None.
Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
NY	SNR*	B	1	Red Maple-Black Gum Swamp	Edinger et al. 2002

Local Range: This basin swamp occurs most commonly at Roosevelt Farm and Forest, and was also documented during one accuracy assessment survey at Val-Kill.
Classification Comments: This association was used to classify palustrine forests with the combination of species that includes *Acer rubrum* (red maple), *Nyssa sylvatica* (blackgum), *Vaccinium corymbosum* (highbush blueberry), and *Osmunda cinnamomea* (cinnamon fern).
Other Comments: None.
Local Description Authors: Frederick C. Sechler, Jr.
Plots: Roosevelt Farm and Forest (ROVA.109, ROVA.114, ROVA.138, ROVA.146)
AA Points: Roosevelt Farm and Forest (ROVA.167, ROVA.168, ROVA.184), Val-Kill (ROVA.117).
Roosevelt-Vanderbilt National Historic Site Inventory Notes: None.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Class	Forest and Woodland (1)
Subclass	Temperate Forest (1.C)
Formation	Temperate Flooded and Swamp Forest (1.C.3)
Division	Eastern North American Flooded and Swamp Forest (D011)
Macrogroup	Northern and Central Swamp Forest (M030)
Group	Northern and Central Conifer and Hardwood Acidic Swamp Group (G045)
Alliance*	*Acer rubrum - Nyssa sylvatica* Saturated Forest Alliance (A.348)
Alliance (English name)*	Red Maple - Blackgum Saturated Forest Alliance
Association	*Acer rubrum - Nyssa sylvatica - Betula alleghaniensis / Sphagnum* spp. Forest
Association (English name)	Red Maple - Blackgum - Yellow Birch / Peatmoss species Forest
Ecological System(s)	Laurentian-Acadian Pine-Hemlock-Hardwood Forest (CES201.563) North-Central Appalachian Acidic Swamp (CES202.604)

* Alliance assignment as of 2007. All USNVC alliances are currently (2014) under review and revision.

GLOBAL DESCRIPTION

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

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

Vegetation Description: The tree canopy varies from an open woodland to nearly complete. Shrubs are well-represented and may be locally dense. Herbs are likewise patchy, and the herb layer is usually dominated by only a few species. The bryoid layer varies but is often extensive. Hummock-and-hollow microtopography is often pronounced, with bryophytes common on the hummocks and in those hollows where water does not stand for long periods. The canopy is dominated by *Acer rubrum* (red maple) and *Nyssa sylvatica* (blackgum); however, even where red maple is more abundant, the longevity and stature of the blackgum trees give them a strong impact. *Betula alleghaniensis* (yellow birch), *Tsuga canadensis* (eastern hemlock), *Pinus strobus*

(eastern white pine), and in the north *Picea rubens* (red spruce) may be minor canopy associates. The most abundant shrubs are *Ilex verticillata* (common winterberry) and *Vaccinium corymbosum* (highbush blueberry); associated shrub species include *Viburnum nudum var. cassinoides* (withe-rod), *Nemopanthus mucronatus* (catberry), *Kalmia angustifolia* (sheep laurel), *Gaylussacia baccata* (black huckleberry), *Chamaedaphne calyculata* (leatherleaf), *Lyonia ligustrina* (maleberry), *Spiraea alba var. latifolia* (white meadowsweet), and *Cephalanthus occidentalis* (common buttonbush). *Osmunda cinnamomea* (cinnamon fern) is the characteristic dominant in the herb layer, with associates including *Osmunda regalis* (royal fern), *Thelypteris palustris* (eastern marsh fern), *Woodwardia virginica* (Virginia chainfern), *Glyceria canadensis* (rattlesnake mannagrass), *Coptis trifolia* (threeleaf goldthread), *Carex atlantica* (prickly bog sedge), *Carex trisperma* (threeseeded sedge), *Carex folliculata* (northern long sedge), *Carex intumescens* (greater bladder sedge), *Calla palustris* (water arum), *Triadenum virginicum* (Virginia marsh St. Johnswort), and *Symplocarpus foetidus* (skunk-cabbage). Mosses are primarily *Sphagnum* (sphagnum) spp., including *Sphagnum palustre* (prairie sphagnum) and *Sphagnum magellanicum* (Magellan's sphagnum).

Most Abundant Species:

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

Characteristic Species: *Acer rubrum* (red maple), *Betula alleghaniensis* (yellow birch), *Carex folliculata* (northern long sedge), *Chamaedaphne calyculata* (leatherleaf), *Ilex verticillata* (common winterberry), *Nyssa sylvatica* (blackgum), *Osmunda cinnamomea* (cinnamon fern), *Vaccinium corymbosum* (highbush blueberry)

Other Noteworthy Species: Information not available.

USFWS Wetland System: Palustrine.

DISTRIBUTION

Range: Information not available.

States/Provinces: CT, MA:S2, MD?, ME, NH:S1S2, NJ, NY, PA, VT

Federal Lands: NPS (Delaware Water Gap, Gateway); USFS (Green Mountain)

CONSERVATION STATUS

Rank: GNR (1-Dec-1997)

Reasons: Information not available.

CLASSIFICATION INFORMATION

Status: Standard

Confidence: 2 - Moderate

Comments: Information not available.

Similar Associations:

- *Acer rubrum - Betula alleghaniensis / Lindera benzoin* Forest (CEGL006936)

- *Acer rubrum - Nyssa sylvatica - Magnolia virginiana / Viburnum nudum var. nudum / Osmunda cinnamomea - Woodwardia areolata* Forest (CEGL006238)
- *Acer rubrum - Nyssa sylvatica* High Allegheny Plateau, Central Appalachian Forest (CEGL006132)
- *Acer rubrum / Rhododendron viscosum - Clethra alnifolia* Forest (CEGL006156)
- *Acer saccharum - Betula alleghaniensis - Fraxinus pennsylvanica / Lindera benzoin* Forest (CEGL006956)
- *Tsuga canadensis - Betula alleghaniensis / Ilex verticillata / Sphagnum* spp. Forest (CEGL006226)

Related Concepts:
- Black gum-red maple swamp (NAP pers. comm. 1998) ?
- Palustrine Broad-leaved Deciduous Saturated Forested Wetland (PFO1B) (Cowardin et al. 1979) ?
- Red Maple-Black Gum Swamp (Thompson 1996) ?
- Southern New England acidic seepage swamp, black gum swamp (Rawinski 1984) ?
- Southern New England basin swamp, black gum association (Rawinski 1984) ?

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

Figure F-25. Red Maple - Blackgum Basin Swamp (AA point ROVA.168). 06/24/2008. NAD 1983 / UTM-18 easting 590461, northing 4623927.

Local Name: Red Maple / Tussock Sedge Wooded Marsh (CEGL006119)

SYNONYMS

USNVC English Name: **Red Maple / Tussock Sedge - Sensitive Fern Woodland**
USNVC Scientific Name: ***Acer rubrum* / *Carex stricta* - *Onoclea sensibilis* Woodland**
USNVC Identifier: **CEGL006119**

LOCAL INFORMATION

Environmental Description: This open-canopied forested wetland occurs in wet depressions in saturated soils with a strong microtopography of hummocks and standing water. This wetland occurs on silt loam soils with underlying bedrock comprised of shale and siltstone with minor amounts of sandstone of the Ordovician Formation. Adjacent wetland/lacustrine associations include Southern New England / Northern Piedmont Red Maple Seepage Swamp (CEGL006406) and Duckweed Pond (CEGL003059). Adjacent upland associations include Dry, Rich Oak - Hickory Forest (CEGL006236), Northeastern Modified Successional Forest (CEGL006599), Northeastern Dry Oak-Hickory Forest (CEGL006336), Semi-rich Northern Hardwood Forest (CEGL006211), and Central Appalachian Hemlock - Chestnut Oak Forest (CEGL006923).

Vegetation Description: The relatively open tree canopy averages 48% cover and 16.3 meters in height. Characteristic species include *Acer rubrum* (red maple), *Quercus bicolor* (swamp white oak) and *Ulmus americana* (American elm). The tree subcanopy layer averages 25.8% cover and 11.2 meters in height. This subcanopy layer is heavily dominated by *Acer rubrum* (red maple), along with associate *Ulmus americana* (American elm). The tall shrub layer averages 28.9% cover and 3 meters in height. Characteristic species include *Vaccinium corymbosum* (highbush blueberry), *Ilex verticillata* (common winterberry), *Acer rubrum* (red maple), *Cornus amomum* (silky dogwood) and *Rosa palustris* (swamp rose). The sparse short shrub layer averages 9.9% cover and is characterized by *Ilex verticillata* (common winterberry), *Viburnum dentatum* (southern arrowwood) and *Cornus amomum* (silky dogwood). The sparse vine layer averages 2.9% cover and is dominated by *Toxicodendron radicans* (eastern poison ivy). The herbaceous layer averages 47.6% cover and is characterized by *Carex stricta* (upright sedge), *Boehmeria cylindrica* (smallspike false nettle), *Lythrum salicaria* (purple loosestrife), *Osmunda regalis* (royal fern) and *Onoclea sensibilis* (sensitive fern). The emergent aquatic layer averages 3.3% cover and is dominated by *Carex stricta* (upright sedge). The floating aquatic layer averages 4.4% cover with *Lemna minor* (common duckweed) occurring as the dominant species.

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy/subcanopy	Broad-leaved deciduous tree	*Acer rubrum* (red maple), *Ulmus americana* (American elm)
Tree canopy	Broad-leaved deciduous tree	*Quercus bicolor* (swamp white oak)
Tall/short shrub/sapling	Broad-leaved deciduous shrub	*Ilex verticillata* (common winterberry)
Tall shrub/sapling	Broad-leaved deciduous shrub	*Vaccinium corymbosum* (highbush blueberry)
Herb (field)	Vine/liana	*Toxicodendron radicans* (eastern poison ivy)
Herb (field)	Graminoid	*Carex stricta* (upright sedge)
Herb (field)	Forb	*Boehmeria cylindrica* (smallspike false nettle)

Characteristic Species: *Acer rubrum* (red maple), *Vaccinium corymbosum* (highbush blueberry), *Ilex verticillata* (common winterberry), and *Carex stricta* (upright sedge)
Other Noteworthy Species: None.
Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
NY	S4			Red-maple hardwood swamp	Edinger et al. 2002

Local Range: This association is most common at park unit Val-Kill and to a lesser degree at Roosevelt Farm and Forest. This association was also documented at Home of Franklin D. Roosevelt NHS (excluding Roosevelt Farm and Forest).
Classification Comments: This association was classified using the following suite of dominant species in an overall open canopied wetland: *Acer rubrum* (red maple), *Vaccinium corymbosum* (highbush blueberry), and *Carex stricta* (upright sedge).
Other Comments: None.
Local Description Authors: Frederick C. Sechler, Jr.
Plots: Roosevelt Farm and Forest (ROVA.144), Val-Kill (ROVA.34, ROVA.86, ROVA.87, ROVA.88, ROVA.89).
AA Points: Roosevelt Farm and Forest (ROVA.166, ROVA.174, ROVA.207), Home of Franklin D. Roosevelt NHS (excluding Roosevelt Farm and Forest) (ROVA.76, ROVA.99), Val-Kill (ROVA.122).
Roosevelt-Vanderbilt National Historic Site Inventory Notes: None.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Class	Forest and Woodland (1)
Subclass	Temperate Forest (1.C)
Formation	Temperate Flooded and Swamp Forest (1.C.3)
Division	Eastern North American Flooded and Swamp Forest (D011)
Macrogroup	Northern and Central Swamp Forest (M030)
Group	Northern and Central Conifer and Hardwood Acidic Swamp Group (G045)
Alliance*	*Acer rubrum* Seasonally Flooded Woodland Alliance (A.653)
Alliance (English name)*	Red Maple Seasonally Flooded Woodland Alliance
Association	*Acer rubrum / Carex stricta - Onoclea sensibilis* Woodland
Association (English name)	Red Maple / Tussock Sedge - Sensitive Fern Woodland
Ecological System(s)	Northern Appalachian-Acadian Conifer-Hardwood Acidic Swamp (CES201.574) North-Central Appalachian Acidic Swamp (CES202.604)

* Alliance assignment as of 2007. All USNVC alliances are currently (2014) under review and revision.

GLOBAL DESCRIPTION

Concept Summary: This association is a partly wooded, deciduous-canopy wetland of the northeastern United States. It occurs on muck soils or mineral soils with a surface organic layer in poorly drained depressions influenced by groundwater. It is also common in those streamside and lakeside settings where the hydrology is that of a basin setting rather than a floodplain. The community is typically flooded in spring, with pools and small streams persisting throughout much of the growing season; soils may remain saturated or may become dry on the surface over the course of the growing season. Hummock-and-hollow topography may be pronounced. The canopy consists of scattered trees, with as little as 25% overall cover. The shrub layer is patchy and may be extensive in places. The herb layer is typically well-developed, with ferns and graminoids dominant. The bryophyte cover is variable. *Acer rubrum* (red maple) is dominant in the canopy, often with many standing dead trees, and may be the only canopy species present.

Associated trees may include *Fraxinus nigra* (black ash), *Ulmus americana* (American elm), and occasional *Pinus strobus* (eastern white pine), *Tsuga canadensis* (eastern hemlock), or *Picea rubens* (red spruce). The shrub layer is characterized by *Vaccinium corymbosum* (highbush blueberry), *Spiraea alba var. latifolia* (white meadowsweet), and *Ilex verticillata* (common winterberry). The herbaceous layer is typically dominated by the graminoids or the ferns. *Sphagnum* (sphagnum) spp. are the characteristic bryophytes, with non-sphagnous mosses as associates. These woodlands are ecologically similar to both *Acer rubrum / Nemopanthus mucronatus - Vaccinium corymbosum* Forest (CEGL006220) and *Picea rubens - Acer rubrum / Nemopanthus mucronatus* Forest (CEGL006198), but those are closed-canopy wetlands. This association does not include red maple wooded wetlands on deeper peat soils [see *Acer rubrum / Alnus incana - Ilex verticillata / Osmunda regalis* Woodland (CEGL006395) and *Acer rubrum - Larix laricina / Rhamnus alnifolia* Woodland (CEGL006118)].

Environmental Description: This association is a partly wooded, deciduous-canopy wetland of central and northern New England. It occurs on muck soils or mineral soils with a surface organic layer, in poorly drained depressions influenced by groundwater. It is also common in those streamside and lakeside settings where the hydrology is that of a basin setting rather than a floodplain. The community is typically flooded in spring, with pools and small streams persisting throughout much of the growing season; soils may remain saturated, or may become dry on the surface over the course of the growing season. Hummock-and-hollow topography may be pronounced.

Vegetation Description: The canopy consists of scattered trees, with as little as 25% overall cover. The shrub layer is patchy and may be extensive in places. The herb layer is typically well-developed, with ferns and graminoids dominant. The bryophyte cover is variable. *Acer rubrum* (red maple) is dominant in the canopy, often with many standing dead trees. Associated trees may include *Fraxinus nigra* (black ash), *Ulmus americana* (American elm), and occasional *Pinus strobus* (eastern white pine), *Tsuga canadensis* (eastern hemlock), or *Picea rubens* (red spruce). The shrub layer is characterized by *Vaccinium corymbosum* (highbush blueberry), *Spiraea alba var. latifolia* (white meadowsweet), and *Ilex verticillata* (common winterberry). Other shrubs may be locally common, including *Nemopanthus mucronatus* (catberry), *Viburnum nudum var. cassinoides* (withe-rod), *Viburnum dentatum* (southern arrow-wood), *Lyonia ligustrina* (maleberry), *Alnus incana* (gray alder), *Ilex laevigata* (smooth winterberry), and the creeping *Rubus hispidus* (bristly dewberry). The herbaceous layer is typically dominated by the graminoids *Carex stricta* (upright sedge), *Carex lacustris* (hairy sedge), or *Calamagrostis canadensis* (bluejoint) or the ferns *Onoclea sensibilis* (sensitive fern), *Osmunda cinnamomea* (cinnamon fern), or *Osmunda claytoniana* (interrupted fern). Less abundant herbs include *Carex intumescens* (greater bladder sedge), *Carex folliculata* (northern long sedge), *Carex canescens* (silvery sedge), *Carex trisperma* (threeseeded sedge), *Glyceria striata* (fowl mannagrass), *Osmunda regalis* (royal fern), *Dryopteris cristata* (crested woodfern), *Thelypteris palustris* (eastern marsh fern), *Lycopus uniflorus* (northern bugleweed), *Symplocarpus foetidus* (skunk-cabbage), *Galium palustre* (common marsh bedstraw), *Cicuta bulbifera* (bulblet-bearing water hemlock), *Caltha palustris* (yellow marsh-marigold), and *Impatiens capensis* (jewelweed). *Sphagnum* (sphagnum) spp. are the characteristic bryophytes, with non-sphagnous mosses as associates.

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Acer rubrum* (red maple)

Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Ilex verticillata* (common winterberry), *Vaccinium corymbosum* (highbush blueberry)
Short shrub/sapling	Broad-leaved deciduous shrub	*Spiraea alba* var. *latifolia* (white meadowsweet)
Herb (field)	Graminoid	*Calamagrostis canadensis* (bluejoint), *Carex lacustris* (hairy sedge), *Carex stricta* (upright sedge)
Herb (field)	Fern or fern ally	*Onoclea sensibilis* (sensitive fern), *Osmunda cinnamomea* (cinnamon fern), *Osmunda claytoniana* (interrupted fern)

Characteristic Species: *Acer rubrum* (red maple), *Ilex verticillata* (common winterberry), *Onoclea sensibilis* (sensitive fern), *Spiraea alba* var. *latifolia* (white meadowsweet), *Vaccinium corymbosum* (highbush blueberry)
Other Noteworthy Species: Information not available.
USFWS Wetland System: Palustrine.

DISTRIBUTION
Range: This wetland is found in central and northern New England, south to Pennsylvania and New Jersey.
States/Provinces: CT, DE, MA, ME, NH, NJ, NY, PA, RI, VT
Federal Lands: NPS (Cape Cod, Minute Man); USFWS (Erie, Great Meadows, Great Swamp, Moosehorn, Oxbow)

CONSERVATION STATUS
Rank: G3G5 (1-Dec-1997)
Reasons: Information not available.

CLASSIFICATION INFORMATION
Status: Standard
Confidence: 2 - Moderate
Comments: Information not available.
Similar Associations:
- *Acer rubrum / Carex lacustris* Woodland (CEGL006105)
- *Acer rubrum / Nemopanthus mucronatus - Vaccinium corymbosum* Forest (CEGL006220)
- *Acer rubrum / Rhododendron viscosum - Clethra alnifolia* Forest (CEGL006156)

Related Concepts:
- *Acer rubrum / Vaccinium corymbosum / Carex intumescens* Alluvial Forest (Barrett and Enser 1997) ?
- Palustrine Broad-leaved Deciduous Forested Wetlands (PFO1) (Cowardin et al. 1979) ?
- Red Maple: 108 (Eyre 1980) B
- Red maple wooded sedge/fern marsh (CAP pers. comm. 1998) ?
- Southern New England stream bottom forest (Rawinski 1984) ?

SOURCES
Description Authors: S.C. Gawler
References: Barrett and Enser 1997, CAP pers. comm. 1998, Cowardin et al. 1979, Eastern Ecology Working Group n.d., Edinger et al. 2002, Eyre 1980, Fike 1999, Gawler 2002, Golet et al. 1993, Hunt 1999, Metzler and Barrett 2001, Moore and Taylor 1927, Rawinski 1984, Sperduto 2000a, Sperduto 2000b, Swain and Kearsley 2001, Thompson and Sorenson 2000

Figure F-26. Red Maple / Tussock Sedge Wooded Marsh (plot ROVA.34). 09/09/2003. NAD 1983 / UTM-18 easting 591302, northing 4624065.

Local Name: Southern New England / Northern Piedmont Red Maple Seepage Swamp (CEGL006406)

SYNONYMS

USNVC English Name:	**Red Maple - (Green Ash, White Ash) / Northern Spicebush / Skunk-cabbage Forest**
USNVC Scientific Name:	***Acer rubrum - Fraxinus* (*pennsylvanica, americana*) / *Lindera benzoin* / *Symplocarpus foetidus* Forest**
USNVC Identifier:	**CEGL006406**

LOCAL INFORMATION

Environmental Description: This association occurs frequently throughout the park, either as relatively small wetland basins on muck substrates at the toe of upland forests, or as wet silty soil palustrine forests along intermittent streams that can resemble the structure of floodplain forests. The largest examples of this type are at Val-Kill, but this type also occurs very commonly as small pockets within Roosevelt Farm and Forest. Several examples of this forest type are quite weedy in nature, being close in proximity to development and cultural natural communities. The underlying bedrock is Ordovician shale and siltstone with minor amounts of sandstone, Austin Glen Formation. Since this type is very common as small pockets within basins of upland forests, many adjacent associations occur. The closely related wetland association occurring adjacent to this type is Red Maple / Tussock Sedge Wooded Marsh (CEGL006119). Adjacent upland associations include, but not limited to, Semi-rich Northern Hardwood Forest (CEGL006211), Red Oak - Northern Hardwood Forest (CEGL006173), Central Appalachian Hemlock - Chestnut Oak Forest (CEGL006923), White Pine Plantation (CEGL007178), and Hemlock - Northern Hardwood Forest (CEGL006109).

Vegetation Description: The tree canopy of this forested wetland averages 62% and 23.8 meters in height. The tree canopy is dominated by *Acer rubrum* (red maple), *Fraxinus pennsylvanica* (green ash) with minor associates *Ulmus americana* (American elm) and *Quercus bicolor* (swamp white oak). The tree subcanopy layer averages 31.8% cover and 13 meters in height. The dominant species include species found in the canopy layer, plus *Carpinus caroliniana* (American hornbeam). The tall shrub layer averages 31.6% cover and 3.2 meters in height. This layer is characterized by *Lindera benzoin* (northern spicebush), *Fraxinus pennsylvania* (green ash), *Ilex verticillata* (common winterberry), *Carpinus caroliniana* (American hornbeam), and *Viburnum lentago* (nannyberry). The short shrub layer averages 32.7% cover and is characterized by many of the same species found in the tall shrub layer. The most abundant species include *Lindera benzoin* (northern spicebush), *Lonicera tatarica* (Tatarian honeysuckle), *Fraxinus pennsylvanica* (green ash), *Cephalanthus occidentalis* (common buttonbush), and *Rubus hispidus* (bristly dewberry). The vine layer averages 17.7% cover and is characterized by *Toxicodendron radicans* (eastern poison ivy) and *Parthenocissus quinquefolia* (Virginia creeper). The herbaceous layer averages 53.3% cover with characteristic species that include *Onoclea sensibilis* (sensitive fern), *Lysimachia nummularia* (creeping jenny), *Symplocarpus foetidus* (skunk cabbage), *Boehmeria cylindrica* (smallspike false nettle), *Carex stricta* (upright sedge), *Osmunda regalis* (royal fern), and *Thelypteris palustris* (eastern marsh fern).

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy/subcanopy	Broad-leaved deciduous tree	*Acer rubrum* (red maple), *Fraxinus pennsylvanica* (green ash), *Ulmus americana* (American elm)
Tree subcanopy	Broad-leaved deciduous tree	*Carpinus caroliniana* (American hornbeam)
Tall shrub/sapling	Broad-leaved deciduous shrub	*Ilex verticillata* (common winterberry)
Tall/short shrub/sapling	Broad-leaved deciduous shrub	*Lindera benzoin* (northern spicebush)
Tall/short shrub/sapling	Broad-leaved deciduous tree	*Fraxinus pennsylvanica* (green ash)
Short shrub/sapling	Broad-leaved deciduous shrub	*Lonicera tatarica* (Tatarian honeysuckle), *Cephalanthus occidentalis* (common buttonbush)
Herb (field)	Vine/liana	*Toxicodendron radicans* (eastern poison ivy), *Parthenocissus quinquefolia* (Virginia creeper)
Herb (field)	Forb	*Lysimachia nummularia* (creeping jenny), *Symplocarpus foetidus* (skunk cabbage), *Boehmeria cylindrica* (smallspike false nettle)
Herb (field)	Graminoid	*Carex stricta* (upright sedge)
Herb (field)	Fern and fern ally	*Osmunda regalis* (royal fern), *Onoclea sensibilis* (sensitive fern), *Thelypteris palustris* (eastern marsh fern)

Characteristic Species: *Acer rubrum* (red maple), *Fraxinus pennsylvanica* (green ash), *Lindera benzoin* (northern spicebush), *Onoclea sensibilis* (sensitive fern), *Symplocarpus foetidus* (skunk cabbage)

Other Noteworthy Species: None.

Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
NY	S4S5*	B	1	Red Maple-Hardwood Swamp	Edinger et al. 2002

Local Range: This association is documented at all units except for Vanderbilt Mansion NHS, and is most abundant at Roosevelt Farm and Forest and Val-Kill.

Classification Comments: This association was used to classify forested wetlands with a combination of species *Acer rubrum* (red maple), *Fraxinus pennsylvanica* (green ash), *Lindera benzoin* (northern spicebush), and *Symplocarpus foetidus* (skunk cabbage).

Other Comments: None.

Local Description Authors: Frederick C. Sechler, Jr.

Plots: Roosevelt Farm and Forest (ROVA.92, ROVA.104, ROVA.110, ROVA.115, ROVA.125, ROVA.126, ROVA.139), Home of Franklin D. Roosevelt NHS (excluding Roosevelt Farm and Forest) (ROVA.58, ROVA.59), Val-Kill (ROVA.28, ROVA.29, ROVA.32, ROVA.41).

AA Points: Roosevelt Farm and Forest **(**ROVA.148, ROVA.176, ROVA.179, ROVA.212), Home of Franklin D. Roosevelt NHS (excluding Roosevelt Farm and Forest) (ROVA.49, ROVA.55), Val-Kill (ROVA.124, ROVA.128).

Roosevelt-Vanderbilt National Historic Site Inventory Notes: None.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Class	Forest and Woodland (1)
Subclass	Temperate Forest (1.C)
Formation	Temperate Flooded and Swamp Forest (1.C.3)
Division	Eastern North American Flooded and Swamp Forest (D011)
Macrogroup	Northern and Central Swamp Forest (M030)
Group	Northern and Central Conifer and Hardwood Acidic Swamp Group (G045)
Alliance*	*Acer rubrum - Fraxinus pennsylvanica* Saturated Forest Alliance (A.3035)
Alliance (English name)*	Red Maple - Green Ash Saturated Forest Alliance
Association	*Acer rubrum - Fraxinus (pennsylvanica, americana) / Lindera benzoin / Symplocarpus foetidus* Forest
Association (English name)	Red Maple - (Green Ash, White Ash) / Northern Spicebush / Skunk-cabbage Forest
Ecological System(s)	North-Central Appalachian Acidic Swamp (CES202.604) Central Appalachian Stream and Riparian (CES202.609) Northern Atlantic Coastal Plain Stream and River (CES203.070)

* Alliance assignment as of 2007. All USNVC alliances are currently (2014) under review and revision.

GLOBAL DESCRIPTION

Concept Summary: This association is a seepage swamp dominated by *Acer rubrum* (red maple) and ranging from southern New England south to the Piedmont of Virginia. It generally occurs in saturated situations on slightly sloping hillsides, along small streams, or in basins that receive overland flooding in addition to groundwater influence. In general, these swamps are moderately acidic to moderately basic and have some seepage indicators but are not particularly species-rich. Soils are shallow to moderately deep mucks over mineral soils. *Acer rubrum* (red maple) dominates the canopy; *Fraxinus pennsylvanica* (green ash) or *Fraxinus americana* (white ash) are usually also found in the canopy. *Fraxinus nigra* (black ash) is not generally associated with this type and, if present, occurs only as scattered individuals. Other canopy or subcanopy associates may include *Liriodendron tulipifera* (tuliptree), *Quercus bicolor* (swamp white oak), *Quercus palustris* (pin oak), *Prunus serotina* (black cherry), *Fagus grandifolia* (American beech), *Betula lenta* (sweet birch), *Ulmus americana* (American elm), and *Ulmus rubra* (slippery elm). Conifers such as *Tsuga canadensis* (eastern hemlock) or *Pinus strobus* (eastern white pine) are generally absent or occur in very low abundance. The shrub layer may be fairly open to quite dense, depending on the amount of canopy closure. Shrub species commonly include *Ilex verticillata* (common winterberry), *Rhododendron viscosum* (swamp azalea), *Clethra alnifolia* (coastal sweet-pepperbush), *Lindera benzoin* (northern spicebush), *Cornus amomum* (silky dogwood), *Alnus serrulata* (hazel alder), and less commonly *Vaccinium corymbosum* (highbush blueberry), *Lyonia ligustrina* (maleberry), *Ilex montana* (mountain holly), *Toxicodendron vernix* (poison-sumac), *Viburnum dentatum* (southern arrow-wood), and *Viburnum nudum var. cassinoides* (withe-rod). The herbaceous layer is variable in cover; *Symplocarpus foetidus* (skunk-cabbage) and *Osmunda cinnamomea* (cinnamon fern) are nearly always present. In some areas, tall ferns (*Osmunda cinnamomea* (cinnamon fern), *Onoclea sensibilis* (sensitive fern), *Osmunda regalis* (royal fern), *Thelypteris palustris* (eastern marsh fern), *Thelypteris noveboracensis* (New York fern)) form an herbaceous canopy within which other species are scattered. Microtopography is generally pronounced, resulting from tip-ups. Tree seedlings and *Sphagnum* (sphagnum) mosses are common on hummocks but do not in general form extensive carpets. Additional nonvascular species can include *Plagiomnium cuspidatum* (toothed plagiomnium moss) and *Calliergon* (calliergon moss) spp. Invasive shrubs and herbs, including

Berberis thunbergii (Japanese barberry), *Rosa multiflora* (multiflora rose), *Lonicera morrowii* (Morrow's honeysuckle), *Alliaria petiolata* (garlic mustard), and *Microstegium vimineum* (Nepalese browntop), may be abundant.

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

Vegetation Description: *Acer rubrum* (red maple) dominates the canopy; *Fraxinus pennsylvanica* (green ash) or *Fraxinus americana* (white ash) are usually also found in the canopy. *Fraxinus nigra* (black ash) is not generally associated with this type and, if present, occurs only as scattered individuals. Other canopy or subcanopy associates may include *Liriodendron tulipifera* (tuliptree), *Quercus bicolor* (swamp white oak), *Quercus palustris* (pin oak), *Prunus serotina* (black cherry), *Fagus grandifolia* (American beech), *Betula lenta* (sweet birch), *Ulmus americana* (American elm), and *Ulmus rubra* (slippery elm). Conifers such as *Tsuga canadensis* (eastern hemlock) or *Pinus strobus* (eastern white pine) are generally absent or occur in very low abundance. The shrub layer may be fairly open to quite dense, depending on the amount of canopy closure. Shrub species commonly include *Ilex verticillata* (common winterberry), *Rhododendron viscosum* (swamp azalea), *Clethra alnifolia* (coastal sweet-pepperbush), *Lindera benzoin* (northern spicebush), *Cornus amomum* (silky dogwood), *Alnus serrulata* (hazel alder), *Carpinus caroliniana* (American hornbeam), and less commonly *Vaccinium corymbosum* (highbush blueberry), *Lyonia ligustrina* (maleberry), *Ilex montana* (mountain holly), *Toxicodendron vernix* (poison-sumac), *Viburnum dentatum* (southern arrow-wood), and *Viburnum nudum var. cassinoides* (withe-rod). The herbaceous layer is variable in cover; *Symplocarpus foetidus* (skunk-cabbage) and *Osmunda cinnamomea* (cinnamon fern) are nearly always present. In some areas, tall ferns (*Osmunda cinnamomea* (cinnamon fern), *Onoclea sensibilis* (sensitive fern), *Osmunda regalis* (royal fern), *Thelypteris palustris* (eastern marsh fern), *Thelypteris noveboracensis* (New York fern)) form an herbaceous canopy within which other species are scattered. These other herbaceous species include *Impatiens capensis* (jewelweed), *Galium aparine* (stickywilly), *Geum canadense* (white avens), *Arisaema triphyllum* (Jack in the pulpit), *Carex stricta* (upright sedge), *Carex gracillima* (graceful sedge), *Carex intumescens* (greater bladder sedge), *Carex radiata* (eastern star sedge), *Carex laevivaginata* (smoothsheath sedge), *Veratrum viride* (green false hellebore), *Boehmeria cylindrica* (small-spike false nettle), *Chelone glabra* (white turtlehead), *Cardamine pensylvanica* (Pennsylvania bittercress), *Pilea pumila* (Canadian clearweed), and *Glyceria* (mannagrass) spp. At the southern end of the range in Maryland and Virginia, *Symplocarpus foetidus* (skunk-cabbage) is usually greatly dominant (>50% cover) early in the growing season, with *Saururus cernuus* (lizard's-tail) frequently assuming patch-dominance during the summer. Tree seedlings and *Sphagnum* (sphagnum) mosses are common on hummocks but do not in general form extensive carpets. Additional nonvascular species can include *Plagiomnium cuspidatum* (toothed plagiomnium moss) and *Calliergon* (calliergon moss) spp. Invasive shrubs and herbs, including *Berberis*

thunbergii (Japanese barberry), *Rosa multiflora* (multiflora rose), *Lonicera morrowii* (Morrow's honeysuckle), *Alliaria petiolata* (garlic mustard), and *Microstegium vimineum* (Nepalese browntop), may be abundant.

Most Abundant Species:

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

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

Other Noteworthy Species: Information not available.

USFWS Wetland System: Palustrine.

DISTRIBUTION

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

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

Federal Lands: NPS (Appomattox Court House, C&O Canal, Delaware Water Gap, Fort Necessity, Gateway, George Washington Parkway, Indiana Dunes, Minute Man, Morristown, National Capital-East?, Prince William, Rock Creek, Roosevelt-Vanderbilt, Upper Delaware, Weir Farm, Wolf Trap); USFWS (Great Meadows?, Iroquois, Montezuma)

CONSERVATION STATUS

Rank: G4G5 (30-Jan-2007)

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

CLASSIFICATION INFORMATION

Status: Standard

Confidence: 1 - Strong

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

Similar Associations:

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

Related Concepts:

- Inland Red Maple Swamp (Breden 1989) B
- Palustrine Broad-leaved Deciduous Forested Wetlands (PFO1) (Cowardin et al. 1979) ?

- Red or Silver Maple-Green Ash Swamp (Thompson 1996) ?
- Southern New England stream bottom forest (Rawinski 1984) ?

SOURCES

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

References: Breden 1989, Breden et al. 2001, Cowardin et al. 1979, Eastern Ecology Working Group n.d., Edinger et al. 2002, Ehrenfeld 1977, Enser 1993, Fleming 2007, Golet et al. 1993, Harrison 2004, Lea and Riley 2005, Metzler and Barrett 2001, NRCS 2001, NRCS 2004, Rawinski 1984, Reschke 1990, Sperduto and Nichols 2004, Swain and Kearsley 2001, Thompson 1996, Thompson and Sorenson 2000.

Figure F-27. Southern New England / Northern Piedmont Red Maple Seepage Swamp (plot ROVA.41). 09/10/2003. NAD 1983 / UTM-18 easting 591312, northing 4624243.

Local Name: Northeastern Pin Oak - Swamp White Oak Forest (CEGL006240)

SYNONYMS

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

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

USNVC Identifier: **CEGL006240**

LOCAL INFORMATION

Environmental Description: The lone example of this forested wetland type occurs at unit Val-Kill. This wetland occurs as a basin on muck substrate in close proximity to a parking lot near suburban development. The underlying bedrock is Ordovician shale and siltstone with minor amounts of sandstone in the Austin Glen Formation. Associated upland associations include Dry, Rich Oak - Hickory Forest (CEGL006236) and the cultural Hardwood Plantation (CEGL006613).

Vegetation Description: This closed canopy forested wetland has a tree canopy of 80% cover and height of 22 meters. The canopy is dominated by *Acer rubrum* (red maple) and *Quercus bicolor* (swamp white oak). The subcanopy, 45% cover and 14.5 meters in height, is characterized by *Acer rubrum* (red maple), *Ulmus americana* (American elm), and *Fraxinus pennsylvanica* (green ash). The sparse tall shrub layer is 20% cover, and is dominated heavily by *Ilex verticillata* (common winterberry). The denser short shrub layer averages 35% cover and is characterized by *Ilex verticillata* (common winterberry), *Vaccinium corymbosum* (highbush blueberry), *Viburnum dentatum* (southern arrowwood), and *Rhododendron viscosum* (swamp azalea). The sparse vine layer is 6% cover and is dominated by *Parthenocissus quinquefolia* (Virginia creeper). The herbaceous layer is 28% cover and is characterized by *Osmunda regalis* (royal fern), *Onoclea sensibilis* (sensitive fern), and *Thelypteris palustris* (eastern marsh fern).

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Quercus bicolor* (swamp white oak)
Tree canopy/subcanopy	Broad-leaved deciduous tree	*Acer rubrum* (red maple)
Tall shrub/sapling	Broad-leaved deciduous shrub	*Ilex verticillata* (common winterberry)
Short shrub/sapling	Broad-leaved deciduous shrub	*Ilex verticillata* (common winterberry), *Vaccinium corymbosum* (highbush blueberry)
Herb (field)	Vine/liana	*Parthenocissus quinquefolia* (Virginia creeper
Herb (field)	Fern and fern ally	*Osmunda regalis* (royal fern), *Onoclea sensibilis* (sensitive fern), *Thelypteris palustris* (eastern marsh fern)

Characteristic Species: *Quercus bicolor* (swamp white oak), *Acer rubrum* (red maple), *Ilex verticillata* (common winterberry), *Osmunda regalis* (royal fern).

Other Noteworthy Species: None.

Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
NY	S4S5*	B		Red Maple-Hardwood Swamp	Edinger et al. 2002

Local Range: This association was only documented at Val-Kill and is likely rare, if present at all, elsewhere within ROVA.
Classification Comments: This association was used to classify palustrine forests with a co-dominance of *Quercus bicolor* (swamp white oak) and *Acer rubrum* (red maple) in the canopy layers.
Other Comments: None
Local Description Authors: Frederick C. Sechler, Jr.
Plots: Val-Kill (ROVA.26)
AA Points: Val-Kill (ROVA.119)
Roosevelt-Vanderbilt National Historic Site Inventory Notes: None.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Class	Forest and Woodland (1)
Subclass	Temperate Forest (1.C)
Formation	Temperate Flooded and Swamp Forest (1.C.3)
Division	Eastern North American Flooded and Swamp Forest (D011)
Macrogroup	Northern and Central Swamp Forest (M030)
Group	Central Flatwoods and Pond Forest Group (G597)
Alliance*	*Quercus palustris - (Quercus bicolor)* Seasonally Flooded Forest Alliance (A.329)
Alliance (English name)*	Pin Oak - (Swamp White Oak) Seasonally Flooded Forest Alliance
Association	*Quercus palustris - (Quercus bicolor) - Acer rubrum / Vaccinium corymbosum / Osmunda cinnamomea* Forest
Association (English name)	Pin Oak - (Swamp White Oak) - Red Maple / Highbush Blueberry / Cinnamon Fern Forest
Ecological System(s)	North-Central Interior Wet Flatwoods (CES202.700) Northern Atlantic Coastal Plain Basin Swamp and Wet Hardwood Forest (CES203.520)

* Alliance assignment as of 2007. All USNVC alliances are currently (2014) under review and revision.

GLOBAL DESCRIPTION

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

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

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

Most Abundant Species:

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

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

Other Noteworthy Species: Information not available.

USFWS Wetland System: Palustrine

DISTRIBUTION

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

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

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

CONSERVATION STATUS

Rank: GNR (1-Dec-1997)

Reasons: Information not available.

CLASSIFICATION INFORMATION

Status: Standard

Confidence: 2 - Moderate

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

Similar Associations:

- *Liquidambar styraciflua - Acer rubrum - Quercus phellos / Leucothoe racemosa* Forest (CEGL006110)--similar to occurrences at the southern end of the range; occurs in Coastal Plain depressions of the Chesapeake Bay region.
- *Quercus palustris - (Fraxinus nigra) / Lindera benzoin / Carex bromoides* Forest (CEGL007399)
- *Quercus palustris - Acer rubrum / Carex grayi - Geum canadense* Forest (CEGL006185)
- *Quercus palustris - Quercus bicolor / Carex tribuloides - Carex radiata - (Carex squarrosa)* Forest (CEGL006497)
- *Quercus palustris - Quercus bicolor / Viburnum prunifolium / Leersia virginica - Impatiens capensis* Forest (CEGL004643)

Related Concepts: Information not available.

SOURCES

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

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

Figure F-28. Northeastern Pin Oak - Swamp White Oak Forest (AA point ROVA.119). 09/13/2006. NAD 1983 / UTM-18 easting 591663, northing 4623993.

Local Name: Northeastern Old Field (CEGL006107)

SYNONYMS

USNVC English Name: **Orchard Grass - Timothy - Fescue species - Goldenrod species Herbaceous Vegetation**

USNVC Scientific Name: ***Dactylis glomerata* - *Phleum pratense* - *Festuca* spp. - *Solidago* spp. Herbaceous Vegetation**

USNVC Identifier: **CEGL006107**

LOCAL INFORMATION

Environmental Description: This association is present in this park as a result of either management and/or abandonment of agricultural lands. This herbaceous dominated upland occurs mostly on silt loam and loamy soils with underlying bedrock of Ordovician shale and siltstone with minor amounts of sandstone, Austin Glen Formation. Adjacent upland associations include Northeastern Oak - Red Maple Successional Forest (CEGL006506), High Allegheny Rich Red Oak - Sugar Maple Forest (CEGL006125), Hardwood Plantation (CEGL006407), Mixed Conifer Plantation (CEGL006313), and White Pine Plantation (CEGL007178). Adjacent wetland associations include Purple Loosestrife Marsh (CEGL006403), and Northeastern Buttonbush Shrub Swamp (CEGL006069).

Vegetation Description: This herbaceous dominated upland type typically occurs on abandoned agricultural and/or mowed fields. The short shrub layer averages 5.9% cover and is characterized by *Rubus flagellaris* (northern dewberry). The dense herbaceous layer averages 94.8% cover. The most abundant species include *Bromus inermis* (smooth brome), *Solidago canadensis* (Canada goldenrod), *Solidago rugosa* (wrinkleleaf goldenrod), *Festuca rubra* (red fescue), *Dactylis glomerata* (orchardgrass), *Tridens flavus* (purpletop tridens), *Galium mollugo* (false baby's breath), *Apocynum cannabinum* (Indianhemp), *Origanum vulgare* (oregano), and *Fragaria virginiana* (Virginia strawberry), and *Agrostis stolonifera* (creeping bentgrass).

Most Abundant Species:

Stratum	Lifeform	Species
Short shrub/sapling	Broad-leaved deciduous shrub	*Rubus flagellaris* (northern dewberry)
Herb (field)	Graminoid	*Bromus inermis* (smooth brome), *Festuca rubra* (red fescue), *Dactylis glomerata* (orchardgrass)
Herb (field)	Forb	*Solidago canadensis* (Canada goldenrod), *Solidago rugosa* (wrinkleleaf goldenrod)

Characteristic Species: *Dactylis glomerata* (orchard-grass).

Other Noteworthy Species: None.

Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
NY	S4*	U	2	Successional Old Field	Edinger et al. 2002

Local Range: This upland association occurs sporadically throughout all four units where managed old fields and abandoned agricultural fields occur.

Classification Comments: This old field is classified by using a variety of species, including *Dactylis glomerata* (orchardgrass) and/or *Festuca* spp. (fescue).

Other Comments: None.

Local Description Authors: Frederick C. Sechler, Jr.

Plots: Roosevelt Farm and Forest (ROVA.106), Home of Franklin D. Roosevelt NHS (excluding Roosevelt Farm and Forest) (ROVA.74), Val-Kill (ROVA.33, ROVA.83), Vanderbilt Mansion NHS (ROVA.54).
AA Points: Vanderbilt Mansion NHS (ROVA.4, ROVA.19), Roosevelt Farm and Forest (ROVA.151, ROVA.153), Home of Franklin D. Roosevelt NHS (excluding Roosevelt Farm and Forest (ROVA.57)
Roosevelt-Vanderbilt National Historic Site Inventory Notes: None.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Class	Shrubland and Grassland (2)
Subclass	Temperate and Boreal Shrubland and Grassland (2.C)
Formation	Temperate Grassland, Meadow, and Shrubland (2.C.1)
Division	Eastern North American Grassland, Meadow, and Shrubland (D024)
Macrogroup	Eastern North American Ruderal Grassland and Shrubland (M123)
Group	Northern and Central Ruderal Meadow and Shrubland Group (G059)
Alliance*	*Dactylis glomerata* - *Rumex acetosella* Herbaceous Alliance (A.1190)
Alliance (English name)*	Orchard Grass - Common Sheep Sorrel Herbaceous Alliance
Association	*Dactylis glomerata* - *Phleum pratense* - *Festuca* spp. - *Solidago* spp. Herbaceous Vegetation
Association (English name)	Orchard Grass - Timothy - Fescue species - Goldenrod species Herbaceous Vegetation
Ecological System(s)	Semi-natural / Altered Vegetation and Conifer Plantations (CES203.074)

* Alliance assignment as of 2007. All USNVC alliances are currently (2014) under review and revision.

GLOBAL DESCRIPTION

Concept Summary: This broadly defined vegetation type includes pastures and post-agricultural fields and is largely composed of non-native cool-season grasses and herbs (generally of European origin) in the early stages of succession. The fields are typically mowed at least annually. Physiognomically, these grasslands are generally comprised of mid-height (1-3 feet tall) grasses and forbs, with occasional scattered shrubs. Species composition varies from site to site, depending on land-use history and perhaps soil type, but in general this vegetation is quite wide-ranging in northeastern and midwestern states and at higher elevations (610-1220 m [2000-4000 feet]) in the southeastern states. Dominant grasses vary from site to site but generally feature the nominal species. Other graminoid associates may include *Agrostis stolonifera* (creeping bentgrass), *Agrostis hyemalis* (winter bentgrass), *Elymus repens* (quackgrass), *Bromus inermis* (smooth brome), *Bromus tectorum* (cheatgrass), *Lolium perenne* (perennial ryegrass), *Poa pratensis* (Kentucky bluegrass), *Poa compressa* (Canada bluegrass), *Schizachyrium scoparium* (little bluestem) (not in abundance), and *Anthoxanthum odoratum* (sweet vernalgrass). Forbs scattered among the grasses are varied but include *Hieracium* (hawkweed) spp., *Oxalis stricta* (common yellow oxalis), *Achillea millefolium* (common yarrow), *Asclepias syriaca* (common milkweed), *Solidago rugosa* (wrinkleleaf goldenrod), *Solidago nemoralis* (gray goldenrod), *Solidago juncea* (early goldenrod), *Solidago canadensis* (Canada goldenrod), *Solidago altissima*, *Euthamia graminifolia* (flat-top goldentop), *Cerastium arvense* (field chickweed), *Oenothera biennis* (common evening-primrose), *Potentilla simplex* (common cinquefoil), *Symphyotrichum lateriflorum* (calico aster), *Symphyotrichum novae-angliae* (New England aster), *Symphyotrichum lanceolatum* (white panicle aster), *Daucus carota* (Queen Anne's lace), *Ambrosia artemisiifolia* (annual ragweed), *Vicia cracca* (bird vetch), *Trifolium* (clover) spp., and many others.

Environmental Description: This association occurs on pastures and land that has been tilled. Generally the fields are mowed at least annually.

Vegetation Description: In addition to *Dactylis glomerata* (orchardgrass) and *Phleum pratense* (timothy), these grassy fields are characterized by graminoids including *Agrostis stolonifera* (creeping bentgrass), *Agrostis hyemalis* (winter bentgrass), *Elymus repens* (quackgrass), *Bromus inermis* (smooth brome), *Bromus tectorum* (cheatgrass), *Lolium perenne* (perennial ryegrass), *Poa pratensis* (Kentucky bluegrass), *Poa compressa* (Canada bluegrass), *Schizachyrium scoparium* (little bluestem) (not in abundance), and *Anthoxanthum odoratum* (sweet vernalgrass). Forbs scattered among the grasses are varied but include *Hieracium* (hawkweed) spp., *Oxalis stricta* (common yellow oxalis), *Achillea millefolium* (common yarrow), *Asclepias syriaca* (common milkweed), *Solidago rugosa* (wrinkleleaf goldenrod), *Solidago nemoralis* (gray goldenrod), *Solidago juncea* (early goldenrod), *Solidago canadensis* (Canada goldenrod), *Solidago altissima*, *Euthamia graminifolia* (flat-top goldentop), *Cerastium arvense* (field chickweed), *Oenothera biennis* (common evening-primrose), *Potentilla simplex* (common cinquefoil), *Symphyotrichum lateriflorum* (calico aster), *Symphyotrichum novae-angliae* (New England aster), *Symphyotrichum lanceolatum* (white panicle aster), *Daucus carota* (Queen Anne's lace), *Ambrosia artemisiifolia* (annual ragweed), *Vicia cracca* (bird vetch), *Trifolium* (clover) spp., and many others.

Most Abundant Species:

Stratum	Lifeform	Species
Herb (field)	Forb	*Rumex acetosella* (common sheep sorrel)
Herb (field)	Graminoid	*Dactylis glomerata* (orchardgrass), *Festuca rubra* (red fescue), *Phleum pratense* (timothy)

Characteristic Species: *Achillea millefolium* (common yarrow), *Anthoxanthum odoratum* (sweet vernalgrass), *Dactylis glomerata* (orchardgrass), *Euthamia graminifolia* (flat-top goldentop), *Phleum pratense* (timothy), *Rumex acetosella* (common sheep sorrel), *Solidago canadensis* (Canada goldenrod), *Solidago canadensis* var. *scabra* (tall goldenrod), *Solidago rugosa* (wrinkleleaf goldenrod)

Other Noteworthy Species:

Species	GRank	Type	Note
Anthoxanthum odoratum (sweet vernalgrass)	-	plant	exotic
Bromus tectorum (cheatgrass)	-	plant	exotic
Dactylis glomerata (orchardgrass)	-	plant	exotic
Daucus carota (Queen Anne's lace)	-	plant	exotic
Elymus repens (quackgrass)	-	plant	exotic
Lolium perenne (perennial ryegrass)	-	plant	exotic
Phleum pratense (timothy)	-	plant	exotic
Poa compressa (Canada bluegrass)	-	plant	exotic

USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: This vegetation is quite wide-ranging in northeastern and midwestern states and possibly occurs at higher elevations in the southeastern states.

States/Provinces: CT, DE, KY, MA, MD, ME, NB?, NH, NJ, NS?, NY, PA, QC?, RI, TN, VA, VT, WV

Federal Lands: NPS (Allegheny Portage Railroad, Appomattox Court House, Booker T. Washington, Boston Harbor Islands, Cape Cod, Colonial, Delaware Water Gap, Fire Island, Fort Necessity, Fredericksburg-Spotsylvania, Friendship Hill, Gateway, George Washington

Birthplace, Gettysburg, Johnstown Flood, Marsh-Billings-Rockefeller, Minute Man, Morristown, Petersburg, Richmond, Saint-Gaudens, Roosevelt-Vanderbilt, Upper Delaware, Valley Forge, Weir Farm); USFWS (Aroostook, Assabet River, Cape May, Carlton Pond, Erie, Great Meadows, Iroquois, Montezuma, Moosehorn, Nulhegan Basin, Oxbow, Parker River, Supawna Meadows)

CONSERVATION STATUS

Rank: GNA (modified/managed) (8-Dec-2005)
Reasons: This vegetation type includes pasture and post-agricultural fields and is largely composed of non-native grasses and herbs (generally of European origin).

CLASSIFICATION INFORMATION

Status: Standard
Confidence: 3 - Weak
Comments: *Schizachyrium scoparium - (Andropogon virginicus) - Solidago* spp. Herbaceous Vegetation (CEGL006333) is similar to this type but is dominated by warm-season grasses.
Similar Associations:

- *Lolium (arundinaceum, pratense)* Herbaceous Vegetation (CEGL004048)
- *Panicum virgatum - (Andropogon virginicus)* Herbaceous Vegetation (CEGL006616)
- *Phleum pratense - Bromus pubescens - Helenium autumnale* Herbaceous Vegetation (CEGL004018)
- *Schizachyrium scoparium - (Andropogon virginicus) - Solidago* spp. Herbaceous Vegetation (CEGL006333)--has a greater component of native species and occurs on drier soils.

Related Concepts: Information not available.

SOURCES

Description Authors: S.C. Gawler
References: Clark 1986, Dowhan and Rozsa 1989, Eastern Ecology Working Group n.d., Edinger et al. 2002, Ehrenfeld 1977, Elliman 2003, Keever 1979, NRCS 2004, Perles et al. 2006a, Perles et al. 2006b, Perles et al. 2006c, Perles et al. 2007, Sneddon et al. 1995, TDNH unpubl. Data

Figure F-29. Northeastern Old Field (plot ROVA.106). 07/03/2007. NAD 1983 / UTM-18 easting 590714, northing 4624019.

Local Name: Northeastern Successional Shrubland (CEGL006451)

SYNONYMS

USNVC English Name: **Autumn Olive - Gray Dogwood - Multiflora Rose - Eastern Red-cedar Shrubland**

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

USNVC Identifier: **CEGL006451**

LOCAL INFORMATION

Environmental Description: This successional shrubland occurs either as abandoned successional old fields or maintained powerline right-of-ways. The environmental settings are as variable as the vegetation, but typically occur on silt loam and/or loamy soils on underlying bedrock comprised of shale and siltstone with minor amounts of sandstone of the Ordovician Formation. Adjacent associations include White Pine Plantation (CEGL007178), Red Oak - Northern Hardwood Forest (CEGL006173), Dry, Rich Oak - Hickory Forest (CEGL006236), Hardwood Plantation (CEGL006407), and Northeastern Oak - Red Maple Successional Forest (CEGL006506).

Vegetation Description: The tall shrub layer averages 30.8% and 2.8 meters in height. Characteristic species are extremely variable according to site, but the most abundant species at Roosevelt Farm and Forest include *Betula alleghaniensis* (yellow birch), *Rubus allegheniensis* (Allegheny blackberry), *Lonicera tatarica* (Tatarian honeysuckle), and *Rhus hirta* (staghorn sumac). The short shrub layer averages 56.3% cover and 1.2 meters in height. The most abundant species include the two most abundant species in the tall shrub layer, plus *Rosa multiflora* (multiflora rose) and *Viburnum acerifolium* (mapleleaf viburnum). The vine layer averages 11.8% cover and is characterized by *Vitis* spp. (grape), *Parthenocissus quinquefolia* (Virginia creeper), and *Vitis labrusca* (fox grape). The herbaceous layer averages 40.5% cover and is characterized by *Dennstaedtia punctilobula* (eastern hayscented fern), *Anthoxanthum odoratum* (sweet vernalgrass), *Solidago* sp. (goldenrod) and *Solidago rugosa* (wrinkleleaf goldenrod).

Most Abundant Species:

Stratum	Lifeform	Species
Tall/short shrub/sapling	Broad-leaved deciduous tree	*Betula alleghaniensis* (yellow birch)
Tall/short shrub/sapling	Broad-leaved deciduous shrub	*Rubus alleghaniensis* (Allegheny blackberry), *Lonicera tatarica* (Tatarian honeysuckle)
Herb (field)	Vine/liana	*Vitis sp.* (grape), *Parthenocissus quinquefolia* (Virginia creeper)
Herb (field)	Fern and ally	*Dennstaedtia punctilobula* (eastern hayscented fern)
Herb (field)	Graminoid	*Anthoxanthum odoratum* (sweet vernalgrass)

Characteristic Species: *Rubus alleghaniensis* (Allegheny blackberry), *Rhus hirta* (staghorn sumac), *Vitis* sp. (grape), *Rosa multiflora* (multiflora rose).

Other Noteworthy Species: None.

Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
NY	S4*	I	1	Successional Shrubland	Edinger et al. 2002

Local Range: This shrubland association occurs along right-of-way power lines at Roosevelt Farm and Forest and likely in other areas in the park where disturbance has occurred and/or successional old fields that have been left abandoned.
Classification Comments: This association is the only one available to describe dry shrublands with a variable species composition.
Other Comments: None.
Local Description Authors: Frederick C. Sechler, Jr.
Plots: Roosevelt Farm and Forest (ROVA.99, ROVA.112).
AA Points: Roosevelt Farm and Forest (ROVA.164, ROVA.194).
Roosevelt-Vanderbilt National Historic Site Inventory Notes: None.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Class	Shrubland and Grassland (2)
Subclass	Temperate and Boreal Shrubland and Grassland (2.C)
Formation	Temperate Grassland, Meadow, and Shrubland (2.C.1)
Division	Eastern North American Grassland, Meadow, and Shrubland (D024)
Macrogroup	Eastern North American Ruderal Grassland and Shrubland (M123)
Group	Northern and Central Ruderal Meadow and Shrubland Group (G059)
Alliance*	*Cornus drummondii* Shrubland Alliance (A.3558)
Alliance (English name)*	Roughleaf Dogwood Shrubland Alliance
Association	*Elaeagnus umbellata - Cornus racemosa - Rosa multiflora - Juniperus virginiana* Shrubland
Association (English name)	Autumn Olive - Gray Dogwood - Multiflora Rose - Eastern Red-cedar Shrubland
Ecological System(s)	Semi-natural / Altered Vegetation and Conifer Plantations (CES203.074)

* Alliance assignment as of 2007. All USNVC alliances are currently (2014) under review and revision.

GLOBAL DESCRIPTION

Concept Summary: This association comprises shrubby old fields dominated by thickets of *Elaeagnus angustifolia* (Russian olive), *Cornus racemosa* (gray dogwood), *Viburnum prunifolium* (blackhaw), *Lonicera japonica* (Japanese honeysuckle), *Lonicera morrowii* (Morrow's honeysuckle), *Ligustrum vulgare* (European privet), *Euonymus alatus* (winged burning bush), *Rosa multiflora* (multiflora rose), *Rhus glabra* (smooth sumac), and *Rhus hirta* (staghorn sumac), with patches of herbaceous vegetation among the shrubs. Shorter shrubs include *Berberis thunbergii* (Japanese barberry) and *Rubus* (blackberry) spp., and in some fields *Gaylussacia baccata* (black huckleberry), *Vaccinium pallidum* (Blue Ridge blueberry), *Vaccinium stamineum* (deerberry), and/or *Vaccinium angustifolium* (lowbush blueberry). Small trees are often present but form <25% cover; they include *Juniperus virginiana* (eastern red-cedar), *Betula populifolia* (gray birch), *Prunus virginiana* (chokecherry), *Cornus florida* (flowering dogwood), *Acer rubrum* (red maple), *Juglans nigra* (black walnut), *Prunus serotina* (black cherry), *Robinia pseudoacacia* (black locust), and *Fraxinus americana* (white ash). The herbaceous layer is variable depending on the density of shrub cover. Typical species are those associated with old fields, grasslands, and agricultural sites. Common species include *Solidago rugosa* (wrinkleleaf goldenrod), *Solidago gigantea* (giant goldenrod), *Solidago nemoralis* (gray goldenrod), *Monarda fistulosa* (wild bergamot), *Anthoxanthum odoratum* (sweet vernalgrass), *Poa pratensis* (Kentucky bluegrass), *Oxalis stricta* (common yellow oxalis), *Viola sororia* (common blue violet), *Euthamia graminifolia* (flat-top goldentop), *Festuca rubra* (red fescue),

Schizachyrium scoparium (little bluestem), *Pycnanthemum virginianum* (Virginia mountainmint), *Alliaria petiolata* (garlic mustard), *Galium mollugo* (false baby's breath), *Potentilla simplex* (common cinquefoil), *Achillea millefolium* (common yarrow), *Daucus carota* (Queen Anne's lace), *Trifolium repens* (white clover), *Bromus inermis* (smooth brome), *Agrostis gigantea* (redtop), and *Elymus repens* (quackgrass), among many others. Vines can be absent or dominant, sometimes covering the tall and short shrubs. Common vines are *Vitis aestivalis* (summer grape), *Vitis labrusca* (fox grape), *Toxicodendron radicans* (eastern poison-ivy), *Celastrus orbiculata* (Asian bittersweet), *Parthenocissus quinquefolia* (Virginia creeper), and *Lonicera japonica* (Japanese honeysuckle).

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

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

Most Abundant Species:

Stratum	Lifeform	Species

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

Characteristic Species: *Anthoxanthum odoratum* (sweet vernalgrass), *Celastrus orbiculata* (Asian bittersweet), *Cornus racemosa* (gray dogwood), *Elaeagnus umbellata* (autumn olive), *Juniperus virginiana* (eastern red-cedar), *Monarda fistulosa* (wild bergamot), *Rhus glabra* (smooth sumac), *Rhus hirta* (staghorn sumac), *Rosa multiflora* (multiflora rose), *Solidago canadensis* var. *scabra* (tall goldenrod), *Solidago rugosa* (wrinkleleaf goldenrod), *Vitis aestivalis* (summer grape)
Other Noteworthy Species: Information not available.
USFWS Wetland System: Not applicable.

DISTRIBUTION
Range: This community is common in former agricultural areas in the northeastern U.S.
States/Provinces: CT, DE, MA, NJ, NY, PA
Federal Lands: NPS (Delaware Water Gap, Gateway, Roosevelt-Vanderbilt, Upper Delaware, Valley Forge); USFWS (Cape May, Iroquois, Montezuma, Prime Hook, Supawna Meadows)

CONSERVATION STATUS
Rank: GNA (ruderal) (23-Jun-2006)
Reasons: Information not available.

CLASSIFICATION INFORMATION
Status: Standard
Confidence: 2 - Moderate
Comments: This is a broadly defined type intended for shrubby vegetation on abandoned cropland or pasture.
Similar Associations:
- *Cornus (amomum, sericea) - Viburnum dentatum - Rosa multiflora* Shrubland (CEGL006576)

Related Concepts: Information not available.

SOURCES
Description Authors: S.C. Gawler
References: Eastern Ecology Working Group n.d., Keever 1979, NRCS 2001, NRCS 2004, Overlease 1987.

Figure F-30. Northeastern Successional Shrubland (plot ROVA.112). 07/04/2007. NAD 1983 / UTM-18 easting 590450, northing 4624305.

Local Name: Eastern Woodland Vernal Pool (CEGL006453)

SYNONYMS

USNVC English Name: **Eastern Woodland Vernal Pool Sparse Vegetation**
USNVC Scientific Name: **Eastern Woodland Vernal Pool Sparse Vegetation [Provisional]**
USNVC Identifier: **CEGL006453**

LOCAL INFORMATION

Environmental Description: This association is characterized by seasonally fluctuating water levels and may dry completely in summer. Vegetation reaches maximum abundance in late summer when pools gradually dry. Hydrology may be affected by impermeable soils, seasonally high water tables, seasonal flooding in nearby streams and drainages, and/or impervious bedrock at or near the surface. The substrate associated with most vernal pools is mineral soil with or without a layer of muck, with underlying bedrock of Ordovician shale and siltstone with minor amounts of sandstone, Austin Glen Formation. Vernal pools occurring within this park are typically located on lowslope areas of rolling topography surrounded by upland associations that include Hemlock - Beech - Oak Forest (CEGL006088), Hemlock / White Pine - Red Oak - Mixed Hardwood Forest (CEGL006566), High Allegheny Rich Red Oak - Sugar Maple Forest (CEGL006125), Red Oak - Northern Hardwood Forest (CEGL006173), and Semi-rich Northern Hardwood Forest (CEGL006211).

Vegetation Description: The vegetation described here is somewhat confined to the periphery of the vernal pool. The percentage of tree canopy and subcanopy is calculated as the percentage that is over hanging the pool. However, some shrub and herbaceous species grow directly within the pool, and these species are generally documented in late summer as the pools dry. The tree canopy layer averages 25.8% cover and 25.3 meters in height. The most abundant species include *Acer rubrum* (red maple), *Acer saccharum* (sugar maple), *Quercus bicolor* (swamp white oak), and *Fraxinus pennsylvanica* (green ash). The tree subcanopy layer averages 11.8% cover and 14.4 meters in height. The most abundant species in this layer include the same abundant species in the tree canopy. The tall shrub layer averages 9.4% cover and 2.6 meters in height. The most abundant species include *Cephalanthus occidentalis* (common buttonbush), *Vaccinium corymbosum* (highbush blueberry) and *Ilex verticillata* (common winterberry). The short shrub layer averages 13.6% cover and is dominated by *Cephalanthus occidentalis* (common buttonbush), with minor associates that include *Lindera benzoin* (northern spicebush) and *Vaccinium corymbosum* (highbush blueberry). The sparse vine layer averages 2.1% cover and is dominated by *Smilax rotundifolia* (roundleaf greenbrier). The herbaceous layer averages 8.8% cover and is characterized by *Osmunda regalis* (royal fern), *Carex stricta* (upright sedge), *Boehmeria cylindrica* (smallspike false nettle) and *Osmunda cinnamomea* (cinnamon fern). The unvegetated surface averages 12.3% with water, litter, wood, and mud as the most abundant components.

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy/subcanopy	Broad-leaved deciduous tree	*Acer rubrum* (red maple), *Acer saccharum* (sugar maple)
Tall/short shrub/sapling	Broad-leaved deciduous shrub	*Cephalanthus occidentalis* (common buttonbush),

Tall shrub/sapling	Broad-leaved deciduous shrub	*Vaccinium corymbosum* (highbush blueberry)
Herb (field)	Vine	*Smilax rotundifolia* (roundleaf greenbrier)
Herb (field)	Fern and ally	*Osmunda regalis* (royal fern), *Carex stricta* (upright sedge), *Boehmeria cylindrica* (smallspike false nettle)

Characteristic Species: *Acer rubrum* (red maple), *Vaccinium corymbosum* (highbush blueberry), *Smilax rotundifolia* (roundleaf greenbrier), *Osmunda regalis* (royal fern)

Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
NY	S3S4*	B	1	Vernal Pool	Edinger et al. 2002

Local Range: This woodland vernal pool association is most common at Home of Franklin D. Roosevelt NHS (including Roosevelt Farm and Forest), but at least one vernal pool complex was documented at Val-Kill. This association was also documented at Vanderbilt Mansion NHS.

Classification Comments: This association is not classified to a specific suite of plant species; instead, they are generally defined by their invertebrate and amphibian communities, plus landscape and abiotic characteristics.

Other Comments: None.

Local Description Authors: Frederick C. Sechler, Jr.

Plots: Roosevelt Farm and Forest (ROVA.94, ROVA.101, ROVA.117, ROVA.133, ROVA.136, ROVA.140), and Home of Franklin D. Roosevelt NHS (excluding Roosevelt Farm and Forest) (ROVA.60).

AA Points: Roosevelt Farm and Forest (ROVA.182, ROVA.192, ROVA.193, ROVA.199, ROVA.213), Home of Franklin D. Roosevelt (excluding Roosevelt Farm and Forest) (ROVA.50, ROVA.77, ROVA.98, ROVA.100), Val-Kill (ROVA.118), Vanderbilt Mansion (ROVA.38).

Roosevelt-Vanderbilt National Historic Site Inventory Notes: None.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Class	Shrubland and Grassland (2)
Subclass	Temperate and Boreal Shrubland and Grassland (2.C)
Formation	Temperate and Boreal Scrub and Herb Coastal Vegetation (2.C.3)
Division	Eastern North American Dune and Coastal Grassland and Shrubland (D026)
Macrogroup	Eastern North American Beach, Shoreline, and Flat (M176)
Group	Eastern North American Lake Flat and Beach Group (G342)
Alliance*	Non-tidal Mudflat Seasonally/Temporarily Flooded Sparsely Vegetated Alliance (A.1878)
Alliance (English name)*	Non-tidal Mudflat Seasonally/Temporarily Flooded Sparsely Vegetated Alliance
Association	Eastern Woodland Vernal Pool Sparse Vegetation [Provisional]
Association (English name)	Eastern Woodland Vernal Pool Sparse Vegetation
Ecological System(s)	Information not available.

* Alliance assignment as of 2007. All USNVC alliances are currently (2014) under review and revision.

GLOBAL DESCRIPTION

Concept Summary: This association is characterized by seasonally fluctuating water levels; it may dry out completely in the summer. Hydrology may be affected by impermeable soils, seasonally high water tables, seasonal flooding in nearby streams and drainages, and/or impervious bedrock at or near the surface. The substrate is mineral soil with or without a layer of

muck. The species composition is variable among sites, as well as annually and seasonally. Larger examples of this community type may exhibit strong zonation. Many smaller, shaded vernal ponds are unvegetated, their bottoms consisting of dead leaves and algae.

Environmental Description: This association is characterized by seasonally fluctuating water levels; it may dry out completely in the summer. Hydrology may be affected by impermeable soils, seasonally high water tables, seasonal flooding in nearby streams and drainages, and/or impervious bedrock at or near the surface. The substrate in most vernal pools is mineral soil with or without a layer of muck, but some are boulder-filled depressions. Boulder vernal pools may dry out completely in the summer, and their hydrology is controlled by impervious bedrock below the boulderfield.

Vegetation Description: The species composition is variable among sites, variable annually, and variable seasonally. Larger examples may exhibit strong zonation. Many smaller, shaded vernal ponds are unvegetated, their bottoms consisting of dead leaves and algae. Cover may be sparse and often varies through the season. Species composition is extremely variable, and of the species listed below, only a few are likely to be found on any one site. Typical representatives include *Dulichium arundinaceum* (threeway sedge), *Glyceria* (mannagrass) sp., *Leersia oryzoides* (rice cutgrass), *Scirpus cyperinus* (woolgrass), *Lycopus uniflorus* (northern bugleweed), *Polygonum* (knotweed) spp., *Thelypteris palustris* (eastern marsh fern), *Carex gynandra* (nodding sedge), *Carex crinita* (fringed sedge), *Carex leptonervia* (nerveless woodland sedge), *Carex stipata* (owlfruit sedge), *Carex canescens* (silvery sedge), *Carex vesicaria* (blister sedge), *Juncus effusus* (common rush), *Bidens* (beggarticks) spp., *Hypericum mutilum* (dwarf St. Johnswort), *Hypericum canadense* (lesser Canadian St. Johnswort), *Osmunda cinnamomea* (cinnamon fern), *Osmunda regalis* (royal fern), *Agrostis scabra* (rough bentgrass), *Utricularia geminiscapa* (hiddenfruit bladderwort), *Triadenum virginicum* (Virginia marsh St. Johnswort), *Sagittaria* (arrowhead) sp., and *Eleocharis* (spikerush) spp. Although this community type is predominantly herbaceous, shrubs and small trees may be present. Typical woody species include *Vaccinium corymbosum* (highbush blueberry), *Lyonia ligustrina* (maleberry), *Quercus palustris* (pin oak), *Nyssa sylvatica* (blackgum), *Acer rubrum* (red maple), *Salix* (willow) spp., *Cephalanthus occidentalis* (common buttonbush), and *Ilex verticillata* (common winterberry).

Most Abundant Species:

Stratum	Lifeform	Species
Tall shrub/sapling	Broad-leaved deciduous shrub	*Ilex verticillata* (common winterberry), *Vaccinium corymbosum* (highbush blueberry)
Short shrub/sapling	Broad-leaved deciduous shrub	*Cephalanthus occidentalis* (common buttonbush)
Herb (field)	Forb	*Sagittaria latifolia* (broadleaf arrowhead)
Herb (field)	Graminoid	*Juncus effusus* (common rush), *Leersia oryzoides* (rice cutgrass)
Herb (field)	Fern or fern ally	*Thelypteris palustris* (eastern marsh fern)

Characteristic Species: *Cephalanthus occidentalis* (common buttonbush), *Leersia oryzoides* (rice cutgrass), *Sagittaria latifolia* (broadleaf arrowhead), *Thelypteris palustris* (eastern marsh fern)

Other Noteworthy Species:

Species	GRank	Type	Note
Scirpus ancistrochaetus (barbedbristle bulrush)	G3	plant	Federally listed endangered

USFWS Wetland System: Palustrine.

DISTRIBUTION

Range: This association occurs in the northeastern U.S., and presumably in adjacent Canada, primarily in glaciated or periglacial areas, from Quebec and New Brunswick south through New York to northern Pennsylvania and northern New Jersey.
States/Provinces: CT, MA, ME, NH, NJ, NY, PA, RI, VT
Federal Lands: NPS (Acadia, Delaware Water Gap, Sagamore Hill, Roosevelt-Vanderbilt); USFWS (Cape May, Erie, Great Swamp)

CONSERVATION STATUS

Rank: GNR (8-Feb-2006)
Reasons: Information not available.

CLASSIFICATION INFORMATION

Status: Provisional
Confidence: 3 - Weak
Comments: Recognition of vernal pool associations is complicated not only by the lack of good data but by the seasonal and spatial variability in composition. The largest factor, however, is that vernal pools are generally defined by their invertebrate and amphibian communities and often do not have characteristic suites of plant species. This type should be considered tentative pending more data.
Similar Associations: Information not available.
Related Concepts: Information not available.

SOURCES

Description Authors: S.C. Gawler
References: Colburn 2004, Eastern Ecology Working Group n.d., Fike 1999, NRCS 2004, Soil Conservation Service 1987, Thompson and Sorenson 2000

Figure F-31. Eastern Woodland Vernal Pool (Reference Point ROVA.5). 08/13/2003. NAD 1983 / UTM-18 easting 587575, northing 4624798.

Local Name: Northern Riverside Rock Outcrop (CEGL006284)

SYNONYMS

USNVC English Name: **Big Bluestem - Bluebell Bellflower - Sticky Goldenrod Sparse Vegetation**

USNVC Scientific Name: ***Andropogon gerardii - Campanula rotundifolia - Solidago simplex Sparse Vegetation***

USNVC Identifier: **CEGL006284**

LOCAL INFORMATION

Environmental Description: At ROVA, this association occurs on extremely rocky and temporarily flooded shoreline outcrops along the Hudson River in the northern part of Vanderbilt Mansion NHS. The soils are dry silt loams with underlying bedrock of Ordovician shale and siltstone with minor amounts of sandstone, Austin Glen Formation. Adjacent upland associations include Red Oak - Heath Woodland / Rocky Summit (CEGL006134) and Northeastern Dry Oak-Hickory Forest (CEGL006336). One adjacent wetland association includes Open Water Marsh with Mixed Submergents/Emergents (CEGL006196).

Vegetation Description: The sparse tall shrub layer averages 3.5% cover and 1.4 meters in height. The main two species characterizing this shrub layer include *Amorpha fruticosa* (desert false indigo) and *Juniperus virginiana* (eastern red-cedar). The short shrub layer averages 21.8% cover and 1.1 meters in height. The most abundant species within this layer include *Amorpha fruticosa* (desert false indigo), *Physocarpus opulifolius* (common ninebark) and *Thuja occidentalis* (northern white cedar). The herbaceous layer averages 16.3% cover and is characterized by *Schizachyrium scoparium* (little bluestem), *Trichostema dichotomum* (forked bluecurls), *Andropogon gerardii* (big bluestem), *Zizia aurea* (golden zizia), *Symphyotrichum lateriflorum* (calico aster), *Poa compressa* (Canada bluegrass) and *Lythrum salicaria* (purple loosestrife). The non-vascular layer has 6.3% cover with lichens and bryophytes as the most abundant components.

Most Abundant Species:

Stratum	Lifeform	Species
Tall/short shrub/sapling	Broad-leaved deciduous tree	*Amorpha fruticosa* (desert false indigo)
Short shrub/sapling	Needle-leaved tree	*Juniperus virginiana* (eastern red-cedar)
Short shrub/sapling	Broad-leaved deciduous shrub	*Physocarpus opulifolius* (common ninebark)
Herb (field)	Graminoid	*Schizachyrium scoparium* (little bluestem), *Andropogon gerardii* (big bluestem)
Herb (field)	Forb	*Trichostema dichotomum* (forked bluecurls)

Characteristic Species: *Juniperus virginiana* (eastern red-cedar), *Schizachyrium scoparium* (little bluestem).

Other Noteworthy Species: None.

Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
NY	SNR			Shoreline outcrop	Edinger et al. 2002

Local Range: This association appears to be restricted to unit Vanderbilt Mansion NHS where rocky outcrops occur along the Hudson River.

Classification Comments: Several dominant and characteristic herbaceous species from this association was used in classifying the shoreline outcrops at Vanderbilt Mansion NHS. This type was used to classify shoreline outcrops along the Delaware River.
Other Comments: None.
Local Description Authors: Frederick C. Sechler, Jr.
Plots: Vanderbilt Mansion NHS (ROVA.11, ROVA.13).
AA Points: Vanderbilt Mansion NHS (ROVA.14, ROVA.15, ROVA.16).
Roosevelt-Vanderbilt National Historic Site Inventory Notes: None.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Class	Shrubland and Grassland (2)
Subclass	Temperate and Boreal Shrubland and Grassland (2.C)
Formation	Temperate and Boreal Scrub and Herb Coastal Vegetation (2.C.3)
Division	Eastern North American Dune and Coastal Grassland and Shrubland (D026)
Macrogroup	Eastern North American Beach, Shoreline, and Flat (M176)
Group	Eastern North American River Shoreline Group (G343)
Alliance*	*Andropogon gerardii* - (*Sorghastrum nutans*) Temporarily Flooded Herbaceous Alliance (A.1337)
Alliance (English name)*	Big Bluestem - (Indiangrass) Herbaceous Alliance
Association	*Andropogon gerardii – Campanula rotundifolia – Solidago simplex* Sparse Vegetation
Association (English name)	Big Bluestem – Bluebell Bellflower – Sticky Goldenrod Sparse Vegetation
Ecological System(s)	Laurentian-Acadian Floodplain Forest (CES201.587) Central Appalachian Stream and Riparian (CES202.609)

* Alliance assignment as of 2007. All USNVC alliances are currently (2014) under review and revision.

GLOBAL DESCRIPTION

Concept Summary: This riverside rock outcrop community of the northeastern U.S. occurs on open flood-scoured bedrock exposures of major rivers, typically along river narrows. Emergent seepage is absent. Typically a gradient from dry acidic conditions higher on the bank to moist, fairly enriched conditions lower down may exist at any one site. This community is prone to flooding in the upper regions and deposition in the topographically lower areas. It is also prone to severe drought periods that may stress or kill some vegetation. Within the community, the species are distributed patchily, probably due to microsite conditions. The variability in species composition has not been measured, but it shows substantial variation from site to site and from year to year. Vegetation is typically sparse and occurs in the cracks and crevices of the bedrock. Typical vegetation is a mixture of riparian species, xeric-loving crevice plants, and calciphiles. Characteristic species include *Andropogon gerardii* (big bluestem), *Schizachyrium scoparium* (little bluestem), *Campanula rotundifolia* (bluebell bellflower), *Solidago simplex* (sticky goldenrod), *Toxicodendron radicans* (eastern poison-ivy), *Ionactis linariifolius* (flaxleaf aster), *Sisyrinchium montanum* (strict blue-eyed-grass), *Packera paupercula (= Senecio pauperculus)* (balsam ragwort), and *Prunus pumila* (sand cherry). Other associates include *Anemone virginiana* var. *riparia (= Anemone virginiana* var. *alba) pumila* (river anemone), *Symphyotrichum lateriflorum* (starved aster), *Carex crawei* (Crawe's sedge), *Carex crawfordii* (Crawford's sedge), *Potentilla arguta* (tall cinquefoil), *Arabis lyrata* (lyrleaf rockcress), *Aquilegia canadensis* (wild columbine), *Cornus amomum* (silky dogwood), *Euthamia graminifolia* (flat-top fragrant goldenrod), *Juncus debilis* (weak rush), and *Eupatorium perfoliatum* (common boneset), among others. *Astragalus robbinsii* var. *jesupii* (Jesup's milkvetch),occurs in limited areas along the upper Connecticut River. These sites are susceptible

to invasion by *Lythrum salicaria* (purple loosestrife) and *Melilotus officinalis (= Melilotus alba)* (sweetclover). This association is more temperate than the related *Campanula rotundifolia - Packera paupercula - (Aquilegia canadensis)* Sparse Vegetation (CEGL006532), which occurs on near-boreal rivers and lacks prairie elements such as *Andropogon gerardii*.

Environmental Description: This sparse vegetation occurs on open flood-scoured bedrock exposures of major rivers, typically along river narrows. Emergent seepage is absent. Typically a gradient from dry acidic conditions higher on the bank to moist, fairly enriched conditions lower down may exist at any one site. This community is prone to flooding in the upper regions and deposition in the topographically lower areas. It is also prone to severe drought periods that may stress or kill some vegetation.

Vegetation Description: This community is essentially a rock outcrop with a bit of soil development in the lower reaches. Within the community, the species are distributed patchily, probably due to microsite conditions. The variability in species composition has not been measured but shows substantial variation both spatially and temporally. Vegetation is typically sparse and occurs in the cracks and crevices of the bedrock. Typical vegetation is a mixture of riparian species, xeric-loving crevice plants, and calciphiles. Characteristic species include *Andropogon gerardii* (big bluestem), *Schizachyrium scoparium* (little bluestem), *Campanula rotundifolia* (bluebell bellflower), *Solidago simplex* (sticky goldenrod), *Toxicodendron radicans* (eastern poison-ivy), *Ionactis linariifolius* (flaxleaf aster), *Sisyrinchium montanum* (strict blue-eyed-grass), *Packera paupercula (= Senecio pauperculus)* (balsam ragwort), and *Prunus pumila* (sand cherry). Other associates include *Anemone virginiana* var. *riparia (= Anemone virginiana* var. *alba) pumila* (river anemone), *Symphyotrichum lateriflorum* (starved aster), *Carex crawei* (Crawe's sedge), *Carex crawfordii* (Crawford's sedge), *Potentilla arguta* (tall cinquefoil), *Arabis lyrata* (lyrleaf rockcress), *Aquilegia canadensis* (wild columbine), *Cornus amomum* (silky dogwood), *Euthamia graminifolia* (flat-top fragrant goldenrod), *Juncus debilis* (weak rush), and *Eupatorium perfoliatum* (common boneset), among others. *Astragalus robbinsii* var. *jesupii* (Jesup's milkvetch),occurs in limited areas along the upper Connecticut River. These sites are susceptible to invasion by *Lythrum salicaria* (purple loosestrife) and *Melilotus officinalis (= Melilotus alba)* (sweetclover).

Most Abundant Species:
No information available.

Characteristic Species: *Andropogon gerardii* (big bluestem), *Schizachyrium scoparium* (little bluestem), *Campanula rotundifolia* (bluebell bellflower), *Solidago simplex* (sticky goldenrod), *Toxicodendron radicans* (eastern poison-ivy), *Ionactis linariifolius* (flaxleaf aster), *Sisyrinchium montanum* (strict blue-eyed-grass), *Packera paupercula (= Senecio pauperculus)* (balsam ragwort), *Prunus pumila* (sand cherry)

Other Noteworthy Species:

Species	GRank	Type	Note
Astragalus robbinsii var. *jesupii*	G2	plant	Federally listed endangered; globally critically imperiled

USFWS Wetland System: Riverine.

DISTRIBUTION

Range: This community is reported from Vermont, New Hampshire, Maine, Connecticut, New Jersey, Pennsylvania, and New York. It may also occur in Massachusetts.

States/Provinces: CT, MA, ME, NH, NJ, NY, PA, VT.

Federal Lands: NPS (Delaware Water Gap, Upper Delaware, Roosevelt-Vanderbilt NHS)

CONSERVATION STATUS
Rank: G2 (17-Nov-1997)
Reasons: There are probably fewer than 20 occurrences of this community rangewide. Individual occurrences tend to be small, so there are probably fewer than 500 acres rangewide. Currently five occurrences are documented in New Hampshire, with a total acreage of less than 20 acres. Similar vegetation is reported from Vermont, Maine, and New York, but these still need confirmation. This community is restricted to calcareous or basic bedrock outcrops along ice-scoured upper reaches of major rivers such as the Connecticut River in New Hampshire and Vermont, the Kennebec River in Maine, the Hudson River in New York, and the Delaware River in New Jersey.

CLASSIFICATION INFORMATION
Status: Standard
Confidence: 2 - Moderate
Comments: This community may occur in conjunction with seep communities. However, emergent seepage is absent as are the corresponding seepage and wetland plants found in riverside seeps. Sedges are notably lacking. This community differs from rock outcrop/rocky summit communities by the paucity of lichen and woody species intolerant of flooding and the presence of flood-tolerant species on lower, somewhat enriched reaches of the community, where regular erosion and deposition of silty sediments occur.
Similar Associations:
- *Hypericum prolificum, Leucothoe racemosa) / Schizachyrium scoparium- Solidago simplex var. racemosa – Ionactis linariifolius)* Sparse Vegetation (CEGL006491)
- *Campanula rotundifolia - Packera paupercula - (Aquilegia canadensis)* Sparse Vegetation (CEGL006532)
- *Deschampsia caespitosa – Carex viridula* Herbaceous Vegetation (CEGL006969)

Related Concepts:
- Riverine Lower Perennial Emergent Wetland, Seasonally Flooded (R2EMC) (Cowardin et al. 1979) **?**
- Rivershore Grassland (Thompson 1996) **?**
- Riverside Outcrop Community (Thompson 1996) **?**
- SNE Riverside Outcrop Community (Rawinski 1984) **?**

SOURCES
Description Authors: M. Anderson, mod. S.L. Neid, S.C. Gawler, E. Largay
References: Breden 1989, Cowardin et al. 1979, Eastern Ecology Working Group n.d., Edinger et al. 2002, Gawler 2002, Grossman et al. 1994, Metzler and Barrett 2001, Rawinski 1984, Shank and Shreiner 1999, Sperduto 1992, Sperduto and Nichols 2004, Swain and Kearsley 2001, Thompson 1996, Thompson and Sorenson 2000

Figure F-32. Northern Riverside Rock Outcrop (AA point ROVA.14). 08/30/2006. NAD 1983 / UTM-18 easting 587667, northing 4628843.

Local Name: Golden-saxifrage Forested Seep (CEGL006193)

SYNONYMS

USNVC English Name: **American Golden-saxifrage Herbaceous Vegetation**
USNVC Scientific Name: ***Chrysosplenium americanum* Herbaceous Vegetation**
USNVC Identifier: **CEGL006193**

LOCAL INFORMATION

Environmental Description: This association consists of seeps surrounded by mostly forested uplands. The soils are variable with underlying bedrock of Ordovician shale and siltstone with minor amounts of sandstone, Austin Glen Formation. Surrounding upland associations include Central Appalachian Hemlock - Chestnut Oak Forest (CEGL006923). Surrounding wetland associations include Southern New England / Northern Piedmont Red Maple Seepage Swamp (CEGL006406).

Vegetation Description: The sparse tall and short shrub layers average 15% cover and 3 meters/1 meter in height, respectively. The dominant species in these layers is *Lindera benzoin* (northern spicebush). The dense herbaceous layer averages 80% cover and is characterized by the exotic species *Microstegium vimineum* (Japanese stiltgrass), plus *Onoclea sensibilis* (sensitive fern), *Amphicarpaea bracteata* (American hogpeanut), *Thelypteris palustris* (eastern marsh fern), *Carex bromoides* (bromelike sedge), *Erechtites hieraciifolia* (American burnweed), and *Osmunda claytoniana* (interrupted fern).

Most Abundant Species:

Stratum	Lifeform	Species
Tall/short shrub/sapling	Broad-leaved deciduous shrub	*Lindera benzoin* (northern spicebush)
Herb (field)	Forb	*Microstegium vimineum* (Japanese stiltgrass), *Amphicarpaea bracteata* (American hogpeanut)
Herb (field)	Fern and ally	*Onoclea sensibilis* (sensitive fern)

Characteristic Species: *Onoclea sensibilis* (sensitive fern), *Thelypteris palustris* (eastern marsh fern)

Other Noteworthy Species: None.

Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
NY	S4*	B		Intermittent Stream	Edinger et al. 2002
NY	SNR*	F		Spring	Edinger et al. 2002

Local Range: This association was only documented once at Roosevelt Farm and Forest during accuracy assessment. It is possible that this type could be present in other units in the park.

Classification Comments: This association was used to classify micro-habitat seepage vegetation along intermittent streams and springs.

Other Comments: None.

Local Description Authors: Frederick C. Sechler, Jr.

Plots: None.

AA Points: Roosevelt Farm and Forest (ROVA.136)

Roosevelt-Vanderbilt National Historic Site Inventory Notes: None.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Class Shrubland and Grassland (2)

Subclass	Temperate and Boreal Shrubland and Grassland (2.C)	
Formation	Temperate and Boreal Bog and Fen (2.C.4)	
Division	North American Bog and Fen (D029)	
Macrogroup	Appalachian, Interior Plateau, and Prairie Fen (M061)	
Group	Northeastern and Appalachian Forest Seep Group (G189)	
Alliance*	*Chrysosplenium americanum* Saturated Herbaceous Alliance (A.1685)	
Alliance (English name)*	American Golden-saxifrage Saturated Herbaceous Alliance	
Association	*Chrysosplenium americanum* Herbaceous Vegetation	
Association (English name)	American Golden-saxifrage Herbaceous Vegetation	
Ecological System(s)	Appalachian (Hemlock)-Northern Hardwood Forest (CES202.593)	
	Central and Southern Appalachian Spruce-Fir Forest (CES202.028)	High
	Allegheny Wetland (CES202.069)	

* Alliance assignment as of 2007. All USNVC alliances are currently (2014) under review and revision.

GLOBAL DESCRIPTION

Concept Summary: This type includes small herbaceous seepage areas with scattered cover of forbs. Herbs are strongly dominant and tend to be relatively diverse, especially where there is greater enrichment. Characteristic species can include *Chrysosplenium americanum* (American golden saxifrage), *Cardamine bulbosa* (bulbous bittercress), *Circaea alpina* (small enchanter's nightshade), *Viola cucullata* (marsh blue violet), *Chelone glabra* (white turtlehead), *Glyceria melicaria* (melic mannagrass), *Glyceria striata* (fowl mannagrass), *Cinna arundinacea* (sweet woodreed), *Impatiens capensis* (jewelweed), *Poa paludigena* (bog bluegrass), *Carex scabrata* (eastern rough sedge), *Mimulus ringens* (Allegheny monkeyflower), *Symplocarpus foetidus* (skunk-cabbage), *Pilea pumila* (Canadian clearweed), *Galium triflorum* (fragrant bedstraw), *Saxifraga pensylvanica* (eastern swamp saxifrage), *Thelypteris noveboracensis* (New York fern), *Veratrum viride* (green false hellebore), *Hydrocotyle americana* (American marshpennywort), *Onoclea sensibilis* (sensitive fern), *Laportea canadensis* (Canadian woodnettle), *Arisaema triphyllum* (Jack in the pulpit), *Tiarella cordifolia* (heartleaf foamflower), *Carex gynandra* (nodding sedge), *Geum rivale* (purple avens), and the mosses *Rhizomnium punctatum* (rhizomnium moss), *Rhizomnium appalachianum* (Appalachian rhizomnium moss), *Brachythecium rivulare* (brachythecium moss), *Thuidium delicatulum* (delicate thuidium moss), *Steerecleus serrulatus* (steerecleus moss), and *Bryhnia novae-angliae* (New England bryhnia moss). Typically the community is over-topped by trees and shrubs from the surrounding forest, although large examples will be open.
Environmental Description: Information not available.
Vegetation Description: Information not available.
Most Abundant Species: Information not available.
Characteristic Species: Information not available.
Other Noteworthy Species: Information not available.
USFWS Wetland System: Palustrine.

DISTRIBUTION

Range: This association occurs throughout the eastern United States.
States/Provinces: CT, DE, MA, MD, NH, NY, PA, RI, VA, VT, WV:S3
Federal Lands: USFS (Monongahela)

CONSERVATION STATUS

Rank: G3G5 (1-Dec-1997)
Reasons: Information not available.

CLASSIFICATION INFORMATION

Status: Standard
Confidence: 3 - Weak
Comments: This association currently comprises all forested seeps, springs and intermittent streams; when further data are available regionally, more associations can be teased apart.
Similar Associations:

- *Carex scabrata - Viola cucullata / Plagiomnium ciliare* Herbaceous Vegetation (CEGL006597)
- *Symplocarpus foetidus - Impatiens capensis* Herbaceous Vegetation (CEGL006567)

Related Concepts:

- *Betula alleghaniensis* var. *alleghaniensis / Impatiens capensis - Chrysosplenium americanum - (Symplocarpus foetidus) / Rhizomnium appalachianum* forest seep (Byers et al. 2007) =
- *Symplocarpus foetidus / Brachythecium rivulare - Hygroamblystegium tenax* Herbaceous Vegetation (Clancy 1996) F
- Golden saxifrage forested seep (CAP pers. comm. 1998) ?

SOURCES

Description Authors: Eastern Ecology Group
References: Bowman 2000, Byers et al. 2007, CAP pers. comm. 1998, Clancy 1996, DeMeo et al. 1998, Eastern Ecology Working Group n.d., Edinger et al. 2002, Fike 1999, Harrison 2004, Metzler and Barrett 2001, Schafale 1998, Sperduto 2000a, Swain and Kearsley 2000, Thompson and Sorenson 2000.

Figure F-33. Golden-saxifrage Forested Seep (AA point ROVA.136). 06/17/2008. NAD 1983 / UTM-18 easting 589576, northing 4625182.

Local Name: Skunk Cabbage - Orange Jewelweed Seep (CEGL006567)

SYNONYMS

USNVC English Name: **Skunk-cabbage - Orange Jewelweed Herbaceous Vegetation**
USNVC Scientific Name: ***Symplocarpus foetidus* - *Impatiens capensis* Herbaceous Vegetation**
USNVC Identifier: **CEGL006567**

LOCAL INFORMATION

Environmental Description: This association occurs as micro-habitat seepages along intermittent streams and springs that are intermittently flooded. These seepages allow for a more mesic suite of species compared to the surrounding forest. They occur on loamy soils on underlying bedrock of Ordovician shale and siltstone with minor amounts of sandstone, Austin Glen Formation. Surrounding associations include Hemlock / White Pine - Red Oak - Mixed Hardwood Forest (CEGL006566), and High Allegheny Rich Red Oak - Sugar Maple Forest (CEGL006125).

Vegetation Description: The tree canopy layer averages 60% cover and 26 meters in height. The most abundant species include *Quercus coccinea* (scarlet oak), *Tilia americana* (American basswood), *Acer saccharum* (sugar maple), and *Acer rubrum* (red maple). The tree subcanopy layer averages 40% cover and 16 meters in height. Characteristic species include *Quercus rubra* (northern red oak), *Carya glabra* (pignut hickory) and *Magnolia tripetala* (umbrella-tree) as the most abundant species. The tall shrub layer averages 20% cover and 2.5 meters in height. The dense short shrub layer averages 60% cover. The most abundant species in both of these layers includes *Magnolia tripetala* (umbrella-tree) and *Lindera benzoin* (northern spicebush). The herbaceous layer is relatively sparse, averaging 30% cover. Characteristic species include *Impatiens capensis* (jewelweed), *Pilea pumila* (Canadian clearweed) and *Symplocarpus foetidus* (skunk cabbage).

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Quercus coccinea* (scarlet oak), *Tilia americana* (American basswood), *Acer saccharum* (sugar maple)
Tree subcanopy	Broad-leaved deciduous tree	*Quercus rubra* (northern red oak), *Carya glabra* (pignut hickory), *Magnolia tripetala* (umbrella-tree)
Tall/short shrub/sapling	Broad-leaved deciduous tree	*Magnolia tripetala* (umbrella-tree)
Tall/short shrub/sapling	Broad-leaved deciduous shrub	*Lindera benzoin* (northern spicebush)
Herb (field)	Forb	*Impatiens capensis* (jewelweed), *Pilea pumila* (Canadian clearweed), and *Symplocarpus foetidus* (skunk cabbage)

Characteristic Species: *Symplocarpus foetidus* (skunk-cabbage) and *Impatiens capensis* (jewelweed)

Other Noteworthy Species: None.

Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
NY	S4*	B	1	Intermittent Stream	Edinger et al. 2002

Local Range: This association was documented only at Vanderbilt Mansion NHS, but it is likely under sampled and may occur throughout the park as seepages of intermittent streams and springs.
Classification Comments: This association was used to classify micro-habitat seepage vegetation with *Symplocarpus foetidus* (skunk cabbage) along intermittent streams and springs.
Other Comments: None.
Local Description Authors: Frederick C. Sechler, Jr.
Plots: Vanderbilt Mansion NHS (ROVA.48).
AA Points: Vanderbilt Mansion NHS (ROVA.40).
Roosevelt-Vanderbilt National Historic Site Inventory Notes: None.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Class	Shrubland and Grassland (2)
Subclass	Temperate and Boreal Shrubland and Grassland (2.C)
Formation	Temperate and Boreal Bog and Fen (2.C.4)
Division	North American Bog and Fen (D029)
Macrogroup	Appalachian, Interior Plateau, and Prairie Fen (M061)
Group	Northeastern and Appalachian Forest Seep Group (G189)
Alliance*	*Symplocarpus foetidus* - *Caltha palustris* Saturated Herbaceous Alliance (A.1694)
Alliance (English name)*	Skunk-cabbage - Yellow Marsh-marigold Saturated Herbaceous Alliance
Association	*Symplocarpus foetidus* - *Impatiens capensis* Herbaceous Vegetation
Association (English name)	Skunk-cabbage - Orange Jewelweed Herbaceous Vegetation
Ecological System(s)	Information not available.

* Alliance assignment as of 2007. All USNVC alliances are currently (2014) under review and revision.

GLOBAL DESCRIPTION

Concept Summary: This small seepage wetland vegetation occurs in low-lying areas such as streamheads, lower slope drainages, and the borders of small streams where groundwater emerges. The substrate is mucky, with rocks and boulders often visibly protruding above the surface. Little quantitative data exist for this vegetation, although it appears to be quite common in the northeastern United States. Typically, this vegetation is shaded by tree species of higher ground and surrounding edges of the community, but these species are not characteristic of the vegetation and vary widely among occurrences. *Lindera benzoin* (northern spicebush) may occur, particularly at the edges. Characteristic herbaceous species are *Symplocarpus foetidus* (skunk-cabbage), *Impatiens capensis* (jewelweed), and *Arisaema triphyllum* (Jack in the pulpit). Other common associates are variable but may include *Veratrum viride* (green false hellebore), *Pilea pumila* (Canadian clearweed), *Cardamine pensylvanica* (Pennsylvania bittercress), *Saxifraga pensylvanica* (eastern swamp saxifrage), *Carex canescens* (silvery sedge), *Caltha palustris* (yellow marsh-marigold), and *Viola sororia* (common blue violet).
Environmental Description: Information not available.
Vegetation Description: Information not available.
Most Abundant Species:

Stratum	Lifeform	Species
Herb (field)	Forb	*Symplocarpus foetidus* (skunk-cabbage)

Characteristic Species: *Arisaema triphyllum* (Jack in the pulpit), *Impatiens capensis* (jewelweed), *Symplocarpus foetidus* (skunk-cabbage)
Other Noteworthy Species: Information not available.

USFWS Wetland System: Palustrine.

DISTRIBUTION
Range: This vegetation occurs in the northeastern United States.
States/Provinces: CT, DC, MA, MD?, ME, NH, NJ, NY, PA, RI, VT, WV
Federal Lands: NPS (Morristown, Roosevelt-Vanderbilt, Saugus Iron Works)

CONSERVATION STATUS
Rank: GNR (8-Jul-1999)
Reasons: Information not available.

CLASSIFICATION INFORMATION
Status: Standard
Confidence: Information not available
Comments: Information not available.
Similar Associations:
- *Chrysosplenium americanum* Herbaceous Vegetation (CEGL006193)
- *Onoclea sensibilis - (Adiantum pedatum) - Impatiens capensis - Carex plantaginea* Herbaceous Vegetation [Provisional] (CEGL006409)
- *Vernonia noveboracensis - Thelypteris palustris - Symplocarpus foetidus* Herbaceous Vegetation (CEGL006448)

Related Concepts:
- Stream Thicket community (Ehrenfeld 1977) B

SOURCES
Description Authors: L.A. Sneddon
References: Eastern Ecology Working Group n.d., Ehrenfeld 1977, MNNHP 1993, NRCS 2004, Vanderhorst and Streets 2006, White and Madany 1978

Local Name: Atlantic Coast Wild Rice Tidal Marsh (CEGL004202)

SYNONYMS

NVC English Name: **Annual Wild Rice Tidal Herbaceous Vegetation**
NVC Scientific Name: ***Zizania aquatica* Tidal Herbaceous Vegetation**
NVC Identifier: **CEGL004202**

LOCAL INFORMATION

Environmental Description: This estuarine system association is described as a tidally flooded marsh with very poorly drained, muddy silt soils with a tidal range of 3.2 feet. The underlying bedrock is made of Ordovician shale and siltstone with minor amounts of sandstone, Austin Glen Formation. Adjacent estuarine associations include and Broadleaf Pond-lily Tidal Marsh (CEGL004472) and Cattail Brackish Tidal Marsh (CEGL004201). One upland association, Hemlock - Beech - Oak Forest (CEGL006088), occurs upslope from this association.
Vegetation Description: The emergent aquatic layer has an average 80% cover and is characterized by *Sparganium eurycarpum* (broadfruit bur-reed), *Zizania aquatica* (annual wildrice), *Sagittaria latifolia* (broadleaf arrowhead), *Pontederia cordata* (pickerelweed), and *Nuphar lutea* ssp. *advena* (yellow pond-lily).
Most Abundant Species:

Stratum	Lifeform	Species
Aquatic emergent	Forb	*Sparganium eurycarpum* (broadfruit bur-reed), *Zizania aquatica* (annual wildrice), *Sagittaria latifolia* (broadleaf arrowhead)

Characteristic Species: *Zizania aquatica* (annual wildrice), *Pontederia cordata* (pickerelweed), and *Peltandra virginica* (green arrow arum).
Other Noteworthy Species: None.
Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
NY	S2*	B		Freshwater Tidal Marsh	Edinger et al. 2002

Local Range: This association is part of a significant occurrence of a Freshwater Tidal Marsh at the Home of Franklin D. Roosevelt NHS (excluding Roosevelt Farm and Forest). It was only documented at Home of Franklin D. Roosevelt NHS (excluding Roosevelt Farm and Forest) where wetlands are influenced by the ebb and flow tides of the Hudson River.
Classification Comments: This association was classified for freshwater tidal marshes with *Zizania aquatica* (annual wildrice) as a major component of the overall emergent aquatic layer.
Other Comments: None.
Local Description Authors: Frederick C. Sechler, Jr.
Plots: Home of Franklin D. Roosevelt NHS (excluding Roosevelt Farm and Forest) (ROVA.1, ROVA.79).
AA Points: None.
Roosevelt-Vanderbilt National Historic Site Inventory Notes: None.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Class	Shrubland and Grassland (2)
Subclass	Temperate and Boreal Shrubland and Grassland (2.C)
Formation	Temperate and Boreal Freshwater Wet Meadow and Marsh (2.C.5)

Division	Eastern North American Freshwater Wet Meadow, Riparian, and Marsh (D030)
Macrogroup	Atlantic and Gulf Coastal Plain Freshwater Tidal Marsh (M066)
Group	Atlantic and Gulf Coastal Plain Freshwater Tidal Marsh Group (G110)
Alliance*	*Zizania aquatica* Tidal Herbaceous Alliance (A.1484)
Alliance (English name)*	Annual Wild Rice Tidal Herbaceous Alliance
Association	*Zizania aquatica* Tidal Herbaceous Vegetation
Association (English name)	Annual Wild Rice Tidal Herbaceous Vegetation
Ecological System(s)	Northern Atlantic Coastal Plain Fresh and Oligohaline Tidal Marsh (CES203.516) Atlantic Coastal Plain Embayed Region Tidal Freshwater Marsh (CES203.259) Southern Atlantic Coastal Plain Fresh and Oligohaline Tidal Marsh (CES203.376)

* Alliance assignment as of 2007. All USNVC alliances are currently (2014) under review and revision.

GLOBAL DESCRIPTION

Concept Summary: This is a freshwater tidal marsh characterized by *Zizania aquatica* (annual wildrice) that occurs in oligohaline zones of tidal rivers along the north and mid-Atlantic coast of North America. These marshes occur in the lower reaches of freshwater tidal systems, in fresh to slightly brackish areas along flats that are infrequently exposed at very low tides. Soils are highly variable and are composed of varying amounts of silts, silty mucks, fine peat, to very coarse sands. *Zizania aquatica* (annual wildrice) is dominant, although only conspicuously so in mid to late summer, when it overtops early season vegetation. This community can be codominated by species such as *Pontederia cordata* (pickerelweed), *Peltandra virginica* (green arrow-arum), *Polygonum arifolium* (halberdleaf tearthumb), *Polygonum punctatum* (dotted smartweed), and/or *Bidens* (beggarticks) spp. Common associates are generally a mixture of freshwater and brackish species and can include *Sagittaria latifolia* (broadleaf arrowhead), *Ludwigia palustris* (marsh seedbox), *Impatiens capensis* (jewelweed), *Leersia oryzoides* (rice cutgrass), *Amaranthus cannabinus* (tidalmarsh amaranth), *Hibiscus moscheutos* (crimsoneyed rosemallow), *Sium suave* (hemlock waterparsnip), *Acorus americanus* (sweetflag), and *Schoenoplectus fluviatilis* (river bulrush). This vegetation provides an important food source for migratory birds.

Environmental Description: This association occurs in the lower reaches of freshwater tidal marshes, in fresh to slightly brackish areas that are low within the marsh and are infrequently exposed at lowest tides. It occurs on alluvial soils that are commonly silts or silty clays, although occasionally have a greater sand component. *Zizania* (wildrice) flats are best developed in quiet waters conducive to sedimentation (Barrett 1989).

Vegetation Description: This freshwater tidal marsh community can be highly variable in species composition, but characterized by *Zizania aquatica* (annual wildrice), which is dominant and monotypic in some examples, often forming a "canopy" over such species as *Pontederia cordata* (pickerelweed), *Peltandra virginica* (green arrow-arum), *Polygonum arifolium* (halberdleaf tearthumb), *Polygonum punctatum* (dotted smartweed), and/or *Bidens* (beggarticks) spp., among others. Common associates are generally a mixture of freshwater and brackish species and can include *Sagittaria latifolia* (broadleaf arrowhead), *Ludwigia palustris* (marsh seedbox), *Impatiens capensis* (jewelweed), *Leersia oryzoides* (rice cutgrass), *Amaranthus cannabinus* (tidalmarsh amaranth), *Hibiscus moscheutos* (crimsoneyed rosemallow), *Sium suave* (hemlock waterparsnip), *Acorus americanus* (sweetflag), and *Schoenoplectus fluviatilis* (river bulrush). *Nuphar advena* (yellow pond-lily) is a common associate in the southern portion of the range. This plant association shows extreme seasonal variability with *Zizania aquatica* (annual wildrice) becoming a conspicuous component only in mid to late summer and generally senescing by mid to late autumn. The exotic species *Murdannia keisak* (wartremoving herb) can be a major component in many stands in Virginia. This vegetation provides an important food source for migratory birds.

Most Abundant Species:

Stratum	Lifeform	Species
Herb (field)	Graminoid	*Zizania aquatica* (annual wildrice)

Characteristic Species: *Zizania aquatica* (annual wildrice)

Other Noteworthy Species:

Species	GRank	Type	Note
Aeschynomene virginica (Virginia joint vetch)	G2	plant	Federally listed threatened; globally imperiled

USFWS Wetland System: Palustrine.

DISTRIBUTION

Range: This association occurs along the Atlantic Coastal Plain from Maine and Massachusetts south to South Carolina, possibly extending into Georgia.

States/Provinces: CT, DE:S3, FL?, GA?, MA, MD:S3, ME, MS, NC, NJ:S2S3, NY, RI, SC, VA:S4?

Federal Lands: NPS (Cape Cod); USFS (Croatan, Francis Marion); USFWS (Back Bay?, Chesapeake Marshlands, Presquile, Prime Hook)

CONSERVATION STATUS

Rank: G4? (13-Aug-1997)

Reasons: Information not available.

CLASSIFICATION INFORMATION

Status: Standard

Confidence: 2 - Moderate

Comments: Because of high seasonal variability, stands sampled in the early spring that may appear to be *Peltandra virginica* - *Pontederia cordata* Tidal Herbaceous Vegetation (CEGL004706) may be more appropriately classified as *Zizania aquatica* (annual wildrice) Tidal Herbaceous Vegetation (CEGL004202). This vegetation is best sampled later in the season.

Similar Associations:

- *Zizania (aquatica, palustris)* Herbaceous Vegetation (CEGL002382)
- *Zizania aquatica* Gulf Coast Herbaceous Vegetation (CEGL003887)

Related Concepts:

- *Zizania aquatica* - *Pontederia cordata* - *Peltandra virginica* - *Polygonum punctatum* Tidal Herbaceous Vegetation (VDNH 2003) =
- *Zizania aquatica* Tidal Herbaceous Vegetation (Bowman 2000) =
- *Zizania aquatica* marsh community (Barrett 1989) ?
- FW Tidal Marsh (Rawinski 1984) ?
- Freshwater Tidal Marsh: Wild Rice - Smartweed Type (McCoy and Fleming 2000) ?
- Freshwater tidal marsh complex, midtidal zone (Breden 1989) ?

SOURCES

Description Authors: S.L. Neid

References: Barrett 1989, Barrett 1994, Bowman 2000, Breden 1989, Breden et al. 2001, Coulling 2002, Eastern Ecology Working Group n.d., Edinger et al. 2002, Enser 1999, Ferren and Good 1977, Fleming et al. 2001, Gawler 2001, Gawler 2002, Glitzenstein and Streng 2004, Good and Good 1975, Harrison 2001, Harrison 2004, McCormick and Ashbaugh 1972, McCormick et al. 1970, McCoy and Fleming 2000, Metzler and Barrett 2001, Metzler and Rosza

1982, Odum et al. 1984, Rawinski 1984, Reschke 1990, Schafale 2000, Schafale 2003, Schafale and Weakley 1990, Swain and Kearsley 2001, VDNH 2003, Wharton 1978.

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Figure F-34. Atlantic Coast Wild Rice Tidal Marsh (plot ROVA.79). 09/01/2004. NAD 1983 / UTM-18 easting 588342, northing 4623495.

Local Name: Broadleaf Pond-lily Tidal Marsh (CEGL004472)

SYNONYMS

USNVC English Name: **Broadleaf Pond-lily Tidal Herbaceous Vegetation**
USNVC Scientific Name: ***Nuphar advena* Tidal Herbaceous Vegetation**
USNVC Identifier: **CEGL004472**

LOCAL INFORMATION

Environmental Description: This estuarine system association is described as a periodically tidal flooded marsh with a tidal range of 3.2 feet. This tidal marsh occurs on very poorly drained, muddy silt soils with underlying bedrock of Ordovician shale and siltstone with minor amounts of sandstone, Austin Glen Formation. The flood depth was recorded at 0.5 meters. Adjacent estuarine associations include Atlantic Coast Wild Rice Tidal Marsh (CEGL004202) and Cattail Brackish Tidal Marsh (CEGL004201). Adjacent upland associations include Mesic Sugar Maple - Ash - Oak - Hickory Forest (CEGL006046), Hemlock - Beech - Oak Forest (CEGL006088), High Allegheny Rich Red Oak - Sugar Maple Forest (CEGL006125), and Northeastern Successional Shrubland (CEGL006451).

Vegetation Description: The emergent aquatic layer averages 60.6% cover and is heavily dominated by *Nuphar lutea* ssp. *advena* (yellow pond-lily), with associated species that include *Zizania aquatica* (annual wildrice), *Sparganium eurycarpum* (broadfruit bur-reed), and *Peltandra virginica* (green arrow arum). The percent cover of water averages 15.6% within the surveyed areas, but most of the surveyed plots have a much higher percent.

Most Abundant Species:

Stratum	Lifeform	Species
Emergent Aquatic	Forb	*Nuphar lutea* ssp. *advena* (yellow pond-lily)

Characteristic Species: *Nuphar lutea* ssp. *advena* (yellow pond-lily), *Zizania aquatica* (annual wildrice), *Peltandra virginica* (green arrow arum)

Other Noteworthy Species: None.

Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
NY	S2*	B		Freshwater Tidal Marsh	Edinger et al. 2002

Local Range: This association was documented primarily at Home of Franklin D. Roosevelt NHS (excluding Roosevelt Farm and Forest), and to a lesser degree at Vanderbilt Mansion NHS. This tidal marsh association is restricted to areas where the Hudson River is connected to wetlands.

Classification Comments: This association was classified using freshwater tidal marshes that are dominated by *Nuphar lutea* ssp. *advena* (yellow pond-lily).

Other Comments: None.

Local Description Authors: Frederick C. Sechler, Jr.

Plots: Home of Franklin D. Roosevelt NHS (excluding Roosevelt Farm and Forest) (ROVA.3, ROVA.4, ROVA.5, ROVA.6, ROVA.7), Vanderbilt Mansion NHS (ROVA.14).

AA Points: Home of Franklin D. Roosevelt NHS (excluding Roosevelt Farm and Forest) (ROVA.56, ROVA.87), Vanderbilt Mansion NHS (ROVA.6).

Roosevelt-Vanderbilt National Historic Site Inventory Notes: None.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Class	Shrubland and Grassland (2)
Subclass	Temperate and Boreal Shrubland and Grassland (2.C)
Formation	Temperate and Boreal Freshwater Wet Meadow and Marsh (2.C.5)
Division	Eastern North American Freshwater Wet Meadow, Riparian, and Marsh (D030)
Macrogroup	Atlantic and Gulf Coastal Plain Freshwater Tidal Marsh (M066)
Group	Atlantic and Gulf Coastal Plain Freshwater Tidal Marsh Group (G110)
Alliance*	*Nuphar lutea* Tidal Herbaceous Alliance (A.1708)
Alliance (English name)*	Yellow Pond-lily Tidal Herbaceous Alliance
Association	*Nuphar advena* Tidal Herbaceous Vegetation
Association (English name)	Broadleaf Pond-lily Tidal Herbaceous Vegetation
Ecological System(s)	Northern Atlantic Coastal Plain Fresh and Oligohaline Tidal Marsh (CES203.516) Atlantic Coastal Plain Embayed Region Tidal Freshwater Marsh (CES203.259)

* Alliance assignment as of 2007. All USNVC alliances are currently (2014) under review and revision.

GLOBAL DESCRIPTION

Concept Summary: This association comprises submerged freshwater tidal mudflats of coastal rivers along the Atlantic Coast that are dominated by *Nuphar advena* (yellow pond-lily). This association occurs at low elevations within freshwater tidal marshes, within tidal range but beyond the influence of salinity. It generally occurs below mean low-water level where water depth is approximately 1-3 m or less. It receives a relatively long duration of flooding and is infrequently exposed at only the lowest tides. The association occurs on unconsolidated tidal mudflats and submerged point bars of large coastal river meanders adjacent to open water of river or tidal creek channels. Substrate is silty alluvial mud that is reported to be high in organic matter content at some sites; soil samples from 10 Virginia sites for this vegetation vary in humic matter content from 2 to 26% (mean = 11.5%). Vegetation of this association is characterized by large clonal stands of dense leafy forbs dominated by *Nuphar advena* (yellow pond-lily). Associated species tend to occur as scattered individuals and include *Peltandra virginica* (green arrow-arum), which can also be locally codominant, *Pontederia cordata* (pickerelweed), *Zizania aquatica* (annual wildrice), *Sagittaria latifolia* (broadleaf arrowhead), *Bidens laevis* (smooth beggarticks), *Acorus calamus* (calamus), and/or *Schoenoplectus fluviatilis* (river bulrush). *Nuphar advena* (yellow pond-lily) forms nearly monotypic stands early in the growing season. Associated species emerge later in the season and can eventually overtop *Nuphar* (pond-lily) plants, which senesce and tend to become insect-infested in late summer. Submerged aquatic species can occur in this association, including *Potamogeton epihydrus* (ribbonleaf pondweed), *Ceratophyllum demersum* (coon's-tail), and the invasive exotic *Hydrilla verticillata* (waterthyme).

Environmental Description: This association occurs at low elevations within freshwater tidal marshes, within tidal range but beyond the influence of salinity. It generally occurs below mean low-water level where water depth is approximately 1-3 m or less. It receives a relatively long duration of flooding and is infrequently exposed at only the lowest tides. The association occurs on unconsolidated tidal mudflats and submerged point bars of large coastal river meanders adjacent to open water of river or tidal creek channels. Substrate is silty alluvial mud that is reported to be high in organic matter content at some sites; soil samples from 10 Virginia sites for this vegetation vary in humic matter content from 2 to 26% (mean = 11.5%).

Vegetation Description: Vegetation of this association is characterized by large clonal stands of dense leafy forbs dominated by *Nuphar advena* (yellow pond-lily). Associated species tend to occur as scattered individuals and include *Peltandra virginica* (green arrow-arum), which can

also be locally codominant, *Pontederia cordata* (pickerelweed), *Zizania aquatica* (annual wildrice), *Sagittaria latifolia* (broadleaf arrowhead), *Bidens laevis* (smooth beggarticks), *Acorus calamus* (calamus), and/or *Schoenoplectus fluviatilis* (river bulrush). *Nuphar advena* (yellow pond-lily) forms nearly monotypic stands early in the growing season. Associated species emerge later in the season and can eventually overtop *Nuphar* (pond-lily) plants, which senesce and tend to become insect-infested in late summer. Submerged aquatic species can occur in this association, including *Potamogeton epihydrus* (ribbonleaf pondweed), *Ceratophyllum demersum* (coon's-tail), and the invasive exotic *Hydrilla verticillata* (waterthyme). In shallower waters, additional mudflat species can occur. In Virginia and Maryland stands, submerged aquatics such as *Ceratophyllum demersum* (coon's-tail) may have significant cover, but few other emergent species co-occur, even late in the season. The mean species richness of 19 Virginia and Maryland plot samples was 2 taxa per 100 square meters.
Most Abundant Species: Information not available.
Characteristic Species: Information not available.
Other Noteworthy Species: Information not available.
USFWS Wetland System: Palustrine.

DISTRIBUTION
Range: This association occurs along tidal rivers from New York to North Carolina.
States/Provinces: DC, DE:S4, MD:S4, ME, NC, NJ:S2S3, NY, PA, VA:S3?
Federal Lands: NPS (George Washington Parkway, National Capital-East); USFWS (Chesapeake Marshlands, Prime Hook)

CONSERVATION STATUS
Rank: G4G5 (19-Jan-2006)
Reasons: This vegetation ranges from Delaware Bay to North Carolina, with a discontinuous range north to Maine. It occurs in the freshwater tidal portions of large rivers and embayments and can occupy large patches. This vegetation is vulnerable to pollution from coastal run-off as well as oil spills off the coast.

CLASSIFICATION INFORMATION
Status: Standard
Confidence: 2 - Moderate
Comments: In Virginia, this association is apparently absent from larger tidal rivers such as the Rappahannock and James rivers, where discharge and ebb currents are too great to permit the development of wide estuarine meanders and the deposition of extensive bars of silty clay(Coulling 2002). Taxonomic ambiguity between *Nuphar lutea* ssp. *advena* and *Nuphar lutea* ssp. *variegata* (variegated yellow pond-lily) in past inventory efforts obscures our current understanding of the range of this type in New England. More data are needed to determine the complete range with greater confidence.
Similar Associations:
- *Nuphar advena - Nymphaea odorata* Herbaceous Vegetation (CEGL002386)
- *Peltandra virginica - Pontederia cordata* Tidal Herbaceous Vegetation (CEGL004706)

Related Concepts:
- *Nuphar advena - (Ceratophyllum demersum)* Tidal Herbaceous Vegetation (Coulling 2002) =
- *Nuphar advena - Peltandra virginica* Tidal Herbaceous Vegetation (Coulling 2002) ?
- *Nuphar advena - Peltandra virginica* Tidally Flooded Herbaceous Vegetation (McCoy and Fleming 2000) ?

- *Nuphar advena* Tidal Herbaceous Vegetation (Clancy 1996) ?
- *Nuphar advena* Tidal Herbaceous Vegetation (Harrison 2001) =
- *Nuphar lutea* ssp. *advena* - *(Ceratophyllum demersum)* Tidal Herbaceous Vegetation (VDNH 2003) =
- FW Tidal Marsh (Rawinski 1984) ?
- Freshwater Tidal Marsh complex (Breden 1989) ?
- Freshwater Tidal Marsh: Mud Flat Type (McCoy and Fleming 2000) ?
- Tidal Freshwater Marsh (Pondlily Subtype) (Schafale 2000) ?

SOURCES

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

References: Bowman 2000, Breden 1989, Breden et al. 2001, Clancy 1996, Coulling 2002, Eastern Ecology Working Group n.d., Edinger et al. 2002, Fleming 2001, Fleming et al. 2001, Gawler 2002, Good and Good 1975, Harrison 2001, Harrison 2004, McCormick and Ashbaugh 1972, McCormick et al. 1970, McCoy and Fleming 2000, Odum et al. 1984, Rawinski 1984, Reschke 1990, Schafale 2000, Schafale and Weakley 1990, VDNH 2003.

Figure F-35. Broadleaf Pond-lily Tidal Marsh (AA point ROVA.87). 09/08/2006. NAD 1983 / UTM-18 easting 588025, northing 4624007.

Local Name: Central Appalachian Cutgrass Marsh (CEGL006461)

SYNONYMS

USNVC English Name: **Rice Cutgrass - Broadleaf Arrowhead Herbaceous Vegetation**
USNVC Scientific Name: ***Leersia oryzoides* - *Sagittaria latifolia* Herbaceous Vegetation**
USNVC Identifier: **CEGL006461**

LOCAL INFORMATION

Environmental Description: This association occurs as a small marsh located at the north end of an impounded pond. This marsh has muck soils with underlying bedrock of Ordovician shale and siltstone with minor amounts of sandstone, Austin Glen Formation. Adjacent wetland/lacustrine associations include Eastern Woodland Vernal Pool (CEGL006453) and Duckweed Pond (CEGL003059). Adjacent upland associations include Hemlock / White Pine - Red Oak - Mixed Hardwood Forest (CEGL006566) and Semi-rich Northern Hardwood Forest (CEGL006211).

Vegetation Description: The sparse tree subcanopy layer averages 4% cover and 12 meters in height. The sparse tall shrub layer averages 3.5% cover and 2.2 meters in height. Characteristic species in both these layers include *Acer rubrum* (red maple) and *Platanus occidentalis* (American sycamore). The short shrub layer is extremely sparse, with *Platanus occidentalis* (American sycamore) occurring as the sole species. The sparse vine layer averages 8% cover and is characterized by *Mikania scandens* (climbing hempvine) and *Cuscuta* sp. (dodder). The dense herbaceous layer averages 95% cover and the most abundant species include the exotic *Microstegium vimineum* (Japanese stiltgrass), plus *Polygonum sagittatum* (arrowleaf tearthumb), *Impatiens capensis* (jewelweed), *Polygonum hydropiperoides* (swamp smartweed), *Polygonum arifolium* (halberdleaf tearthumb), *Cyperus squarrosus* (bearded flatsedge), *Boehmeria cylindrica* (smallspike false nettle), *Lobelia cardinalis* (cardinalflower), and *Pilea pumila* (Canadian clearweed).

Most Abundant Species:

Stratum	Lifeform	Species
Tree subcanopy/shrub	Broad-leaved deciduous tree	*Acer rubrum* (red maple), *Platanus occidentalis* (American sycamore)
Herb (field)	Vine	*Mikania scandens* (climbing hempvine)
Herb (field)	Forb	*Polygonum sagittatum* (arrowleaf tearthumb), *Impatiens capensis* (jewelweed)
Herb (field)	Graminoid	*Microstegium vimineum* (Japanese stiltgrass)

Characteristic Species: *Impatiens capensis* (jewelweed), *Polygonum sagittatum* (arrowleaf tearthumb), *Boehmeria cylindrica* (smallspike false nettle).

Other Noteworthy Species: None.

Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
NY	SNR			Shallow Emergent Marsh	Edinger et al. 2002

Local Range: This shallow emergent marsh was found in an impounded area at Roosevelt Farm and Forest. It was not documented in other units of the park.

Classification Comments: This association was used to classify plot I4 and an accuracy assessment point where *Microstegium vimineum* (Japanese stiltgrass) dominated an impounded

marsh, which possibly out competed and replaced *Leersia oryzoides* (rice cutgrass), the characteristic species of this type.
Other Comments: None.
Local Description Authors: Frederick C. Sechler, Jr.
Plots: Roosevelt Farm and Forest (ROVA.132).
AA Points: Roosevelt Farm and Forest (ROVA.205).
Roosevelt-Vanderbilt National Historic Site Inventory Notes: None.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Class	Shrubland and Grassland (2)
Subclass	Temperate and Boreal Shrubland and Grassland (2.C)
Formation	Temperate and Boreal Freshwater Wet Meadow and Marsh (2.C.5)
Division	Eastern North American Freshwater Wet Meadow, Riparian, and Marsh (D030)
Macrogroup	Eastern North American Wet Meadow and Marsh (M069)
Group	Eastern North American Wet Meadow Group (G112)
Alliance*	*Leersia oryzoides* - *Glyceria striata* Seasonally Flooded Herbaceous Alliance (A.1399)
Alliance (English name)*	Rice Cutgrass - Fowl Mannagrass Seasonally Flooded Herbaceous Alliance
Association	*Leersia oryzoides* - *Sagittaria latifolia* Herbaceous Vegetation
Association (English name)	Rice Cutgrass - Broadleaf Arrowhead Herbaceous Vegetation
Ecological System(s)	Central Appalachian Stream and Riparian (CES202.609) High Allegheny Wetland (CES202.069)

* Alliance assignment as of 2007. All USNVC alliances are currently (2014) under review and revision.

GLOBAL DESCRIPTION

Concept Summary: This community occupies wet alluvial bottomlands and beaver ponds in the Central Appalachians and adjacent ecoregions. Parent materials are alluvium derived mainly from acidic sandstones and shales. Surface soils are poorly drained, acidic clay loams. This small-patch wetland community is dominated by grasses and forbs, with scattered trees and shrubs. The dominant grasses are *Leersia oryzoides* (rice cutgrass) and *Phalaris arundinacea* (reed canarygrass) with *Leersia* (cutgrass) strongly dominant at most sites. *Sagittaria latifolia* (broadleaf arrowhead) has high constancy and cover, except at higher elevations. *Scirpus cyperinus* (woolgrass) has high constancy. Additional characteristic herbs include *Boehmeria cylindrica* (small-spike false nettle), *Carex gynandra* (nodding sedge), *Carex intumescens* (greater bladder sedge), *Carex baileyi* (Bailey's sedge), *Dichanthelium clandestinum* (deertongue), *Dulichium arundinaceum* (threeway sedge), *Eupatorium fistulosum* (trumpetweed), *Galium tinctorium* (stiff marsh bedstraw), *Impatiens capensis* (jewelweed), *Juncus effusus* (common rush), *Lobelia siphilitica* (great blue lobelia), *Ludwigia palustris* (marsh seedbox), *Lycopus uniflorus* (northern bugleweed), *Lycopus virginicus* (Virginia water horehound), *Lysimachia terrestris* (earth loosestrife), *Mimulus ringens* (Allegheny monkeyflower), *Polygonum sagittatum* (arrowleaf tearthumb), *Scirpus atrovirens* (green bulrush), and *Typha latifolia* (broadleaf cattail). Areas with longer standing water may have aquatic species, including *Callitriche heterophylla* (twoheaded water-starwort) and *Sparganium* (bur-reed) spp. Scattered small trees include *Robinia pseudoacacia* (black locust), *Salix nigra* (black willow), and *Fraxinus pennsylvanica* (green ash). The exotic shrub *Rosa multiflora* (multiflora rose) is sometimes invasive in this community. *Cornus amomum* (silky dogwood) is a characteristic native shrub.

Environmental Description: This community occupies wet alluvial bottomlands, beaver ponds, and disturbed flats in the Central Appalachians and adjacent ecoregions. Parent materials at documented sites are alluvium derived mainly from acidic sandstones and shales. Surface soils described from sampled plots are somewhat to very poorly drained clay, clay loam, muck, sandy clay, sandy loam, or silty clay. Hydric soil indicators include Histosols, histic epipedon, depleted matrix, and redox depressions. Soil pH averages 4.0 (n=2). The unvegetated surface is predominantly litter, with small amounts of downed wood and standing water, and frequent patches of bare soil. Elevations of documented stands range up to 1300 m.

Vegetation Description: This small-patch wetland community is dominated by grasses and forbs, with scattered trees and shrubs. The dominant grasses are *Leersia oryzoides* (rice cutgrass) and *Phalaris arundinacea* (reed canarygrass). Both of these are native species, however, introduction of Eurasian ecotypes and cultivars of *Phalaris arundinacea* (reed canarygrass) and subsequent hybridization with native stock have been blamed for the current invasive capacity of this species. *Leersia* (cutgrass) is strongly dominant at most sites. *Sagittaria latifolia* (broadleaf arrowhead) has high constancy and cover but drops out at the highest elevations. *Scirpus cyperinus* (woolgrass) has high constancy. Additional characteristic herbs include *Boehmeria cylindrica* (small-spike false nettle), *Carex gynandra* (nodding sedge), *Carex intumescens* (greater bladder sedge), *Carex baileyi* (Bailey's sedge), *Dichanthelium clandestinum* (deertongue), *Dulichium arundinaceum* (threeway sedge), *Eupatorium fistulosum* (trumpetweed), *Galium tinctorium* (stiff marsh bedstraw), *Impatiens capensis* (jewelweed), *Juncus effusus* (common rush), *Lobelia siphilitica* (great blue lobelia), *Ludwigia palustris* (marsh seedbox), *Lycopus uniflorus* (northern bugleweed), *Lycopus virginicus* (Virginia water horehound), *Lysimachia terrestris* (earth loosestrife), *Mimulus ringens* (Allegheny monkeyflower), *Polygonum sagittatum* (arrowleaf tearthumb), *Scirpus atrovirens* (green bulrush), and *Typha latifolia* (broadleaf cattail). Cover by nonvascular plants is generally insignificant. Scattered small trees include *Robinia pseudoacacia* (black locust), *Salix nigra* (black willow), and *Fraxinus pennsylvanica* (green ash). The exotic shrub *Rosa multiflora* (multiflora rose) may be invasive in this community. *Cornus amomum* (silky dogwood) and *Cephalanthus occidentalis* (common buttonbush) are characteristic native shrubs. Areas with longer standing water may have aquatic species, including *Callitriche heterophylla* (twoheaded water-starwort) and *Sparganium* (bur-reed) spp. Mean species richness of vascular plants in 19 WV plots was 16 taxa per 400 square meters.

Most Abundant Species:

Stratum	Lifeform	Species
Herb (field)	Forb	*Sagittaria latifolia* (broadleaf arrowhead)
Herb (field)	Graminoid	*Phalaris arundinacea* (reed canarygrass)

Characteristic Species: *Cephalanthus occidentalis* (common buttonbush), *Cornus amomum* (silky dogwood), *Leersia oryzoides* (rice cutgrass), *Scirpus cyperinus* (woolgrass)

Other Noteworthy Species: Information not available.

USFWS Wetland System: Palustrine.

DISTRIBUTION

Range: This association is currently documented from several areas in West Virginia; it is likely in other parts of the Central Appalachians from Pennsylvania to Virginia.

States/Provinces: DE, MD, NY, PA, VA, WV:S3

Federal Lands: NPS (New River Gorge); USFS (Monongahela); USFWS (Canaan Valley, Montezuma)

CONSERVATION STATUS

Rank: GNR (5-Jun-2006)
Reasons: Need more complete information on range and occurrences before ranking.

CLASSIFICATION INFORMATION

Status: Standard
Confidence: 3 - Weak
Comments: This association is based on 19 plots and anecdotal data from West Virginia, but it is likely wider ranging.
Similar Associations:

- *Leersia oryzoides - Boehmeria cylindrica - Ranunculus flabellaris* Herbaceous Vegetation (CEGL006903)--sinkhole ponds in New Jersey.

Related Concepts:

- *Leersia oryzoides - Phalaris arundinacea - Juncus effusus* herbaceous wetland (Vanderhorst and Streets 2006) =
- *Leersia oryzoides* community (Walbridge 1982) F
- *Leersia oryzoides* herbaceous wetland (Vanderhorst 2001b) =
- Herbaceous wetland (Vanderhorst 2001a) ?
- Rice cutgrass marsh (Putnam 1995) =

SOURCES

Description Authors: S.C. Gawler
References: Byers et al. 2007, Eastern Ecology Working Group n.d., Grafton and Eye 1982, Putnam 1995, Vanderhorst 2001a, Vanderhorst 2001b, Vanderhorst and Streets 2006, Vanderhorst et al. 2007, Walbridge 1982, Walbridge and Lang 1982, Walton et al. 1996

Figure F-36. Central Appalachian Cutgrass Marsh (AA point ROVA.205). 07/25/2008. NAD 1983 / UTM-18easting 589756, northing 4623732.

Local Name: Mixed Forb Marsh (CEGL006446)

SYNONYMS

USNVC English Name: **Nodding Beggarticks - Swamp Verbena – Smartweed species Herbaceous Vegetation**

USNVC Scientific Name: ***Bidens cernua - Verbena hastata - Polygonum* spp. Herbaceous Vegetation**

USNVC Identifier: **CEGL006446**

LOCAL INFORMATION

Environmental Description: This association was documented only once in close proximity to a eutrophic pond during accuracy assessment at Roosevelt Farm and Forest. This marsh occurred on mucky soils with underlying bedrock of Ordovician shale and siltstone with minor amounts of sandstone, Austin Glen Formation. An adjacent upland association includes Northeastern Dry Oak-Hickory Forest (CEGL006236). An adjacent palustrine association includes Duckweed Pond (CEGL003059).

Vegetation Description: This association was documented only once in the park at Roosevelt Farm and Forest as a small area of shallow emergent marsh. The sparse vine layer has 10% cover with *Toxicodendron radicans* (eastern poison ivy) as the most abundant species. The dense herbaceous layer has 90% cover and is characterized by *Scirpus atrovirens* (green bulrush), *Thelypteris palustris* (eastern marsh fern), *Onoclea sensibilis* (sensitive fern), *Equisetum arvense* (field horsetail), *Solidago gigantea* (giant goldenrod), *Euthamia graminifolia* (flat-top goldenrod), and *Lythrum salicaria* (purple loosestrife).

Most Abundant Species:

Stratum	Lifeform	Species
Herb (field)	Graminoid	*Scirpus atrovirens* (green bulrush),
Herb (field)	Forb	*Solidago gigantea* (giant goldenrod), *Euthamia graminifolia* (flat-top goldenrod), *Equisetum arvense* (field horsetail)
Herb (field)	Fern and ally	*Thelypteris palustris* (eastern marsh fern), *Onoclea sensibilis* (sensitive fern)

Characteristic Species: *Scirpus atrovirens* (green bulrush)

Other Noteworthy Species: None

Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
NY	S5*	B	1	Shallow Emergent Marsh	Edinger et al. 2002

Local Range: This association was only documented at Roosevelt Farm and Forest, but may occur as small patches in other areas of the park.

Classification Comments: This association was used to classify shallow emergent marshes where a mix of species occurred.

Other Comments: None.

Local Description Authors: Frederick C. Sechler, Jr.

Plots: None.

AA Points: None.

Roosevelt-Vanderbilt National Historic Site Inventory Notes: None.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Class	Shrubland and Grassland (2)
Subclass	Temperate and Boreal Shrubland and Grassland (2.C)
Formation	Temperate and Boreal Freshwater Wet Meadow and Marsh (2.C.5)
Division	Eastern North American Freshwater Wet Meadow, Riparian, and Marsh (D030)
Macrogroup	Eastern North American Wet Meadow and Marsh (M069)
Group	Eastern North American Wet Meadow Group (G112)
Alliance (A.1669)*	*Pontederia cordata – Peltandra virginica* Semipermanently Flooded Herbaceous Alliance
Alliance (English name)*	Pickerelweed - Green Arrow-arum Semipermanently Flooded Herbaceous Alliance
Association	*Bidens cernua - Verbena hastata - Polygonum* spp. Herbaceous Vegetation
Association (English name)	Nodding Beggarticks - Swamp Verbena - Smartweed species Herbaceous Vegetation
Ecological System(s)	Laurentian-Acadian Freshwater Marsh (CES201.594)

* Alliance assignment as of 2007. All USNVC alliances are currently (2014) under review and revision.

GLOBAL DESCRIPTION

Concept Summary: This variable wetland type occurs in depressions, drainages, and basins that contain ponded water throughout the year. In general, waterflow out of the sites is restricted, either due to naturally occurring depressions or from beaver activity, roads, or berms. The vegetation is dominated by species that are tolerant of standing water, and species composition is extremely variable among sites. Common species may include *Eleocharis acicularis* (needle spikerush), *Verbena hastata* (swamp verbena), *Bidens cernua* (nodding beggarticks), *Eupatorium maculatum* (spotted joepyeweed), *Leersia oryzoides* (rice cutgrass), *Polygonum hydropiper* (marshpepper knotweed), *Polygonum sagittatum* (arrowleaf tearthumb), *Equisetum arvense* (field horsetail), *Symphyotrichum novae-angliae* (New England aster), *Schoenoplectus americanus* (chairmaker's bulrush), *Carex stipata* (owlfruit sedge), *Carex vulpinoidea* (fox sedge), *Eupatorium perfoliatum* (common boneset), *Poa trivialis* (rough bluegrass), *Ludwigia palustris* (marsh seedbox), and/ or *Toxicodendron radicans* (eastern poison-ivy).

Environmental Description: This variable wetland type occurs in depressions, drainages, and basins that contain ponded water throughout the year. Waterflow out of the sites is typically restricted, either due to naturally occurring depressions or from beaver activity, roads, or berms. The vegetation is often restricted to the edges of the basins, with open water remaining in the center. These wetlands typically occur on very poorly drained soils such as mucky silt loam, shallow mucky peat, and, less occasionally, on ponded gravelly sand.

Vegetation Description: This herbaceous-dominated association contains standing water for most or all of the year and is often associated with impounded drainages, ponded areas near streams, or saturated areas surrounding drainages. The vegetation is dominated by species that are tolerant of standing water, and species composition is extremely variable among sites. Common species include *Eleocharis acicularis* (needle spikerush), *Verbena hastata* (swamp verbena), *Bidens cernua* (nodding beggarticks), *Eupatorium maculatum* (spotted joepyeweed), *Leersia oryzoides* (rice cutgrass), *Polygonum hydropiper* (marshpepper knotweed), *Polygonum sagittatum* (arrowleaf tearthumb), *Equisetum arvense* (field horsetail), *Symphyotrichum novae-angliae* (New England aster), *Schoenoplectus americanus* (chairmaker's bulrush), *Carex stipata* (owlfruit sedge), *Carex vulpinoidea* (fox sedge), *Eupatorium perfoliatum* (common boneset), *Poa trivialis* (rough bluegrass), *Ludwigia palustris* (marsh seedbox), and/ or *Toxicodendron radicans* (eastern poison-ivy).

Most Abundant Species:

Stratum	Lifeform	Species
Herb (field)	Forb	*Bidens cernua* (nodding beggarticks), *Polygonum hydropiper* (marshpepper knotweed), *Verbena hastata* (swamp verbena)

Characteristic Species: *Bidens cernua* (nodding beggarticks), *Eupatorium maculatum* (spotted joepyeweed), *Polygonum hydropiper* (marshpepper knotweed), *Toxicodendron radicans* (eastern poison-ivy), *Verbena hastata* (swamp verbena)
Other Noteworthy Species: Information not available.
USFWS Wetland System: Palustrine.

DISTRIBUTION
Range: This community is described from Pennsylvania and New Jersey and probably ranges northward.
States/Provinces: CT?, MA?, NJ, NY, PA, RI?, VT?
Federal Lands: NPS (Delaware Water Gap, Gateway, Roosevelt-Vanderbilt, Upper Delaware); USFWS (Iroquois)

CONSERVATION STATUS
Rank: GNR (7-Feb-2006)
Reasons: Better data on this community are needed in order to assign a conservation rank to it.

CLASSIFICATION INFORMATION
Status: Nonstandard
Confidence: 3 - Weak
Comments: Information not available.
Similar Associations: Information not available.
Related Concepts: Information not available.

SOURCES
Description Authors: S.C. Gawler, mod. E. Largay
References: Eastern Ecology Working Group n.d., FNA Editorial Committee 2006, Fike 1999, NRCS 2001, NRCS 2004

Figure F-37. Mixed Forb Marsh at ROVA.

Local Name: Steeplebush / Reed Canarygrass Successional Wet Meadow (CEGL006571)

SYNONYMS

USNVC English Name*:*	**Steeplebush - Blackberry species / Reed Canarygrass Shrubland**
USNVC Scientific Name:	***Spiraea tomentosa* - *Rubus* spp. / *Phalaris arundinacea* Shrubland**
USNVC Identifier*:*	**CEGL006571**

LOCAL INFORMATION

Environmental Description: This association occurs as moist to wet meadows underlain with sandy clay loam soils. This type can occur in low-lying areas of successional old fields, or adjacent to other shallow emergent marshes and shrubs swamps. The bedrock is Ordovician shale and siltstone with minor amounts of sandstone from the Austin Glen Formation. Adjacent wetland associations include Purple Loosestrife Wetland (CEGL006403). Adjacent upland associations include Northeastern Old Field (CEGL006107) and Northeastern Oak - Red Maple Successional Forest (CEGL006506).

Vegetation Description: The sparse tree canopy layer averages 10% cover and 8 meters in height. Two species documented in the canopy layer include *Fraxinus pennsylvanica* (green ash) and *Ulmus americana* (American elm). The tall shrub layer averages 52% cover and 1.5 meters in height. Characteristic species include *Cornus amomum* (silky dogwood), *Cephalanthus occidentalis* (common buttonbush), *Alnus incana* ssp. rugosa (speckled alder), *Sambucus nigra* var. *canadensis* (common elderberry), and *Rosa palustris* (swamp rose). The sparse short shrub layer averages 5% cover. Characteristic species include *Spiraea alba* var. *latifolia* (white meadowsweet), *Rosa palustris* (swamp rose), and *Rubus flagellaris* (northern dewberry). The very dense herbaceous layer averages 95% cover and the most abundant species include *Carex scoparia* (broom sedge), exotic *Lythrum salicaria* (purple loosestrife), *Symphyotrichum pilosum* var. *pilosum* (hairy white oldfield aster), *Pycnanthemum tenuifolium* (narrowleaf mountainmint), *Carex vulpinoidea* (fox sedge), *Solidago rugosa* (wrinkleleaf goldenrod), *Iris versicolor* (harlequin blueflag), *Vernonia noveboracensis* (New York ironweed).

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Fraxinus pensylvanica* (green ash), *Ulmus americana* (American elm)
Tall shrub/sapling	Broad-leaved deciduous shrub	*Cornus amomum* (silky dogwood), *Cephalanthus occidentalis* (common buttonbush), *Alnus incana* ssp. *rugosa* (speckled alder)
Short shrub/sapling	Broad-leaved deciduous shrub	*Spiraea alba* var. *latifolia* (white meadowsweet)
Herb (field)	Forb	*Pycnanthemum tenuifolium* (narrowleaf mountainmint), *Lythrum salicaria* (purple loosestrife), *Symphyotrichum pilosum* var. *pilosum* (hairy white oldfield aster)

Herb (field)	Graminoid	*Carex scoparia* (broom sedge), *Carex vulpinoidea* (fox sedge)

Characteristic Species: *Cornus amomum* (silky dogwood), *Spiraea alba* var. *latifolia* (white meadowsweet), *Solidago rugosa* (wrinkleleaf goldenrod).
Other Noteworthy Species: None.
Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
NY	S5*	B	1	Shallow Emergent Marsh	Edinger et al. 2002

Local Range: This association was only documented at Val-Kill, but may occur elsewhere within the park as small areas of low lying successional old fields and/or wet meadows.
Classification Comments: This association has similar species assemblages as Silky Dogwood - Hazel Alder Shrubland (CEGL006414), but in general, this association has significant *Spiraea alba* var. *latifolia* (white meadowsweet) as a shrub layer component. In addition, this association also has a much denser and more diverse herbaceous layer.
Other Comments: None.
Local Description Authors: Frederick C. Sechler, Jr.
Plots: Val-Kill (ROVA.85).
AA Points: Val-Kill (ROVA.125).
Roosevelt-Vanderbilt National Historic Site Inventory Notes: None.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Class	Shrubland and Grassland (2)
Subclass	Temperate and Boreal Shrubland and Grassland (2.C)
Formation	Temperate and Boreal Freshwater Wet Meadow and Marsh (2.C.5)
Division	Eastern North American Freshwater Wet Meadow, Riparian, and Marsh (D030)
Macrogroup	Eastern North American Wet Meadow and Marsh (M069)
Group	Eastern North American Wet Meadow Group (G112)
Alliance*	*Spiraea (alba, tomentosa)* - *Rubus* spp. Seasonally Flooded Shrubland Alliance (A.3022)
Alliance (English name)*	(White Meadowsweet, Steeplebush) - Blackberry species Seasonally Flooded Shrubland Alliance
Association	*Spiraea tomentosa* - *Rubus* spp. / *Phalaris arundinacea* Shrubland
Association (English name)	Steeplebush - Blackberry species / Reed Canarygrass Shrubland
Ecological System(s)	High Allegheny Wetland (CES202.069)

* Alliance assignment as of 2007. All USNVC alliances are currently (2014) under review and revision.

GLOBAL DESCRIPTION

Concept Summary: This wet meadow vegetation of the northeastern states occurs in a variety of settings, most frequently in low-lying areas of old fields or pastures, headwater basins, or beaver-impacted wetlands. The physiognomy is complex and variable, ranging from shrub thicket to herbaceous meadow with scattered shrubs. Shrub species usually include *Spiraea tomentosa* (steeplebush), *Spiraea alba* var. *alba* (white meadowsweet), *Cornus amomum* (silky dogwood), *Rubus allegheniensis* (Allegheny blackberry), *Rubus hispidus* (bristly dewberry), *Salix* (willow) spp., and others. *Hypericum densiflorum* (bushy St. Johnswort) often occurs in the Central Appalachians. The invasive exotic shrubs *Lonicera morrowii* (Morrow's honeysuckle) and *Rosa multiflora* (multiflora rose) may be locally abundant. Associated herbaceous species are also variable in composition, depending on land-use history. Commonly seen are *Phalaris arundinacea* (reed canarygrass), *Solidago rugosa* (wrinkleleaf goldenrod), *Solidago gigantea*

(giant goldenrod), *Solidago canadensis* (Canada goldenrod), *Juncus effusus* (common rush), *Scirpus cyperinus* (woolgrass), *Scirpus expansus* (woodland bulrush), *Leersia oryzoides* (rice cutgrass), *Calamagrostis canadensis* (bluejoint), *Carex scoparia* (broom sedge), *Carex folliculata* (northern long sedge), *Carex lurida* (shallow sedge), *Carex lupulina* (hop sedge), *Carex vulpinoidea* (fox sedge), *Carex trichocarpa* (hairyfruit sedge), *Vernonia noveboracensis* (New York ironweed), *Triadenum virginicum* (Virginia marsh St. Johnswort), *Lycopus uniflorus* (northern bugleweed), *Impatiens capensis* (jewelweed), *Eupatorium maculatum* (spotted joepyeweed), *Polygonum sagittatum* (arrowleaf tearthumb), *Thelypteris palustris* (eastern marsh fern), *Onoclea sensibilis* (sensitive fern), *Eleocharis* (spikerush) spp., and others. The invasive species *Microstegium vimineum* (Nepalese browntop), *Lythrum salicaria* (purple loosestrife), and *Phragmites australis* (common reed) can be abundant or form monocultures in these wetlands. Successional wet meadows in the Coastal Plain of New Jersey can include scattered patches of *Liquidambar styraciflua* (sweetgum) and *Morella pensylvanica* (northern bayberry), and more predominantly grassy patches of *Andropogon virginica*, *Panicum rigidulum* (redtop panicgrass), *Panicum virgatum* (switchgrass), and *Spiraea tomentosa* (steeplebush).

Environmental Description: This wet meadow vegetation of the northeastern states occurs in a variety of settings, most frequently in low-lying areas of old fields or pastures, headwater basins, or beaver-impacted wetlands. These wetlands typically flood early in the growing season and may be saturated to near the surface for some of the growing season, but they are generally dry for much of the year. The substrate is typically mineral soil with a layer of muck at the surface.

Vegetation Description: The physiognomy is complex and variable, ranging from shrub thicket to herbaceous meadow with scattered shrubs. Within each wetland, species may be locally abundant and often have patchy distribution. Shrub species usually include *Spiraea tomentosa* (steeplebush), *Spiraea alba* var. *alba* (white meadowsweet), *Cornus amomum* (silky dogwood), *Rubus allegheniensis* (Allegheny blackberry), *Rubus hispidus* (bristly dewberry), *Salix* (willow) spp., and others. *Hypericum densiflorum* (bushy St. Johnswort) often occurs in the Central Appalachians. The invasive exotic shrubs *Lonicera morrowii* (Morrow's honeysuckle) and *Rosa multiflora* (multiflora rose) may be locally abundant. Associated herbaceous species are also variable in composition, depending on land-use history. Commonly seen are *Phalaris arundinacea* (reed canarygrass), *Solidago rugosa* (wrinkleleaf goldenrod), *Solidago gigantea* (giant goldenrod), *Solidago canadensis* (Canada goldenrod), *Juncus effusus* (common rush), *Scirpus cyperinus* (woolgrass), *Scirpus expansus* (woodland bulrush), *Leersia oryzoides* (rice cutgrass), *Calamagrostis canadensis* (bluejoint), *Carex scoparia* (broom sedge), *Carex folliculata* (northern long sedge), *Carex lurida* (shallow sedge), *Carex lupulina* (hop sedge), *Carex vulpinoidea* (fox sedge), *Carex trichocarpa* (hairyfruit sedge), *Vernonia noveboracensis* (New York ironweed), *Triadenum virginicum* (Virginia marsh St. Johnswort), *Lycopus uniflorus* (northern bugleweed), *Impatiens capensis* (jewelweed), *Eupatorium maculatum* (spotted joepyeweed), *Polygonum sagittatum* (arrowleaf tearthumb), *Thelypteris palustris* (eastern marsh fern), *Onoclea sensibilis* (sensitive fern), *Eleocharis* (spikerush) spp., and others. *Sphagnum* (sphagnum) spp. are often abundant along with lesser amounts of other nonvascular species. The invasive species *Microstegium vimineum* (Nepalese browntop), *Lythrum salicaria* (purple loosestrife), and *Phragmites australis* (common reed) can be abundant or form monocultures in these wetlands. Successional wet meadows in the Coastal Plain of New Jersey can include scattered patches of *Liquidambar styraciflua* (sweetgum) and *Morella pensylvanica* (northern bayberry), and more predominantly grassy patches of *Andropogon virginica*, *Panicum rigidulum* (redtop panicgrass), *Panicum virgatum* (switchgrass), and *Spiraea tomentosa* (steeplebush).

Most Abundant Species:

Stratum	Lifeform	Species
Short shrub/sapling	Broad-leaved deciduous shrub	*Rubus allegheniensis* (Allegheny blackberry), *Spiraea alba* var. *alba* (white meadowsweet), *Spiraea tomentosa* (steeplebush)
Herb (field)	Forb	*Solidago canadensis* (Canada goldenrod), *Solidago rugosa* (wrinkleleaf goldenrod)
Herb (field)	Graminoid	*Leersia oryzoides* (rice cutgrass), *Phalaris arundinacea* (reed canarygrass)

Characteristic Species: *Rubus allegheniensis* (Allegheny blackberry), *Spiraea tomentosa* (steeplebush)
Other Noteworthy Species: Information not available.
USFWS Wetland System: Palustrine.

DISTRIBUTION

Range: Although this vegetation is widespread, its range has not been evaluated. It is known from the Central Appalachian ecoregion, the High Alleghany Plateau, Western Alleghany Plateau, North Atlantic Coast, and the Lower New England / Northern Piedmont ecoregions, and is likely in others.
States/Provinces: CT, MA, ME?, NJ, NY, PA, WV:S2
Federal Lands: NPS (Allegheny Portage Railroad, Boston Harbor Islands, Cape Cod, Delaware Water Gap, Johnstown Flood, Roosevelt-Vanderbilt, Upper Delaware, Weir Farm); USFS (Monongahela); USFWS (Assabet River?, Erie, Great Meadows?, Great Swamp, Iroquois, Montezuma, Parker River?, Supawna Meadows)

CONSERVATION STATUS

Rank: GNR (8-Jul-1999)
Reasons: Information not available.

CLASSIFICATION INFORMATION

Status: Standard
Confidence: 2 - Moderate
Comments: Information not available.
Similar Associations:

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

Related Concepts: Information not available.

SOURCES

Description Authors: L.A. Sneddon, mod. S.C. Gawler and E.F. Largay
References: Byers et al. 2007, Decker 1955, Eastern Ecology Working Group n.d., Fike 1999, NRCS 2004, NatureServe and Russell 2003

Figure F-38. Steeplebush / Reed Canarygrass Successional Wet Meadow (plot ROVA.85). 09/14/2004. NAD 1983 / UTM-18 easting 590925, northing 4624228.

Local Name: Eastern Cattail Marsh (CEGL006153)

SYNONYMS

USNVC English Name: **(Narrowleaf Cattail, Broadleaf Cattail) - (Clubrush species) Eastern Herbaceous Vegetation**

USNVC Scientific Name: ***Typha* (*angustifolia, latifolia*) - (*Schoenoplectus* spp.) Eastern Herbaceous Vegetation**

USNVC Identifier: **CEGL006153**

LOCAL INFORMATION

Environmental Description: The one example from the Home of Franklin D. Roosevelt NHS (excluding Roosevelt Farm and Forest) occurs in a step in slope topographic position with wet loamy soils with underlying bedrock of Ordovician shale and siltstone with minor amounts of sandstone, Austin Glen Formation. Adjacent upland associations include Northeastern Old Field (CEGL006107), Northeastern Modified Successional Forest (CEGL006599). Adjacent wetland associations include Red Maple / Tussock Sedge Wooded Marsh (CEGL006119).

Vegetation Description: This association is dominated by *Typha angustifolia* (narrowleaf cattail). The dense herbaceous layer has 95% cover and an average height of 2 meters. *Typha angustifolia* is by far the dominant species in this layer, with accompanying minor associates such as *Polygonum sagittatum* (arrowleaf tearthumb), *Polygonum hydropiperoides* (swamp smartweed), *Thelypteris palustris* (eastern marsh fern), *Onoclea sensibilis* (sensitive fern), and *Erechtites hieraciifolia* (American burnweed).

Most Abundant Species:

Stratum	Lifeform	Species
Herb (field)	Forb	*Typha angustifolia* (narrowleaf cattail), *Polygonum sagittatum* (arrowleaf tearthumb)

Characteristic Species: *Typha angustifolia* (narrowleaf cattail)

Other Noteworthy Species: None.

Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
NY	S5*	B	1	Shallow Emergent Marsh	Edinger et al. 2002

Local Range: This association is apparently very uncommon within the park and was only documented at unit Home of Franklin D. Roosevelt NHS (excluding Roosevelt Farm and Forest). Other small areas of *Typha* sp. (cattail) may occur in low lying areas or marshes throughout the park.

Classification Comments: This association was used to classify non-tidal shallow emergent marshes with *Typha* spp. (cattail) as the dominant species.

Other Comments: None.

Local Description Authors: Frederick C. Sechler, Jr.

Plots: Home of Franklin D. Roosevelt NHS (excluding Roosevelt Farm and Forest) (ROVA.73)

AA Points: None.

Roosevelt-Vanderbilt National Historic Site Inventory Notes: None.

None.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Class Shrubland and Grassland (2)

Subclass	Temperate and Boreal Shrubland and Grassland (2.C)
Formation	Temperate and Boreal Freshwater Wet Meadow and Marsh (2.C.5)
Division	Eastern North American Freshwater Wet Meadow, Riparian, and Marsh (D030)
Macrogroup	Eastern North American Wet Meadow and Marsh (M069)
Group	Eastern North American Freshwater Marsh Group (G125)
Alliance*	*Typha (angustifolia, latifolia)* - *(Schoenoplectus* spp.) Semipermanently Flooded Herbaceous Alliance (A.1436)
Alliance (English name)*	(Narrowleaf Cattail, Broadleaf Cattail) - (Clubrush species) Semipermanently Flooded Herbaceous Alliance
Association	*Typha (angustifolia, latifolia)* - *(Schoenoplectus* spp.) Eastern Herbaceous Vegetation
Association (English name)	(Narrowleaf Cattail, Broadleaf Cattail) - (Clubrush species) Eastern Herbaceous Vegetation
Ecological System(s)	Laurentian-Acadian Freshwater Marsh (CES201.594)

* Alliance assignment as of 2007. All USNVC alliances are currently (2014) under review and revision.

GLOBAL DESCRIPTION

Concept Summary: These tall emergent marshes are common throughout the northeastern United States and adjacent Canadian provinces. They occur in permanently flooded basins, often as part of a larger wetland mosaic and associated with lakes, ponds, or slow-moving streams. The substrate is muck over mineral soil. Lacustrine cattail marshes typically have a muck-bottom zone bordering the shoreline, where cattails are rooted in the bottom substrate, and a floating mat zone, where the roots grow suspended in a buoyant peaty mat. Tall graminoids dominate the vegetation; scattered shrubs are often present (usually totaling less than 25% cover) and are frequently shorter than the graminoids. Trees are absent. Bryophyte cover varies and is rarely extensive; bryophytes are mostly confined to the hummocks. *Typha angustifolia* (narrowleaf cattail), *Typha latifolia* (broadleaf cattail), or their hybrid *Typha X glauca* (blue cattail) dominate, either alone or in combination with other tall emergent marsh species. Associated species vary widely; sedges, such as *Carex aquatilis* (water sedge), *Carex lurida* (shallow sedge), *Carex rostrata* (beaked sedge), *Carex pellita* (woolly sedge), *Carex stricta* (upright sedge), *Scirpus cyperinus* (woolgrass), and bulrushes, such as *Schoenoplectus americanus* (chairmaker's bulrush) and *Schoenoplectus acutus* (hardstem bulrush), occur along with patchy grasses, such as *Calamagrostis canadensis* (bluejoint). Broad-leaved herbs include *Thelypteris palustris* (eastern marsh fern), *Asclepias incarnata* (swamp milkweed), *Onoclea sensibilis* (sensitive fern), *Symplocarpus foetidus* (skunk-cabbage), *Calla palustris* (water arum), *Impatiens capensis* (jewelweed), *Sagittaria latifolia* (broadleaf arrowhead), *Scutellaria lateriflora* (blue skullcap), *Sparganium eurycarpum* (broadfruit bur-reed), and *Verbena hastata* (swamp verbena). Floating aquatics, such as *Lemna minor* (common duckweed), may be common in deeper zones. Shrub species vary across the geographic range of this type; in the northern part of its range, *Myrica gale* (sweetgale), *Ilex verticillata* (common winterberry), and *Spiraea alba* var. *alba* (white meadowsweet) are common. The invasive exotic plants *Lythrum salicaria* (purple loosestrife) and *Phragmites australis* (common reed) may be abundant in parts of some occurrences. This association is distinguished from other northeastern freshwater marshes by the strong dominance of *Typha* (cattail) spp.

Environmental Description: These tall emergent marshes are common throughout the northeastern United States and adjacent Canadian provinces. They occur in permanently flooded basins, often as part of a larger wetland mosaic and associated with lakes, ponds, or slow-moving streams. The substrate is muck over mineral soil. Lacustrine cattail marshes typically have a muck-bottom zone bordering the shoreline, where cattails are rooted in the bottom substrate, and

a floating mat zone, where the roots grow suspended in a buoyant peaty mat. This association is often found in impounded waters.

Vegetation Description: Tall graminoids dominate the vegetation; scattered shrubs are often present (usually totaling less than 25% cover) and are frequently shorter than the graminoids. Trees are absent. Bryophyte cover varies and is rarely extensive; bryophytes are mostly confined to the hummocks. *Typha angustifolia* (narrowleaf cattail), *Typha latifolia* (broadleaf cattail), or their hybrid *Typha X glauca* (blue cattail) dominate, either alone or in combination with other tall emergent marsh species. Associated species vary widely; sedges, such as *Carex aquatilis* (water sedge), *Carex lurida* (shallow sedge), *Carex rostrata* (beaked sedge), *Carex pellita* (woolly sedge), *Carex stricta* (upright sedge), *Scirpus cyperinus* (woolgrass), and bulrushes, such as *Schoenoplectus americanus* (chairmaker's bulrush) and *Schoenoplectus acutus* (hardstem bulrush), occur along with patchy grasses, such as *Calamagrostis canadensis* (bluejoint). Broad-leaved herbs include *Thelypteris palustris* (eastern marsh fern), *Asclepias incarnata* (swamp milkweed), *Onoclea sensibilis* (sensitive fern), *Symplocarpus foetidus* (skunk-cabbage), *Calla palustris* (water arum), *Impatiens capensis* (jewelweed), *Sagittaria latifolia* (broadleaf arrowhead), *Scutellaria lateriflora* (blue skullcap), *Sparganium eurycarpum* (broadfruit bur-reed), and *Verbena hastata* (swamp verbena). Floating aquatics, such as *Lemna minor* (common duckweed), may be common in deeper zones. Shrub species vary across the geographic range of this type; in the northern part of its range, *Myrica gale* (sweetgale), *Ilex verticillata* (common winterberry), and *Spiraea alba* var. alba (white meadowsweet) are common. The invasive plants *Lythrum salicaria* (purple loosestrife) and *Phragmites australis* (common reed) may be abundant in parts of some occurrences.

Most Abundant Species:

Stratum	Lifeform	Species
Herb (field)	Graminoid	*Typha angustifolia* (narrowleaf cattail), *Typha latifolia* (broadleaf cattail), *Typha* x *glauca* (blue cattail)

Characteristic Species: *Onoclea sensibilis* (sensitive fern), *Schoenoplectus acutus* (hardstem bulrush), *Schoenoplectus americanus* (chairmaker's bulrush), *Typha angustifolia* (narrowleaf cattail), *Typha latifolia* (broadleaf cattail)

Other Noteworthy Species:

Species	GRank	Type	Note
Lythrum salicaria (purple loosestrife)	-	plant	invasive exotic
Phragmites australis (common reed)	-	plant	invasive

USFWS Wetland System: Palustrine.

DISTRIBUTION

Range: This association occurs throughout the northeastern U.S. from Maine to North Carolina.

States/Provinces: CT, DC?, DE, MA, MD, ME:S5, NC, NH:S4?, NJ:S5, NY, PA:S5, RI, VA, VT, WV

Federal Lands: NPS (Acadia, Blue Ridge Parkway?, Boston Harbor Islands, C&O Canal?, Cape Cod, Delaware Water Gap, Johnstown Flood, Minute Man, National Capital-East?, Saint-Gaudens, Roosevelt-Vanderbilt, Upper Delaware); USFS (Nantahala?, Pisgah?); USFWS (Aroostook, Assabet River, Carlton Pond?, Erie, Great Meadows, Great Swamp, Iroquois, Montezuma, Moosehorn, Nomans Land Island, Nulhegan Basin, Oxbow, Pondicherry?, Prime Hook)

CONSERVATION STATUS
Rank: G5 (1-Dec-1997)
Reasons: Information not available.

CLASSIFICATION INFORMATION
Status: Standard
Confidence: 2 - Moderate
Comments: *Typha angustifolia* (narrowleaf cattail) can grow in deeper water compared to *Typha latifolia* (broadleaf cattail), although both species reach maximum growth at a water depth of 50 cm (Grace and Wetzel 1981). *Typha* (cattail) often occurs in pure stands and can colonize areas recently exposed by either natural or human causes.
Similar Associations:
- *Typha latifolia* Southern Herbaceous Vegetation (CEGL004150)
- *Typha* spp. - *Schoenoplectus acutus* - Mixed Herbs Midwest Herbaceous Vegetation (CEGL002229)
- *Typha* spp. - *Schoenoplectus tabernaemontani* - Mixed Herbs Southern Great Lakes Shore Herbaceous Vegetation (CEGL005112)
- *Typha* spp. Midwest Herbaceous Vegetation (CEGL002233)

Related Concepts:
- *Typha* (*angustifolia, latifolia*) - (*Scirpus* spp.) Herbaceous Vegetation (Clancy 1996) =
- Cattail Marsh (Thompson 1996) ?
- Cattail marsh (CAP pers. comm. 1998) ?
- Palustrine Narrow-leaved Persistent Emergent Wetland, Permanently Flooded (PEM5H) (Cowardin et al. 1979) ?
- Robust Emergent Marsh (Breden 1989) ?
- Southern New England nutrient-poor streamside/lakeside marsh (Rawinski 1984) ?
- Southern New England nutrient-rich streamside/lakeside marsh (Rawinski 1984) ?

SOURCES
Description Authors: S.C. Gawler
References: Breden 1989, Breden et al. 2001, CAP pers. comm. 1998, Clancy 1996, Cowardin et al. 1979, Eastern Ecology Working Group n.d., Edinger et al. 2002, Fike 1999, Gawler 2002, Grace and Wetzel 1981, Harrison 2004, Metzler and Barrett 2001, NRCS 2004, Northern Appalachian Ecology Working Group 2000, Rawinski 1984, Sperduto and Nichols 2004, Swain and Kearsley 2001, Thompson 1996, Thompson and Sorenson 2000.

Local Name: Alluvial Alder Swamp (CEGL006414)

SYNONYMS

USNVC English Name: **Silky Dogwood - Hazel Alder Shrubland**
USNVC Scientific Name: ***Cornus amomum* - *Alnus serrulata* Shrubland**
USNVC Identifier: **CEGL006414**

LOCAL INFORMATION

Environmental Description: This shrub swamp association occurs in alluvial low level areas in natural hydrological regimes. In one example at the Home of Franklin D. Roosevelt NHS (excluding Roosevelt Farm and Forest), it occurs along a stream that empties into a freshwater tidal marsh and is impounded by a dirt road crossing with a culvert. The soils are either muck or silt loam and occur in very wet or saturated substrates. Adjacent wetland associations include Southern New England / Northern Piedmont Red Maple Seepage Swamp (CEGL006406) and Red Maple / Tussock Sedge Wooded Marsh (CEGL006119). Adjacent upland associations include Dry, Rich Oak - Hickory Forest (CEGL006236), Hemlock - Beech - Oak Forest (CEGL006088), and Northeastern Old Field (CEGL006107).

Vegetation Description: The sparse tree canopy averages 8% cover and 8 meters in height. Characteristic species of this layer include *Fraxinus pennsylvanica* (green ash), and *Ulmus americana* (American elm). The tall shrub layer averages 52% cover and 1.5 meters in height and characteristic species include *Cornus amomum* (silky dogwood), *Cephalanthus occidentalis* (common buttonbush), *Alnus incana ssp*. rugosa (speckled alder), *Sambucus nigra* var. *canadensis* (common elderberry) and *Rosa palustris* (swamp rose). The short shrub layer averages 56.3% cover and is characterized by *Rubus allegheniensis* (Allegheny blackberry), *Betula alleghaniensis* (yellow birch), and *Rosa multiflora* (multiflora rose). The herbaceous layer averages 48% cover and the most abundant species include *Carex lacustris* (hairy sedge), *Impatiens capensis* (jewelweed), *Thelypteris palustris* (eastern marsh fern), and *Peltandra virginica* (green arrow arum).

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Fraxinus pensylvanica* (green ash), *Ulmus americana* (American elm)
Tall shrub/sapling	Broad-leaved deciduous shrub	*Cornus amomum* (silky dogwood), *Cephalanthus occidentalis* (common buttonbush)
Herb (field)	Fern and ally	*Thelypteris palustris* (eastern marsh fern)
Herb (field)	Forb	*Impatiens capensis* (jewelweed)
Herb (field)	Graminoid	*Carex lacustris* (hairy sedge)

Characteristic Species: *Cornus amomum* (silky dogwood), *Cephalanthus occidentalis* (common buttonbush), *Rubus allegheniensis* (Allegheny blackberry), *Carex lacustris* (hairy sedge), and *Impatiens capensis* (jewelweed).

Other Noteworthy Species: None.

Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
NY	SNR			Shrub Swamp	Edinger et al. 2002

Local Range: This shrub swamp association was only documented twice during field surveys at Home of Franklin D. Roosevelt NHS (excluding Roosevelt Farm and Forest) and Val-Kill units.
Classification Comments: This association was used to classify *Cornus amomum* (silky dogwood) dominated shrub swamps.
Other Comments: None.
Local Description Authors: Frederick C. Sechler, Jr.
Plots: Home of Franklin D. Roosevelt NHS (excluding Roosevelt Farm and Forest) (ROVA.19), and Val-Kill (ROVA.43).
AA Points: None.
Roosevelt-Vanderbilt National Historic Site Inventory Notes: None.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Class	Shrubland and Grassland (2)
Subclass	Temperate and Boreal Shrubland and Grassland (2.C)
Formation	Temperate and Boreal Freshwater Wet Meadow and Marsh (2.C.5)
Division	Eastern North American Freshwater Wet Meadow, Riparian, and Marsh (D030)
Macrogroup	Northern and Central Tall Shrub Wetland (M160)
Group	Northern and Central Shrub Swamp Group (G167)
Alliance*	*Alnus serrulata* Temporarily Flooded Shrubland Alliance (A.943)
Alliance (English name)*	Hazel Alder Temporarily Flooded Shrubland Alliance
Association	*Cornus amomum* - *Alnus serrulata* Shrubland
Association (English name)	Silky Dogwood - Hazel Alder Shrubland
Ecological System(s)	Atlantic Coastal Plain Northern Salt Pond Marsh (CES203.892)
	Northern Atlantic Coastal Plain Stream and River (CES203.070)

* Alliance assignment as of 2007. All USNVC alliances are currently (2014) under review and revision.

GLOBAL DESCRIPTION

Concept Summary: This Coastal Plain alluvial shrubland occurs in the Chesapeake Bay Lowlands on the non-tidal portions of rivers and non-tidal bay mouths. The shrub canopy is characterized by *Cornus amomum* (silky dogwood) with other associates including *Alnus serrulata* (hazel alder), *Cephalanthus occidentalis* (common buttonbush) and *Viburnum* (viburnum) spp., as well as saplings of *Acer rubrum* (red maple), *Fraxinus pennsylvanica* (green ash), and *Salix nigra* (black willow). Herbaceous associates include *Osmunda regalis* (royal fern), *Decodon verticillatus* (swamp-loosestrife), *Utricularia* (bladderwort) spp., *Limnobium spongia* (American spongeplant), and *Cicuta bulbifera* (bulblet-bearing water hemlock).
Environmental Description: Information not available.
Vegetation Description: Information not available.
Most Abundant Species: Information not available.
Characteristic Species: Information not available.
Other Noteworthy Species: Information not available.
USFWS Wetland System: Palustrine.

DISTRIBUTION

Range: This Coastal Plain alluvial shrubland occurs in the Chesapeake Bay Lowlands.
States/Provinces: DE, MD, NY, VA?
Federal Lands:

CONSERVATION STATUS
Rank: GNR (10-Oct-2000)
Reasons: Information not available.

CLASSIFICATION INFORMATION
Status: Standard
Confidence: 3 - Weak
Comments: Information not available.
Similar Associations:
- *Alnus (incana* ssp. *rugosa, serrulata)* - *Cornus amomum* Shrubland (CEGL006337)

Related Concepts: Information not available.

SOURCES
Description Authors: Chesapeake Bay Ecology Group
References: Eastern Ecology Working Group n.d., Harrison 2004, Tiner 1985

Figure F-39. Alluvial Alder Swamp, with silver-spotted skipper on buttonbush (plot ROVA.19). 08/13/2003. NAD 1983 / UTM-18 easting 588043, northing 4624079.

Local Name: Northeastern Buttonbush Shrub Swamp (CEGL006069)

SYNONYMS

USNVC English Name: **Common Buttonbush - Swamp-loosestrife Shrubland**
USNVC Scientific Name: ***Cephalanthus occidentalis* - *Decodon verticillatus* Shrubland**
USNVC Identifier: **CEGL006069**

LOCAL INFORMATION

Environmental Description: This wetland association occurs on loamy or muck soils underlain on bedrock Ordovician shale and siltstone with minor amounts of sandstone, Austin Glen Formation. Adjacent upland associations include Northeastern Old Field (CEGL006107). Adjacent wetland associations include Southern New England / Northern Piedmont Red Maple Seepage Swamp (CEGL006406).

Vegetation Description: The sparse tree canopy layer averages 10% cover and 8 meters in height. The two species documented in this layer include *Fraxinus pennsylvanica* (green ash) and *Ulmus americana* (American elm). The tall shrub layer averages 52% cover and 1.5 meters in height. Characteristic species include *Cornus amomum* (silky dogwood), *Cephalanthus occidentalis* (common buttonbush), *Alnus incana* ssp. *rugosa* (speckled alder), *Sambucus nigra* var. *canadensis* (common elderberry) and *Rosa palustris* (swamp rose) as the most abundant species. The moderately dense short shrub layer averages 60% cover and is heavily dominated by *Cephalanthus occidentalis* (common buttonbush). The sparse herbaceous layer averages 10% cover and is characterized by *Onoclea sensibilis* (sensitive fern) and *Boehmeria cylindrica* (smallspike false nettle).

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Fraxinus pensylvanica* (green ash), *Ulmus americana* (American elm)
Tall shrub/sapling	Broad-leaved deciduous shrub	*Cornus amomum* (silky dogwood), *Cephalanthus occidentalis* (common buttonbush), *Alnus incana* ssp. *rugosa* (speckled alder)
Short shrub/sapling	Broad-leaved deciduous shrub	*Cephalanthus occidentalis* (common buttonbush)
Herb (field)	Fern and ally	*Onoclea sensibilis* (sensitive fern)
Herb (field)	Forb	*Boehmeria cylindrica* (smallspike false nettle)

Characteristic Species: *Cephalanthus occidentalis* (common buttonbush)
Other Noteworthy Species: None.
Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
NY	S5*	B	1	Shrub Swamp	Edinger et al. 2002

Local Range: This shrub swamp association was documented at park units Home of Franklin D. Roosevelt NHS (excluding Roosevelt Farm and Forest) and Val-Kill.
Classification Comments: This association was used to classify shrub swamps dominated by *Cephalanthus occidentalis* (common buttonbush).
Other Comments: None.
Local Description Authors: Frederick C. Sechler, Jr.

Plots: Val-Kill (ROVA.35)
AA Points: Home of Franklin D. Roosevelt NHS (excluding Roosevelt Farm and Forest) (ROVA.75).
Roosevelt-Vanderbilt National Historic Site Inventory Notes: None.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Class	Shrubland and Grassland (2)
Subclass	Temperate and Boreal Shrubland and Grassland (2.C)
Formation	Temperate and Boreal Freshwater Wet Meadow and Marsh (2.C.5)
Division	Eastern North American Freshwater Wet Meadow, Riparian, and Marsh (D030)
Macrogroup	Northern and Central Tall Shrub Wetland (M160)
Group	Northern and Central Shrub Swamp Group (G167)
Alliance*	*Cephalanthus occidentalis* Semipermanently Flooded Shrubland Alliance (A.1011)
Alliance (English name)*	Common Buttonbush Semipermanently Flooded Shrubland Alliance
Association	*Cephalanthus occidentalis* - *Decodon verticillatus* Shrubland
Association (English name)	Common Buttonbush - Swamp-loosestrife Shrubland
Ecological System(s)	Laurentian-Acadian Floodplain Forest (CES201.587)
	Central Appalachian River Floodplain (CES202.608)

* Alliance assignment as of 2007. All USNVC alliances are currently (2014) under review and revision.

GLOBAL DESCRIPTION

Concept Summary: This buttonbush swamp occurs in the northeastern United States. These swamps experience prolonged or semipermanent flooding for much of the growing season, with water tables receding below the soil surface only during drought or very late in the growing season. They occur in a variety of environmental settings, including backwater sloughs or oxbow ponds, wet swales in floodplains, pond and lake borders, and small, isolated depressions where water levels recede very slowly, such as those with perched water tables. The substrate is typically loose muck. *Cephalanthus occidentalis* (common buttonbush) is dominant and often monotypic. Occasional associates depend on the environmental setting and most often occur in drier areas. They include *Vaccinium corymbosum* (highbush blueberry), *Rhododendron viscosum* (swamp azalea), *Acer rubrum* (red maple), *Cornus* (dogwood) spp. closer to upland borders, or *Acer saccharinum* (silver maple), *Fraxinus pennsylvanica* (green ash), and *Viburnum dentatum* (southern arrow-wood) where adjacent to floodplains, or *Decodon verticillatus* (swamp-loosestrife), *Chamaedaphne calyculata* (leatherleaf), and *Spiraea alba* var. *latifolia* (white meadowsweet) in more stagnant basins. Herbaceous species tend to be sparse but can include *Glyceria canadensis* (rattlesnake mannagrass), *Dulichium arundinaceum* (threeway sedge), *Carex stricta* (upright sedge), *Scirpus cyperinus* (woolgrass), *Thelypteris palustris* (eastern marsh fern), *Leersia oryzoides* (rice cutgrass), *Acorus calamus* (calamus), *Alisma plantago-aquatica* (American waterplantain), *Polygonum* (knotweed) spp., *Sparganium* (bur-reed) spp., and floating or submerged aquatic species such as *Lemna minor* (common duckweed), *Potamogeton natans* (floating pondweed), and *Nuphar variegata*. Bryophytes, if present, cling to shrub bases and include *Warnstorfia fluitans* (warnstorfia moss), *Drepanocladus aduncus* (drepanocladus moss), or *Sphagnum fallax* (sphagnum). In disturbed areas, these wetlands may be invaded by *Lythrum salicaria* (purple loosestrife).

Environmental Description: This association includes buttonbush swamps that experience prolonged or semipermanent flooding for much of the growing season with water tables receding below the soil surface only during drought or very late in the growing season. They occur in a variety of environmental settings including backwater sloughs or oxbow ponds, wet swales in

floodplains, pond and lake borders, and small, isolated depressions where water levels recede very slowly, such as those with perched water tables. Soils are often organic mucks or silt loams.
Vegetation Description: This association includes buttonbush swamps of the eastern and northeastern United States. These swamps experience prolonged or semipermanent flooding for much of the growing season with water tables receding below the soil surface only during drought or very late in the growing season. They occur in a variety of environmental settings including backwater sloughs or oxbow ponds, wet swales in floodplains, pond and lake borders, and small isolated depressions where water levels recede very slowly, such as those with perched water tables. *Cephalanthus occidentalis* (common buttonbush) is dominant and often monotypic. Scattered *Acer rubrum* (red maple) trees may be present in the wetland. Occasional associates depend on the environmental setting, and some only occur in drier areas. They include *Vaccinium corymbosum* (highbush blueberry), *Rhododendron viscosum* (swamp azalea), *Acer rubrum* (red maple), *Salix* (willow) spp., *Cornus amomum* (silky dogwood) or *Cornus sericea* (red-osier dogwood) closer to upland borders, or *Acer saccharinum* (silver maple), *Fraxinus pennsylvanica* (green ash), or *Viburnum dentatum* (southern arrow-wood) where adjacent to floodplains, or *Decodon verticillatus* (swamp-loosestrife), *Chamaedaphne calyculata* (leatherleaf), and *Spiraea alba* var. *latifolia* (white meadowsweet) in more stagnant basins. Herbaceous species tend to be sparse but can include *Glyceria canadensis* (rattlesnake mannagrass), *Dulichium arundinaceum* (threeway sedge), *Carex stricta* (upright sedge), *Scirpus cyperinus* (woolgrass), *Osmunda regalis* (royal fern), *Thelypteris palustris* (eastern marsh fern), *Bidens* (beggarticks) spp., *Sium suave* (hemlock waterparsnip), *Scutellaria lateriflora* (blue skullcap), *Alisma plantago-aquatica* (American waterplantain), *Polygonum* (knotweed) spp., *Sparganium* (bur-reed) spp., and floating or submerged aquatic species such as *Lemna minor* (common duckweed), *Potamogeton natans* (floating pondweed), and *Nuphar variegata*. Bryophytes, if present, cling to shrub bases and include *Warnstorfia fluitans* (warnstorfia moss), *Drepanocladus aduncus* (drepanocladus moss), or *Sphagnum fallax* (sphagnum).
Most Abundant Species:

Stratum	Lifeform	Species
Short shrub/sapling	Broad-leaved deciduous shrub	*Cephalanthus occidentalis* (common buttonbush)
Herb (field)	Graminoid	*Dulichium arundinaceum* (threeway sedge)

Characteristic Species: *Cephalanthus occidentalis* (common buttonbush), *Dulichium arundinaceum* (threeway sedge), *Osmunda regalis* (royal fern), *Sparganium americanum* (American bur-reed), *Vaccinium corymbosum* (highbush blueberry)
Other Noteworthy Species:

Species	GRank	Type	Note
Lythrum salicaria (purple loosestrife)	-	plant	invasive/exotic

USFWS Wetland System: Palustrine.

DISTRIBUTION
Range: This association is found throughout the northeastern United States (an estimated 450,000 square km based on subsection attribution).
States/Provinces: CT, DC, DE, MA, MD, ME, NH, NJ, NY, PA, RI, VA, VT, WV?
Federal Lands: NPS (Boston Harbor Islands, C&O Canal?, Cape Cod, Delaware Water Gap, Minute Man, National Capital-East?, Roosevelt-Vanderbilt, Weir Farm); USFWS (Assabet River?, Chesapeake Marshlands, Great Meadows, Great Swamp, Oxbow)

CONSERVATION STATUS

Rank: G4G5 (31-Jan-2007)

Reasons: This association is widely distributed in the northeastern U.S. and relatively common in its small-patch setting. It is vulnerable to groundwater disruption, agricultural runoff, and adjacent forest clearing.

CLASSIFICATION INFORMATION

Status: Standard

Confidence: 2 - Moderate

Comments: This type may be synonymous with *Cephalanthus occidentalis / Carex* spp. Northern Shrubland (CEGL002190), although it also ranges south of the glaciation boundary in the east. CEGL002190 is distributed from the Western Allegheny Plateau (TNC Ecoregion 49) and Great Lakes (TNC Ecoregion 48) west to the Central Tallgrass Prairie (TNC Ecoregion 36), while this type occurs from the Central Appalachian Forest (TNC Ecoregion 59) and High Allegheny Plateau (TNC Ecoregion 60) east.

Similar Associations:

- *Cephalanthus occidentalis - (Leucothoe racemosa) / Carex joorii* Shrubland (CEGL004075)
- *Cephalanthus occidentalis / Carex* spp. - *Lemna* spp. Southern Shrubland (CEGL002191)
- *Cephalanthus occidentalis / Carex* spp. Northern Shrubland (CEGL002190)

Related Concepts:

- *Cephalanthus occidentalis* Semi-permanently Flooded Shrubland (Clancy 1996) ?
- Buttonbush Swamp (Kettle Basin Shrub Swamp) (Thompson 1996) ?
- Buttonbush semipermanently flooded shrub swamp (CAP pers. comm. 1998) ?
- Palustrine Broad-leaved Deciduous Scrub-Shrub Wetland, Seasonally Flooded (PSS1C) (Cowardin et al. 1979) ?

SOURCES

Description Authors: S.L. Neid, mod. E. Southgate, L.A. Sneddon, S.C. Gawler, E. Largay

References: Bowman 2000, Breden et al. 2001, CAP pers. comm. 1998, Clancy 1996, Cowardin et al. 1979, Eastern Ecology Working Group n.d., Edinger et al. 2002, Elliman 2003, Enser 1999, Fike 1999, Fleming et al. 2001, Gawler 2002, Harrison 2004, Hopping 2000, J. Harrison pers. comm., Karanaukas 2001, Metzler and Barrett 2001, NRCS 2004, Nichols et al. 2001, Sperduto 2000b, Swain and Kearsley 2001, Thompson 1996, Thompson and Sorenson 2000

Figure F-40. Northeastern Buttonbush Shrub Swamp (plot ROVA.35). 09/09/2003. NAD 1983 / UTM-18 easting 591098, northing 4624056.

Local Name: Eastern Reed Marsh (CEGL004141)

SYNONYMS

USNVC English Name: **Common Reed Eastern North America Temperate Semi-natural Herbaceous Vegetation**

USNVC Scientific Name: ***Phragmites australis* Eastern North America Temperate Semi-natural Herbaceous Vegetation**

USNVC Identifier: **CEGL004141**

LOCAL INFORMATION

Environmental Description: This association dominated by the exotic *Phragmites australis* (common reed) occurs on a step in slope topographic position in loam muck soils. At the Home of Franklin D. Roosevelt NHS (excluding Roosevelt Farm and Forest), this association occurs in low-lying areas adjacent to Northeastern Old Field (CEGL006107), and is also closely associated with Eastern Cattail Marsh (CEGL006153), a type where cattails (*Typha* spp.) may be replaced by the more aggressive exotic *Phragmites australis* (common reed).

Vegetation Description: This association is dominated by the exotic species *Phragmites australis* (common reed). The herbaceous layer averages 74.3% cover and 2.5 meters in height. This layer is heavily dominated by *Phragmites australis* (common reed), with associated species including *Microstegium vimineum* (Japanese stiltgrass), *Lythrum salicaria* (purple loosestrife) and *Typha angustifolia* (narrowleaf cattail). The unvegetated surface averages 25% cover and is comprised mainly of water.

Most Abundant Species:

Stratum	Lifeform	Species
Herb (field)	Graminoid	*Phragmites australis* (common reed), *Microstegium vimineum* (Japanese stiltgrass)
Herb (field)	Forb	*Lythrum salicaria* (purple loosestrife), *Typha angustifolia* (narrowleaf cattail)

Characteristic Species: exotic *Phragmites australis* (common reed)

Other Noteworthy Species: None.

Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
NY	S5*	B	1	Reedgrass Marsh	Edinger et al. 2002

Local Range: This association was only documented at Home of Franklin D. Roosevelt NHS (excluding Roosevelt Farm and Forest), but could occur elsewhere in the park as small patches where *Phragmites australis* (common reed) has invaded shallow emergent marshes/swales or low lying areas.

Classification Comments: This type was classified for shallow emergent marshes using *Phragmites australis* (common reed) as the dominant species.

Other Comments: None.

Local Description Authors: Frederick C. Sechler, Jr.

Plots: Roosevelt Home **(**ROVA.72)

AA Points: Home of Franklin D. Roosevelt NHS (excluding Roosevelt Farm and Forest (ROVA.60, ROVA.61)

Roosevelt-Vanderbilt National Historic Site Inventory Notes: None.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Class	Shrubland and Grassland (2)
Subclass	Temperate and Boreal Shrubland and Grassland (2.C)
Formation	Temperate and Boreal Freshwater Wet Meadow and Marsh (2.C.5)
Division	Eastern North American Freshwater Wet Meadow, Riparian, and Marsh (D030)
Macrogroup	Eastern North American Ruderal Wet Meadow and Marsh (M303)
Group	Northern and Central Ruderal Wet Meadow and Marsh Group (G556)
Alliance*	*Phragmites australis* Semipermanently Flooded Herbaceous Alliance (A.1431)
Alliance (English name)*	Common Reed Semipermanently Flooded Herbaceous Alliance
Association	*Phragmites australis* Eastern North America Temperate Semi-natural Herbaceous Vegetation
Association (English name)	Common Reed Eastern North America Temperate Semi-natural Herbaceous Vegetation
Ecological System(s)	North-Central Interior Freshwater Marsh (CES202.899) Semi-natural / Altered Vegetation and Conifer Plantations (CES203.074)

* Alliance assignment as of 2007. All USNVC alliances are currently (2014) under review and revision.

GLOBAL DESCRIPTION

Concept 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: Stands occur in semipermanently flooded marshes, ditches, impoundments, etc. that have often been disturbed by human activity.

Vegetation Description: 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:

Stratum	Lifeform	Species
Herb (field)	Graminoid	*Phragmites australis* (common reed)

Characteristic Species: *Phragmites australis* (common reed)

Other Noteworthy Species: Information not available.

USFWS Wetland System: Palustrine.

DISTRIBUTION

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.

States/Provinces: AL, AR, CT, DE:S5, FL, GA, IA, IN, LA, MA, MD, ME, MI, MN, MS, NC, NH, NJ, NY, OH, ON, PA, RI, SC, TX, VA, VT, WI, WV

Federal Lands: NPS (Assateague Island, Boston Harbor Islands, Cape Cod, Indiana Dunes, Minute Man, Saint Croix, Roosevelt-Vanderbilt, Sleeping Bear Dunes, Upper Delaware, Voyageurs); USFWS (Alligator River, Aransas, Bon Secour, Brazoria, Cape May, Great Dismal Swamp, Great Meadows, Great Swamp, Matagorda Island, Montezuma, Nomans Land Island?, Oxbow, Parker River, Prime Hook, Supawna Meadows)

CONSERVATION STATUS

Rank: GNA (invasive) (23-Nov-1997)

Reasons: 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 INFORMATION

Status: Standard

Confidence: 1 - Strong

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).

Similar Associations:

- *Phragmites australis* Tidal Herbaceous Vegetation (CEGL004187)
- *Phragmites australis* Western North America Temperate Semi-natural Herbaceous Vegetation (CEGL001475)

Related Concepts:

- *Phragmites australis* community (Metzler and Barrett 1992) ?
- *Phragmites australis* tidal marsh association (Clancy 1993) ?
- Inland Emergent Marsh (Chapman et al. 1989) B
- Southern New England nutrient-poor streamside/lakeside marsh (Rawinski 1984) ?
- Southern New England nutrient-rich streamside/lakeside marsh (Rawinski 1984) ?

SOURCES

Description Authors: D. Faber-Langendoen

References: Bailey 1997, Bailey 1998, Bell et al. 2002, Chapman et al. 1989, Clancy 1993, Harris et al. 1996, INAI unpubl. data, Metzler and Barrett 1992, Metzler and Barrett 2001, NRCS 2004, Nelson 1986, Rawinski 1984, Schafale and Weakley 1990, Schotz pers. comm., Southeastern Ecology Working Group n.d., Swain and Kearsley 2001

Figure F-41. Eastern Reed Marsh (plot ROVA.72). 08/31/2004. NAD 1983 / UTM-18 easting 588392, northing 4624238.

Local Name: Purple Loosestrife Wetland (CEGL006403)

SYNONYMS

USNVC English Name: **Purple Loosestrife Herbaceous Vegetation**
USNVC Scientific Name: ***Lythrum salicaria* Herbaceous Vegetation**
USNVC Identifier: **CEGL006403**

LOCAL INFORMATION

Environmental Description: This exotic dominated shallow emergent marsh occurs in low-lying areas and ditches of successional old fields, and in disturbed marshes. The soils are generally silt loam and occasionally muck with underlying bedrock of Ordovician shale and siltstone with minor amounts of sandstone, Austin Glen Formation. Adjacent and surrounding associations include Northeastern Old Field (CEGL006107), Steeplebush / Reed Canarygrass Successional Wet Meadow (CEGL006571), Northeastern Successional Shrubland (CEGL006451), and High Allegheny Rich Red Oak - Sugar Maple Forest (CEGL006125).
Vegetation Description: The tree canopy layer averages 8.6% cover and 24 meters in height. The characteristic species include *Salix* x *sepulcralis* (weeping willow) and *Acer rubrum* (red maple). The sparse tall shrub layer has 5% cover and averages 3 meters in height. The most abundant species include *Cephalanthus occidentalis* (common buttonbush) and *Alnus serrulata* (hazel alder). The sparse short shrub layer has 9% cover and averages 1.4 meters in height. The most abundant species within this layer include the exotic *Frangula alnus* (glossy buckthorn), *Cornus amomum* (silky dogwood), and *Cephalanthus occidentalis* (common buttonbush). The herbaceous layer averages 82.1% cover and is heavily dominated by the exotic *Lythrum salicaria* (purple loosestrife) to the exclusion of other plant species. Associated species in this exotic dominated wetland include *Thelypteris palustris* (eastern marsh fern), *Onoclea sensibilis* (sensitive fern), *Typha latifolia* (broadleaf cattail), *Carex* sp. (sedge), *Apocynum cannabinum* (Indianhemp), *Polygonum arifolium* (halberdleaf tearthumb), *Scirpus atrovirens* (green bulrush), and *Polygonum hydropiperoides* (swamp smartweed).
Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Salix* x *sepulcralis* (weeping willow), *Acer rubrum* (red maple)
Tall/short shrub/sapling	Broad-leaved deciduous shrub	*Cephalanthus occidentalis* (common buttonbush)
Tall/short shrub/sapling	Broad-leaved deciduous shrub	*Lindera benzoin* (northern spicebush)
Herb (field)	Forb	*Impatiens capensis* (jewelweed), *Pilea pumila* (Canadian clearweed), and *Symplocarpus foetidus* (skunk cabbage)

Characteristic Species: *Lythrum salicaria* (purple loosestrife)
Other Noteworthy Species: None.
Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
NY	S5*	B	1	Purple Loosestrife Marsh	Edinger et al. 2002

Local Range: This wetland, dominated by the exotic *Lythrum salicaria* (purple loosestrife), unfortunately is fairly common and is documented in all units except Home of Franklin D. Roosevelt NHS (excluding Roosevelt Farm and Forest). This type appears to be most common at Val-Kill, likely due to the close proximity of wetlands to development.

Classification Comments: This association was used to classify shallow emergent marshes in which *Lythrum salicaria* (purple loosestrife) was the dominant species.
Other Comments: None.
Local Description Authors: Frederick C. Sechler, Jr.
Plots: Roosevelt Farm and Forest (ROVA.120), Val-Kill (ROVA.44, ROVA.84).
AA Points: Val-Kill (ROVA.123, ROVA.126, ROVA.127), Vanderbilt Mansion NHS (ROVA.18), and Roosevelt Farm and Forest (ROVA.139).
Roosevelt-Vanderbilt National Historic Site Inventory Notes: None.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Class	Shrubland and Grassland (2)
Subclass	Temperate and Boreal Shrubland and Grassland (2.C)
Formation	Temperate and Boreal Freshwater Wet Meadow and Marsh (2.C.5)
Division	Eastern North American Freshwater Wet Meadow, Riparian, and Marsh (D030)
Macrogroup	Eastern North American Ruderal Wet Meadow and Marsh (M303)
Group	Northern and Central Ruderal Wet Meadow and Marsh Group (G556)
Alliance*	*Lythrum salicaria* Herbaceous Alliance (A.3030)
Alliance (English name)*	Purple Loosestrife Herbaceous Alliance
Association	*Lythrum salicaria* Herbaceous Vegetation
Association (English name)	Purple Loosestrife Herbaceous Vegetation
Ecological System(s)	Information not available.

* Alliance assignment as of 2007. All USNVC alliances are currently (2014) under review and revision.

GLOBAL DESCRIPTION

Concept Summary: This association consists of wetlands heavily invaded by *Lythrum salicaria* (purple loosestrife) with few or no species indicating the former more native association analog. *Lythrum* (loosestrife) makes up at least 75% of the vegetation cover and may approach 100%. The sparse associates include common wetland plants such as *Impatiens capensis* (jewelweed), *Onoclea sensibilis* (sensitive fern), *Thelypteris palustris* (eastern marsh fern), *Carex stricta* (upright sedge), and *Typha* (cattail) spp. Shrubs are sparse or absent.
Environmental Description: Information not available.
Vegetation Description: *Lythrum salicaria* makes up at least 75% of the vegetation cover and may approach 100%. The sparse associates include common wetland plants such as *Impatiens capensis* (jewelweed), *Onoclea sensibilis* (sensitive fern), *Thelypteris palustris* (eastern marsh fern), *Carex stricta* (upright sedge), and *Typha* (cattail) spp. Shrubs are sparse or absent.
Most Abundant Species:

Stratum	Lifeform	Species
Herb (field)	Forb	*Lythrum salicaria* (purple loosestrife)

Characteristic Species: *Lythrum salicaria* (purple loosestrife)
Other Noteworthy Species:

Species	GRank	Type	Note
Lythrum salicaria (purple loosestrife)	-	plant	state-level noxious weed

USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: This association is known from the northeastern U.S.
States/Provinces: MA, NY
Federal Lands: NPS (Minute Man, Roosevelt-Vanderbilt?); USFWS (Iroquois, Montezuma)

CONSERVATION STATUS
Rank: GNA (invasive) (7-Dec-2005)
Reasons: This community represents vegetation which has invaded native wetlands. It is not a conservation priority and does not receive a conservation rank.

CLASSIFICATION INFORMATION
Status: Standard
Confidence: 3 - Weak
Comments: This association is reserved for areas strongly dominated by *Lythrum salicaria* (purple loosestrife) and consequently without a suite of associated species that indicate the native community that formerly occupied the site.
Similar Associations: Information not available.
Related Concepts: Information not available.

SOURCES
Description Authors: S.C. Gawler
References: Eastern Ecology Working Group n.d., NRCS 2004

Figure F-42. Purple Loosestrife Wetland (plot ROVA.84). 09/14/2004. NAD 1983 / UTM-18 easting 590886, northing 4624184.

Local Name: Cattail Brackish Tidal Marsh (CEGL004201)

SYNONYMS

USNVC English Name: **Narrowleaf Cattail - Eastern Rosemallow Herbaceous Vegetation**

USNVC Scientific Name: ***Typha angustifolia* - *Hibiscus moscheutos* Herbaceous Vegetation**

USNVC Identifier: **CEGL004201**

LOCAL INFORMATION

Environmental Description: This estuarine system association is described as a tidally flooded *Typha* spp. (cattail) marsh with very poorly drained, mucky and muddy silt soils and a tidal range of 3.2 feet. The underlying bedrock is made of Ordovician shale and siltstone with minor amounts of sandstone, Austin Glen Formation. Adjacent estuarine associations include Atlantic Coast Wild Rice Tidal Marsh (CEGL004202) and Broadleaf Pond-lily Tidal Marsh (CEGL004472). Adjacent palustrine associations include Eastern Cattail Marsh (CEGL006153). Adjacent upland associations include Northeastern Old Field (CEGL006107), Hemlock - Northern Hardwood Forest (CEGL006109), and Red Oak - Northern Hardwood Forest (CEGL006173).

Vegetation Description: The sparse herbaceous layer averages 17.6% cover and 2.3 meters in height. The most abundant species include *Typha angustifolia* (narrowleaf cattail), *Peltandra virginica* (green arrow arum), *Polygonum hydropiperoides* (swamp smartweed) and *Polygonum amphibium* var. *emersum* (longroot smartweed). The emergent aquatic layer averages 64% cover and is characterized by several dominant species in the herbaceous layer such as *Typha angustifolia* (narrowleaf cattail), *Polygonum hydropiperoides* (swamp smartweed), and *Peltandra virginica* (green arrow arum), plus *Impatiens capensis* (jewelweed).

Most Abundant Species:

Stratum	Lifeform	Species
Herb (field)	Forb	*Typha angustifolia* (narrowleaf cattail), *Peltandra virginica* (green arrow arum), *Polygonum hydropiperoides* (swamp smartweed)
Aquatic emergent	Forb	*Typha angustifolia* (narrowleaf cattail), *Polygonum hydropiperoides* (swamp smartweed), *Peltandra virginica* (green arrow arum), *Impatiens capensis* (jewelweed)

Characteristic Species: *Typha angustifolia* (narrowleaf cattail), *Peltandra virginica* (green arrow arum), *Impatiens capensis* (jewelweed).

Other Noteworthy Species: None.

Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
NY	S3S4*	B		Brackish Tidal Marsh	Edinger et al. 2002

Local Range: This brackish tidal marsh occurs in association with other tidal wetlands and was only documented at Home of Franklin D. Roosevelt NHS (excluding Roosevelt Farm and Forest).

Classification Comments: This association was used to classify tidal marshes with *Typha angustifolia* (narrowleaf cattail) as the dominant species.
Other Comments: None.
Local Description Authors: Frederick C. Sechler, Jr.
Plots: Home of Franklin D. Roosevelt NHS (excluding Roosevelt Farm and Forest) (ROVA.2, ROVA.8, ROVA.23).
AA Points: Home of Franklin D. Roosevelt NHS (excluding Roosevelt Farm and Forest) (ROVA.88, ROVA.89, ROVA.92).
Roosevelt-Vanderbilt National Historic Site Inventory Notes: None.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Class	Shrubland and Grassland (2)
Subclass	Temperate and Boreal Shrubland and Grassland (2.C)
Formation	Salt Marsh (2.C.6)
Division	Temperate and Boreal Atlantic Coastal Salt Marsh (D034)
Macrogroup	Eastern North American Atlantic Salt Marsh (M079)
Group	North American Atlantic Brackish Tidal Marsh Group (G120)
Alliance*	*Typha (angustifolia, domingensis)* Tidal Herbaceous Alliance (A.1472)
Alliance (English name)*	(Narrowleaf Cattail, Southern Cattail) Tidal Herbaceous Alliance
Association	*Typha angustifolia - Hibiscus moscheutos* Herbaceous Vegetation
Association (English name)	Narrowleaf Cattail - Eastern Rosemallow Herbaceous Vegetation
Ecological System(s)	Northern Atlantic Coastal Plain Brackish Tidal Marsh (CES203.894)
	Atlantic Coastal Plain Northern Salt Pond Marsh (CES203.892)
	Atlantic Coastal Plain Embayed Region Tidal Freshwater Marsh (CES203.259)
	Acadian Estuary Marsh (CES201.579)

* Alliance assignment as of 2007. All USNVC alliances are currently (2014) under review and revision.

GLOBAL DESCRIPTION

Concept 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* (crimsoneyed 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: 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: 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* (crimsoneyed 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:

Stratum	Lifeform	Species
Herb (field)	Semi-shrub	*Hibiscus moscheutos* (crimsoneyed rosemallow)
Herb (field)	Graminoid	*Schoenoplectus pungens* (common threesquare), *Typha angustifolia* (narrowleaf cattail)
Floating aquatic	Aquatic herb (floating & submergent)	*Pontederia cordata* (pickerelweed)

Characteristic Species: *Hibiscus moscheutos* (crimsoneyed rosemallow), *Typha angustifolia* (narrowleaf cattail)
Other Noteworthy Species: Information not available.
USFWS Wetland System: Estuarine.

DISTRIBUTION
Range: This association occurs along the Atlantic coast from Maine to Virginia and possibly to South Carolina.
States/Provinces: CT, DE, MA, MD:S4, ME, NC?, NH, NJ:S4, NY, RI, SC?, VA
Federal Lands: NPS (Acadia, Assateague Island, Boston Harbor Islands, Cape Cod, Fire Island, Saugus Iron Works); USFWS (Back Bay?, Cape May, Chesapeake Marshlands, Chincoteague, Monomoy?, Parker River?, Prime Hook, Supawna Meadows)

CONSERVATION STATUS
Rank: G4G5 (19-Jan-2006)
Reasons: 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 INFORMATION
Status: Standard
Confidence: 2 - Moderate
Comments: A non-tidal barrier wetland documented at the Cove Point Wetland, Calvert County, Maryland (Steury 1999) appears to fit this concept.
Similar Associations:
- *Typha domingensis* Tidal Herbaceous Vegetation (CEGL008456)

Related Concepts:

- *Hibiscus* marsh (Cahoon and Stevenson 1986) ?
- *Typha (angustifolia, latifolia)* - *Hibiscus moscheutos* Herbaceous Vegetation (Harrison 2001) =
- *Typha angustifolia* - *Hibiscus moscheutos* Herbaceous Vegetation (Bowman 2000) =
- *Typha angustifolia* - *Hibiscus palustris* community (Metzler and Barrett 1992) ?
- *Typha angustifolia* community (Good and Good 1975) ?
- *Typha angustifolia* type (Ferren et al. 1981) ?
- *Typha* association (Shreve et al. 1910) =
- Brackish Tidal Marsh (Rawinski 1984) ?
- 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 (Narrowleaf Cattail Subtype) (Schafale 2000) ?
- Transitional fresh marsh (Hill 1986)

SOURCES

Description Authors: S.L. Neid

References: Bowman 2000, Breden 1989, Breden et al. 2001, Cahoon and Stevenson 1986, Coulling 2002, Dowhan and Rozsa 1989, Eastern Ecology Working Group n.d., Edinger et al. 2002, Ferren et al. 1981, Fleming 2001, Fleming and Moorhead 1998, Fleming et al. 2001, Gawler 2002, Good and Good 1975, Harrison 2001, Harrison 2004, Hill 1986, Klotz 1986, MENHP 1991, McCormick and Ashbaugh 1972, Metzler and Barrett 1992, Metzler and Barrett 2001, Odum et al. 1984, Rawinski 1984, Reschke 1990, Saltonstall 2002, Schafale 2000, Schafale 2003, Schafale and Weakley 1990, Shreve et al. 1910, Sperduto 1994, Sperduto 1997a, Sperduto 2000b, Steury 1999, Swain and Kearsley 2001

Figure F-43. Cattail Brackish Tidal Marsh (plot ROVA.23). 08/13/2003. NAD 1983 / UTM-18 easting 587828, northing 4624244.

Local Name: Duckweed Pond (CEGL005451)

SYNONYMS

USNVC English Name: **Duckweed species Eastern North American Aquatic Vegetation**
USNVC Scientific Name: ***Lemna* spp. Eastern North American Aquatic Vegetation**
USNVC Identifier: **CEGL005451**

LOCAL INFORMATION

Environmental Description: This association occurs as permanently inundated eutrophic ponds with a variable percentage of vegetation. These eutrophic ponds occur on silt loam soils on underlying bedrock of Ordovician shale and siltstone with minor amounts of sandstone, Austin Glen Formation. Adjacent upland associations include Hemlock - Beech - Oak Forest (CEGL006088), Semi-rich Northern Hardwood Forest (CEGL006211), Successional Tree-of-Heaven Forest (CEGL007191), Hemlock - Northern Hardwood Forest (CEGL006109), and Red Oak - Northern Hardwood Forest (CEGL006173). An adjacent wetland association is Red Maple / Tussock Sedge Wooded Marsh (CEGL006119).

Vegetation Description: The extremely sparse tree canopy layer averages 1.3% cover consists primarily of *Acer rubrum* (red maple). The sparse tall shrub layer averages 5% cover and 3 meters in height. The most abundant species is *Cephalanthus occidentalis* (common buttonbush). The herbaceous layer is relatively sparse, averaging 11.3% cover. Characteristic species include *Bidens connata* (purplestem beggarticks), *Polygonum hydropiperoides* (swamp smartweed), *Pilea pumila* (Canadian clearweed), and *Bidens frondosa* (devil's beggarticks). The emergent aquatic layer averages 23.8% cover and the most abundant species include *Lemna minor* (common duckweed) and *Wolffia brasiliensis* (Brazilian watermeal). The floating aquatic layer averages 45.8% cover and is characterized by *Lemna minor* (common duckweed) and *Wolffia braziliensis* (Brazilian watermeal).

Most Abundant Species:

Stratum	Lifeform	Species
Emergent Aquatic	Aquatic herb (floating & submergent)	*Lemna minor* (common duckweed)

Characteristic Species: *Lemna minor* (common duckweed)

Other Noteworthy Species: None.

Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
NY	SNR			Eutrophic Pond	Edinger et al. 2002.

Local Range: This eutrophic pond association occurs sporadically within units Home of Franklin D. Roosevelt NHS (including Roosevelt Farm and Forest). It was not documented at Vanderbilt Mansion NHS and Val-Kill.

Classification Comments: This association was used to classify eutrophic ponds dominated by *Lemna minor* (common duckweed).

Other Comments: None.

Local Description Authors: Frederick C. Sechler, Jr.

Plots: None.

AA Points: None.

Roosevelt-Vanderbilt National Historic Site Inventory Notes: None.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Class	Aquatic Vegetation (5)
Subclass	Freshwater Aquatic Vegetation (5.B)
Formation	Freshwater Aquatic Vegetation (5.B.1)
Division	North American Freshwater Freshwater Aquatic Vegetation (D049)
Macrogroup	Eastern North American Freshwater Aquatic Vegetation (M108)
Group	Eastern North American Freshwater Aquatic Vegetation Group (G114)
Alliance*	*Lemna* spp. Permanently Flooded Herbaceous Alliance (A.1747)
Alliance (English name)*	Duckweed species Permanently Flooded Herbaceous Alliance
Association	*Lemna* spp. Eastern North American Aquatic Vegetation
Association (English name)	Duckweed species Eastern North American Aquatic Vegetation
Ecological System(s)	South-Central Interior Large Floodplain (CES202.705)

* Alliance assignment as of 2007. All USNVC alliances are currently (2014) under review and revision.

GLOBAL DESCRIPTION

Concept Summary: This aquatic association of floating vegetation is known to occur throughout temperate eastern North America. *Lemna* spp. typically dominate but may be mixed with other plant taxa floating on the water surface. *Lemna*-dominated aquatic vegetation occupies wetlands that are permanently, semipermanently or seasonally flooded. These small plants may float on the water's surface or become stranded and possibly rooted during drawdown periods. Water chemistry is fresh. The standing water habitat is relatively shallow, generally less than 2-4 m (6.6-13.1 feet) and occurs as ponds, lakes, ditches, stock ponds, and backwater sloughs of river and stream channels. Standing water for much or most of the growing season is characteristic. Depth of the water is of no consequence to floating plants; they occur where the wind pushes them. The composition of examples varies across this wide distributional range. *Lemna* taxa that may be present in eastern North America include *Lemna aequinoctialis* (southwest U.S. as well as southeast U.S.), *Lemna minor* (widespread across temperate North America), *Lemna minuta* (widespread across southern U.S.), *Lemna obscura* (eastern-southeastern U.S.), *Lemna perpusilla* (eastern U.S.), *Lemna trisulca* (widespread temperate and boreal, but not southeast U.S.), *Lemna turionifera* (widespread temperate and boreal, but not southeast U.S.), and *Lemna valdiviana* (southeast U.S., and spotty in the southwest U.S.). Other species present may include *Spirodela polyrrhiza* (widespread temperate U.S.), *Spirodela punctata* (southeastern U.S.), *Azolla mexicana, Azolla filiculoides, Wolffiella lingulata* (rare), *Wolffiella oblonga* (extreme southwest and southeast U.S.), *Wolffiella gladiata* (southeast coastal plain), *Wolffia brasiliensis* (eastern temperate U.S.), *Wolffia borealis* (west coast temperate and eastern temperate U.S., but not coastal plain), *Wolffia globosa* (eastern temperate U.S.), and *Wolffia columbiana* (eastern temperate U.S.), as well as *Riccia* spp. (aquatic liverworts). Associated rooted floating aquatics include *Potamogeton* spp., *Sagittaria* spp., or *Polygonum* spp. may also be present s. While these latter species are rooted submerged species, and technically not part of the strictly floating community, they do intermingle. Biomass can be abundant under eutrophic conditions.

Environmental Description: *Lemna*-dominated aquatic vegetation occupies wetlands that are permanently flooded, semi-permanently flooded to seasonally flooded. Water chemistry is fresh. The standing water habitat is relatively shallow, generally less than 2-4 m (6.6-13.1 feet) and occurs as ponds, lakes, ditches, stock ponds, and backwater sloughs of river and stream channels. Standing water for much or most of the growing season is characteristic. Depth of the water is of no consequence to floating plants; they occur where the wind pushes them. Community

composition may change hour to hour, yet the environment, only the top few centimeters of water, is homogeneous. Biomass can be abundant under eutrophic conditions.
Vegetation Description: The composition of examples varies across the wide distributional range of this community. *Lemna* taxa that may be present in eastern North America include *Lemna aequinoctialis* (southwest U.S. as well as southeast U.S.), *Lemna minor* (widespread across temperate North America), *Lemna minuta* (widespread across southern U.S.), *Lemna obscura* (eastern-southeastern U.S.), *Lemna perpusilla* (eastern U.S.), *Lemna trisulca* (widespread temperate and boreal, but not southeast U.S.), *Lemna turionifera* (widespread temperate and boreal, but not southeast U.S.), and *Lemna valdiviana* (southeast U.S., and spotty in the southwest U.S.). Other species present may include *Spirodela polyrrhiza* (widespread temperate U.S.), *Spirodela punctata* (southeastern U.S.) *Azolla mexicana, Azolla filiculoides, Wolffiella lingulata* (rare), *Wolffiella oblonga* (extreme southwest and southeast U.S.), *Wolffiella gladiata* (southeast coastal plain), *Wolffia brasiliensis* (eastern temperate U.S.), *Wolffia borealis* (west coast temperate and eastern temperate U.S., but not coastal plain), *Wolffia globosa* (eastern temperate U.S.), and *Wolffia columbiana* (eastern temperate U.S.).
Most Abundant Species:

Stratum	Lifeform	Species
Floating aquatic	Aquatic herb (floating & submergent)	*Lemna minor* (common duckweed)

Characteristic Species: *Lemna minor* (common duckweed)
Other Noteworthy Species: Information not available.
USFWS Wetland System: Palustrine.

DISTRIBUTION
Range: This aquatic association of floating vegetation is known to occur throughout temperate eastern North America.
States/Provinces: AL, AR, DE, FL, GA, IA, IL, IN, KS, KY, LA, MA, MD, ME, MI, MN, MO, MS, NC, ND, NE, NH, NJ, NY, OH, OK, PA, RI, SC, SD, TN, TX, UT, VA, VT, WV
Federal Lands: NPS (Roosevelt-Vanderbilt); USFWS (Iroquois, Reelfoot)

CONSERVATION STATUS
Rank: G5 (11-Jul-2013)
Reasons: If this community is found across eastern North America, it is ranked G5. Even if it is subdivided into "division-level" subunits, those are likely secure.

CLASSIFICATION INFORMATION
Status: Standard
Confidence: 2 - Moderate
Comments: It is possible that a coastal plain *Lemna* association could be recognized based on the restricted distribution of many *Lemna* spp. [see Southeastern North American Freshwater Aquatic Vegetation Group (G561)]. *Lemna* and other characteristic wetland taxa that comprise floating, submerged and aquatic rooted associations are not well-reported in the literature, but they are known to occur in the field. *Lemna* and *Azolla* will be easy to distinguish from each other; some *Lemna* taxa may be less easy to distinguish from *Spirodela, Wolffiella*, and *Wolffia*.
Similar Associations:
- *Lemna minor* Herbaceous Vegetation (CEGL003305)
- *Lemna* spp. Western North American Aquatic Vegetation (CEGL005450)

Related Concepts: Information not available.

SOURCES
Description Authors: D. Faber-Langendoen
References: Edinger et al. 2002, Schafale and Weakley 1990, Southeastern Ecology Working Group n.d.

Figure F-44. Duckweed Pond (plot ROVA.75). 09/01/2004. NAD 1983 / UTM-18 easting 588487, northing 4623660.

Local Name: Open Water Marsh with Mixed Submergents/Emergents (CEGL006196)

SYNONYMS

USNVC English Name: **American Eel-grass - Claspingleaf Pondweed Herbaceous Vegetation**
USNVC Scientific Name: ***Vallisneria americana - Potamogeton perfoliatus* Herbaceous Vegetation**
USNVC Identifier: **CEGL006196**

LOCAL INFORMATION

Environmental Description: This association occurs as permanently flooded aquatic beds in channel beds with muddy silt soils with underlying bedrock of Ordovician shale and siltstone with minor amounts of sandstone, Austin Glen Formation. Adjacent associations that occur upslope from this aquatic natural community include Hemlock - Beech - Oak Forest (CEGL006088) and Northeastern Dry Oak-Hickory Forest (CEGL006336).
Vegetation Description: The submerged aquatic layer averages 60% cover and the only species documented is *Vallisneria americana* (eelgrass). Water dominates the unvegetated layer.
Most Abundant Species:

Stratum	Lifeform	Species
Emergent Aquatic	Aquatic herb (floating & submergent)	*Vallisneria americana* (American eelgrass)

Characteristic Species: *Vallisneria americana* (American eelgrass)
Other Noteworthy Species: None.
Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
NY	SNR*	B		Freshwater subtidal aquatic bed	Edinger et al. 2002

Local Range: This association was documented only at Vanderbilt Mansion NHS but could occur in small patches at Home of Franklin D. Roosevelt NHS (excluding Roosevelt Farm and Forest) where other tidal wetlands are present.
Classification Comments: This association was used to classify open water subtidal aquatic beds with *Vallisneria americana* (American eelgrass) as the dominant species.
Other Comments: None.
Local Description Authors: Frederick C. Sechler, Jr.
Plots: Vanderbilt Mansion NHS (ROVA.15).
AA Points: Vanderbilt Mansion NHS (ROVA.13, ROVA.30).
Roosevelt-Vanderbilt National Historic Site Inventory Notes: None.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Class	Aquatic Vegetation (5)
Subclass	Freshwater Aquatic Vegetation (5.B)
Formation	Freshwater Aquatic Vegetation (5.B.1)
Division	North American Freshwater Freshwater Aquatic Vegetation (D049)
Macrogroup	Eastern North American Freshwater Aquatic Vegetation (M108)
Group	Eastern North American Freshwater Aquatic Vegetation Group (G114)
Alliance*	*Vallisneria americana* Permanently Flooded Temperate Herbaceous Alliance (A.1757)
Alliance (English name)*	American Eel-grass Permanently Flooded Temperate Herbaceous Alliance
Association	*Vallisneria americana - Potamogeton perfoliatus* Herbaceous Vegetation

Association (English name) American Eel-grass - Claspingleaf Pondweed Herbaceous Vegetation
Ecological System(s) Laurentian-Acadian Freshwater Marsh (CES201.594)
* Alliance assignment as of 2007. All USNVC alliances are currently (2014) under review and revision.

GLOBAL DESCRIPTION

Concept Summary: This aquatic vegetation of sheltered bays of the northeastern United States occurs on lakes and streams where it is not highly disturbed by wave action. The vegetation is dominated by submergent or emergent plants with only minor floating-leaved components. Characteristic species may include *Vallisneria americana* (American eel-grass), *Potamogeton perfoliatus* (claspingleaf pondweed), *Potamogeton epihydrus* (ribbonleaf pondweed), *Potamogeton nodosus* (longleaf pondweed), *Heteranthera dubia* (grassleaf mudplantain), *Heteranthera reniformis* (kidneyleaf mudplantain), *Myriophyllum* (watermilfoil) spp., *Elodea canadensis* (Canadian waterweed), *Utricularia* (bladderwort) spp., and *Eriocaulon aquaticum* (sevenangle pipewort).
Environmental Description: Information not available.
Vegetation Description: Information not available.
Most Abundant Species: Information not available.
Characteristic Species: Information not available.
Other Noteworthy Species: Information not available.
USFWS Wetland System: Palustrine.

DISTRIBUTION

Range: Information not available.
States/Provinces: CT, DE, MA, MD, ME, NH, NJ:S4, NY, PA, RI, VT, WV
Federal Lands: NPS (Acadia)

CONSERVATION STATUS

Rank: G5 (1-Dec-1997)
Reasons: Information not available.

CLASSIFICATION INFORMATION

Status: Standard
Confidence: 3 - Weak
Comments: Information not available.
Similar Associations: Information not available.
Related Concepts:

- *Vallisneria americana* Herbaceous Vegetation (Bowman 2000) =
- Tape-grass shallow shore (CAP pers. comm. 1998)

SOURCES

Description Authors: Northern Appalachian Planning Team
References: Bowman 2000, Breden et al. 2001, CAP pers. comm. 1998, Eastern Ecology Working Group n.d., Gawler 2002, Harrison 2004, Kunsman 1994, Metzler and Barrett 2004

Figure F-45. Open Water Marsh with Mixed Submergents/Emergents (AA point ROVA.13). 08/30/2006. NAD 1983 / UTM-18 easting 587655, northing 4628706.

Table F-1. Equivalency between U.S. National Vegetation Classification associations and New York Natural Community Types at Roosevelt-Vanderbilt National Historic Sites (forests and woodlands).

U.S. National Vegetation Classification Association	**New York Natural Community Type equivalent**
Red Oak-Heath Woodland/Rocky Summit (CEGL006134)	Appalachian Oak-Hickory Forest
Northeastern Dry Oak-Hickory Forest (CEGL006336)	
Dry, Rich Oak-Hickory Forest (CEGL006301)	
Mesic Sugar Maple - Ash - Oak -Hickory Forest (CEGL006046)	
Red-cedar Rocky Summit (CEGL006002)	Red-cedar Rocky Summit
Black Locust Successional Forest (CEGL007279)	Successional Southern Hardwoods
Northeastern Modified Successional Forest(CEGL006599)	
Successional Tree-of-Heaven Forest (CEGL007191)	
Early-Successional Aspen – Birch Woodland (CEGL006303)	Successional Northern Hardwoods
Eastern White Pine Successional Forest (CEGL007944)	
Northeastern Oak-Red Maple Successional Forest (CEGL006506)	
Norway Maple Forest (CEGL006407)	
Hardwood Plantation (CEGL006613)	Hardwood Plantation
Mixed Pine Conifer Plantation (CEGL006313)	Conifer Plantation
Norway Spruce Plantation (CEGL007167)	Spruce-Fir Plantation
White Pine Plantation (CEGL007177)	Pine Plantation
Red Pine Plantation (CEGL007178)	
Central Appalachian Hemlock-Chestnut Oak Forest (CEGL006923)	Hemlock-Northern Hardwood Forest
Hemlock-Beech-Oak Forest (CEGL006088)	
Hemlock-Northern Hardwood Forest (CEGL006109)	
Hemlock/White Pine-Red Oak-Mixed Hardwood Forest (CEGL006566)	
White Pine-Hemlock Dry-Mesic Coniferous Forest (CEGL006328)	
High Allegheny Rich Red Oak-Sugar Maple Forest (CEGL006125)	Oak-Tulip Tree Forest
Red Oak-Northern Hardwood Forest (CEGL006173)	Beech-Maple Mesic Forest
Semi-rich Northern Hardwood Forest (CEGL006211)	
Northern Hardwood - White Pine Forest (CEGL005005)	Pine-Northern Hardwood Forest
Sugar Maple - Ash - Basswood Northern Rich Mesic Forest (CEGL005008)	Maple-Basswood Rich Mesic Forest
Hemlock-Hardwood Swamp (CEGL006226)	Hemlock-Hardwood Swamp
Red Maple - Blackgum Basin Swamp (CEGL006014)	Red Maple-Blackgum Swamp
Red Maple/Tussock Sedge Wooded Marsh (CEGL006119)	Red Maple-Hardwood Swamp
Southern New England / Northern Piedmont Red Maple Seepage	
Northeastern Pin Oak-Swamp White Oak Forest (CEGL006240)	

Table F-2. Equivalency between U.S. National Vegetation Classification associations and New York Natural Community Types at Roosevelt-Vanderbilt National Historic Sites (non-forested vegetation).

U.S. National Vegetation Classification Association	**New York Natural Community Type equivalent**
Northeastern Old Field (CEGL006107)	Successional Old Field
Northeastern Successional Shrubland (CEGL006451)	Successional Shrubland
Eastern Woodland Vernal Pool (CEGL006453)	Vernal Pool
Northern Riverside Rock Outcrop (CEGL006284)	Shoreline Outcrop
Skunk Cabbage -Orange Jewelweed Seep (CEGL006567)	Intermittent Stream
Golden-saxifrage Forested Seep (CEGL006193)	
Atlantic Coast Wild Rice Tidal Marsh (CEGL004202)	Freshwater Tidal Marsh
Broadleaf Pond-lily Tidal Marsh (CEGL004472)	
Central Appalachian Cutgrass Marsh (CEGL006461)	Shallow Emergent Marsh
Mixed Forb Marsh (CEGL006446)	
Steeplebush / Reed Canarygrass Successional Wet Meadow (CEGL006571)	
Eastern Cattail Marsh (CEGL006153)	
Alluvial Alder Swamp (CEGL006414)	Shrub Swamp
Northeastern Buttonbush Shrub Swamp (CEGL006069)	
Eastern Reed Marsh (CEGL004141)	Reedgrass Marsh
Purple Loosestrife Wetland (CEGL006403)	Purple Loosestrife Marsh
Cattail Brackish Tidal Marsh (CEGL004201)	Brackish Tidal Marsh
Duckweed Pond (CEGL005451)	Eutrophic Pond
Open Water Marsh with Mixed Submergents/Emergents (CEGL006196)	Freshwater Subtidal Aquatic Bed

Literature Cited for Roosevelt-Vanderbilt National Historical Sites Descriptions of Vegetation Associations

Allard, D. J. 1990. Southeastern United States ecological community classification. Interim report, Version 1.2. The Nature Conservancy, Southeast Regional Office, Chapel Hill, NC. 96 pp.

Anderson, D. M. 1982. Plant communities of Ohio: A preliminary classification and description. Division of Natural Areas and Preserves, Ohio Department of Natural Resources, Columbus, OH. 182 pp.

Anderson, L.E. 1990. A checklist of Sphagnum in North America north of Mexico. *The Bryologist* 93: 500-501.

Anderson, L.E., H.A. Crum, and W.R. Buck. 1990. List of mosses of North America north of Mexico. *The Bryologist* 93: 448-499.

Baalman, R. J. 1965. Vegetation of the Salt Plains National Wildlife Refuge, Jet, Oklahoma. Unpublished Ph.D. dissertation, University of Oklahoma, Norman, OK.

Bailey, R. 1997. Map: Ecoregions of North America (rev.). 1:15,000,000. USDA Forest Service in cooperation with The Nature Conservancy and the U.S. Geological Survey. Washington, DC.

Bailey, R. G. 1998. Ecoregion map of North America: Explanatory note. Miscellaneous Publication Number 1548, USDA Forest Service. Washington, DC. 10 pp.

Bakowsky, W. D., and H. T. Lee. 1996. Vegetation communities of southern Ontario (draft). Ontario Natural Heritage Information Centre and Southern Region STTU, Ontario Ministry of Natural Resources, Peterborough, Ontario. 87 pp.

Barrett, N. E. 1989. Vegetation of the tidal wetlands of the lower Connecticut River: Ecological relationships of plant community-types with respect to flooding and habitat. M.S. thesis, University of Connecticut, Storrs, CT. 209 pp.

Barrett, N. E. 1994. Vegetation patch dynamics in freshwater tidal wetlands. Ph.D. dissertation, University of Connecticut, Storrs, CT. 277 pp.

Barrett, N., and R. Enser. 1997. Alluvial plant communities within the Wood-Pawcatuck Major Basin, Rhode Island, May 12, 1997. The Nature Conservancy, Connecticut Field office, Middletown, CT, and The Rhode Island Natural Heritage Program, Department of Environmental Management, Providence, RI.

Bartgis, R. 1986. Natural community descriptions. Unpublished draft. Maryland Natural Heritage Program, Maryland Department of Natural Resources, Annapolis, MD.

Bell, R., M. Chandler, R. Buchsbaum, and C. Roman. 2002. Inventory of intertidal habitats: Boston Harbor Islands, a National Park area. Technical Report NPS/NERBOST/NRTR-2004/1. USDI National Park Service, Northeast Region, Boston, MA. 13 pp.

Berdine, M. A. 1998. Maryland vegetation classification. Maryland Department of Natural Resources, Annapolis, MD.

Bowman, P. 2000. Draft classification for Delaware. Unpublished draft. Delaware Natural Heritage Program, Smyrna, DE.

Braun, E. L. 1950. Deciduous forests of eastern North America. Hafner Press, New York, NY. 596 pp.

Breden, T. F. 1989. A preliminary natural community classification for New Jersey. Pages 157-191 in: E. F. Karlin, editor. New Jersey's rare and endangered plants and animals. Institute for Environmental Studies, Ramapo College, Mahwah, NJ. 280 pp.

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

Brown, J. H. Jr., C. A. Castaneda, and R. J. Hindle. 1982a. Floristic relationships and dynamics of hemlock (*Tsuga canadensis*) communities in Rhode Island. *Bulletin of the Torrey Botanical Club* 109:385-391.

Byers, E. A., J. P. Vanderhorst, and B. P. Streets. 2007. Classification and conservation assessment of high elevation wetland communities in the Allegheny Mountains of West Virginia. West Virginia Natural Heritage Program, West Virginia Division of Natural Resources, Elkins, WV.

Cahoon, D. R., and J. C. Stevenson. 1986. Production, predation, and decomposition in a low-salinity *Hibiscus* marsh. *Ecology* 67:1341-1350.

Cain, S. A., and W. T. Penfound. 1938. *Aceretum rubri*: The red maple swamp forest of central Long Island. *The American Midland Naturalist* 19:390-416.

CAP [Central Appalachian Forest Working Group]. 1998. Central Appalachian Working group discussions. The Nature Conservancy, Boston, MA.

Chapman, K. A., D. A. Albert, and G. A. Reese. 1989. Draft descriptions of Michigan's natural community types. Michigan Department of Natural Resources, Lansing, MI. 35 pp.

Clancy, K. 1993. A preliminary classification of the natural communities of Delaware. Unpublished draft, Delaware Natural Heritage Inventory, Division of Parks and Recreation, Dover, DE. 30 pp.

Clancy, K. 1996. Natural communities of Delaware. Unpublished review draft. Delaware Natural Heritage Program, Division of Fish and Wildlife, Delaware Division of Natural Resources and Environmental Control, Smyrna, DE. 52 pp.

Clark, J. S. 1986. Vegetation and land-use history of the William Floyd Estate, Fire Island National Seashore, Long Island, New York. USDI, National Park Service, North Atlantic Region, Office of Scientific Studies, Boston, MA. 126 pp.

Colburn, E. A. 2004. Vernal pools: Natural history and conservation. McDonald and Woodward Publishing, Blacksburg, VA. 426 pp.

Coulling, P. P. 2002. A preliminary classification of tidal marsh, shrub swamp, and hardwood swamp vegetation and assorted non-tidal, chiefly non-maritime, herbaceous wetland communities of the Virginia Coastal Plain. October 2002. Virginia Department of Conservation and Recreation, Division of Natural Heritage, Richmond, VA.

Coulling, P. P., and T. J. Rawinski. 1999. Classification of vegetation and ecological land units of the Piney River and Mt. Pleasant area, Pedlar Ranger District, George Washington and Jefferson National Forests, Virginia. Natural Heritage Technical Report 99-03, Virginia Department of Conservation and Recreation, Division of Natural Heritage, Richmond, VA.

Cowardin, L. M., V. Carter, F. C. Golet, and E. T. LaRoe. 1979. Classification of wetlands and deepwater habitats of the United States. U.S. Fish and Wildlife Service, Biological Service Program. FWS/OBS-79/31. Washington, DC. 103 pp.

Damman, A. W. H. 1977. Geographical changes in the vegetation patterns of raised bogs in the Bay of Fundy region of Maine and New Brunswick. *Vegetatio* 35:137-151.

Damman, A. W. H., and B. Kershner. 1977. Floristic composition and topographical distribution of the forest communities of the gneiss areas of western Connecticut. *Naturaliste Canadien* 104:23-45.

Decker, E. 1955. The Conneaut Marsh: Marsh and waterfowl investigations. M.S. thesis, Pennsylvania State University Graduate School, School of Forestry. State College, PA. 108 pp.

DeMeo, T., D. McCay, D. Walton, and J. Concannon. 1998. Terrestrial ecological classification of the Monogahela National Forest. USDA Forest Service, Elkins, WV.

Dowhan, J. J., and R. Rozsa. 1989. Flora of Fire Island, Suffolk Country, New York. *Bulletin of the Torrey Botanical Club* 116:265-282.

Eastern Ecology Working Group of NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Terrestrial Vegetation. NatureServe, Boston, MA.

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

Ehrenfeld, J. G. 1977. Vegetation of Morristown National Historical Park: Ecological analysis and management alternatives. Final Report. USDI National Park Service Contract No. 1600-7-0004. Morristown, NJ. 166 pp.

Elias, T. B. 1980. The complete trees of North America, field guide and natural history. Book Division, Times Mirror Magazines, Inc. New York, NY. 948 pp.

Elliman, T. 2003. Boston Harbor Islands plant communities. Report submitted to Massachusetts Natural Heritage & Endangered Species Program, Massachusetts Division of Fisheries & Wildlife, Westborough, MA.

Enser, R. 1993. Natural community classification for Rhode Island (draft). Rhode Island Natural Heritage Program. Providence, RI.

Enser, R. 1999. Natural communities of Rhode Island. Unpublished draft, December 1999. 22 pp. Providence, RI.

Eyre, F. H., editor. 1980. Forest cover types of the United States and Canada. Society of American Foresters, Washington, DC. 148 pp.

Ferren, W. R., Jr., and R. E. Good. 1977. Habitat, morphology and phenology of southern wild rice (*Zizania aquatica* L.) from the Wading River in New Jersey. *Bulletin of the Torrey Botanical Club* 104:392-399.

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.

Fike, J. 1999. Terrestrial and palustrine plant communities of Pennsylvania. Pennsylvania Natural Diversity Inventory. Pennsylvania Department of Conservation and Recreation. Bureau of Forestry. Harrisburg, PA. 86 pp.

Fleming, G. P. 1985. A study of the dwarf pine forest and *Carex polymorpha* Muhl. on Panther Knob, West Virginia. Final report prepared for The Nature Conservancy, West Virginia Field Office. Elkins, WV. 149 pp.

Fleming, G. P. 1999. Plant communities of limestone, dolomite, and other calcareous substrates in the George Washington and Jefferson national forests, Virginia. Natural Heritage Technical Report 99-4. Virginia Department of Conservation and Recreation, Division of Natural Heritage, Richmond, VA. Unpublished report submitted to the USDA Forest Service. 218 pp. plus appendices.

Fleming, G. P. 2001. Community types of Coastal Plain calcareous ravines in Virginia. Preliminary analysis and classification. Virginia Department of Conservation and Recreation, Division of Natural Heritage, Richmond, VA. 4 pp.

Fleming, G. P., and P. P. Coulling. 2001. Ecological communities of the George Washington and Jefferson national forests, Virginia. Preliminary classification and description of vegetation types. Virginia Department of Conservation and Recreation, Division of Natural Heritage, Richmond, VA. 317 pp.

Fleming, G. P., and W. H. Moorhead, III. 1996. Ecological land units of the Laurel Fork Area, Highland County, Virginia. Virginia Department of Conservation and Recreation, Division of Natural Heritage. Natural Heritage Technical Report 96-08. Richmond, VA. 114 pp. plus appendices.

Fleming, G. P., and W. H. Moorhead, III. 1998. Comparative wetlands ecology study of the Great Dismal Swamp, Northwest River, and North Landing River in Virginia. Natural Heritage Technical Report 98-9. Virginia Department of Conservation and Recreation, Division of Natural Heritage, Richmond, VA. Unpublished report submitted to the U.S. Environmental Protection Agency. 181 pp.

Fleming, G. P., and W. H. Moorhead, III. 2000. Plant communities and ecological land units of the Peter's Mountain area, James River Ranger District, George Washington and Jefferson national forests, Virginia. Natural Heritage Technical Report 00-07. Virginia Department of Conservation and Recreation, Division of Natural Heritage, Richmond, VA. Unpublished report submitted to the USDA Forest Service. 195 pp. plus appendices.

Fleming, G. P., P. P. Coulling, D. P. Walton, K. M. McCoy, and M. R. Parrish. 2001. The natural communities of Virginia: Classification of ecological community groups. First approximation. Natural Heritage Technical Report 01-1. Virginia Department of Conservation and Recreation, Division of Natural Heritage, Richmond, VA. Unpublished report. January 2001. 76 pp.

Fleming, Gary P. Personal communication. Ecologist, Virginia Department of Conservation and Recreation, Division of Natural Heritage, Richmond, VA.

FNA Editorial Committee [Flora of North America Editorial Committee], editor. 2006. Flora of North America, north of Mexico. Volume 21. Magnoliophyta: Asteridae, part 8: Asteraceae, part 3. Oxford University Press, New York, NY. 616 pp.

Gaertner, F. 1955. Honeylocust (*Gleditsia triacanthos* L.) in field shelterbelts of western Oklahoma. Unpublished M.S. thesis, Oklahoma State University, Stillwater, OK.

Gawler, S. C. 2002. Natural landscapes of Maine: A guide to vegetated natural communities and ecosystems. Maine Natural Areas Program, Department of Conservation, Augusta, ME. [in press]

Glitzenstein, J. S., and D. R. Streng. 2004. Evaluating the NatureServe preliminary plant community classification for Francis Marion National Forest. Tall Timbers Research Station, Tallahassee, FL. Plus appendices and data.

Golet, F. C., A. J. K. Calhoun, W. R. DeRagon, D. J. Lowry, and A. J. Gold. 1993. Ecology of red maple swamps in the glaciated Northeast: A community profile. USDI Fish & Wildlife Service, Washington, DC. 151 pp.

Good, R. E., and N. F. Good. 1975b. Vegetation and production of the Woodbury Creek and Hessian Run freshwater tidal marshes. *Bartonia* 43:38-45.

Gordon, R. B. 1937. The botanical survey of the Allegheny State Park. New York State Museum Handbook 17:23-88. State University of New York, Albany, NY.

Grace, J. B., and R. G. Wetzel. 1981. Habitat partitioning and competitive displacement in cattail (*Typha*): Experimental field studies. *The American Midland Naturalist* 118:463-474.

Grafton, W. N., and O. L. Eye. 1982. Vascular flora of eight selected West Virginia wetlands with special reference to rare species. Pages 107-115 in: Proceedings of the Symposium on Wetlands of the Unglaciated Appalachian Region. West Virginia University, Morgantown.

Grossman, D. H., K. Lemon Goodin, and C. L. Reuss, editors. 1994. Rare plant communities of the conterminous United States: An initial survey. The Nature Conservancy. Arlington, VA. 620 pp.

Harris, A. G., S. C. McMurray, P. W. C. Uhlig, J. K. Jeglum, R. F. Foster, and G. D. Racey. 1996. Field guide to the wetland ecosystem classification for northwestern Ontario. Ontario Ministry of Natural Resources, Northwest Science and Technology, Thunder Bay, Ontario. Field guide FG-01. 74 pp. plus appendix.

Harrison, J. W. 2001. Herbaceous tidal wetland communities of Maryland's eastern shore: Identification, assessment and monitoring. Report submitted to the U.S. EPA (Clean Water Act 1998 State Wetlands Protection Development Grant Program). Biodiversity Program, Maryland Department of Natural Resources, Wildlife and Heritage Division. 30 June 2001. [U.S. EPA Reference Wetland Natural communities of Maryland's Herbaceous Tidal Wetlands Grant #CD993724].

Harrison, J. W., compiler. 2004. Classification of vegetation communities of Maryland: First iteration. A subset of the International Classification of Ecological Communities: Terrestrial Vegetation of the United States, NatureServe. Maryland Natural Heritage Program, Maryland Department of Natural Resources, Annapolis, MD. 243 pp.

Harrison, Jason W. Personal communication. State Community Ecologist, Maryland Wildlife and Heritage Division, Department of Natural Resources, Tawes State Office Building, E-1, Annapolis, MD 21401.

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

Hoagland, B. 2000. The vegetation of Oklahoma: A classification for landscape mapping and conservation planning. *The Southwestern Naturalist* 45(4):385-420.

Hopping, R. 2000. Property Profile (World's End). The Trustees of Reservations. Beverly, MA.

Hough, A. F. 1943. Soil factors and stand history in a virgin forest valley on the northern Allegheny Plateau. *Soil Science* 56:19-28.

Hough, A. F., and R. D. Forbes. 1943. The ecology and silvics of forests in the high Plateaus of Pennsylvania. *Ecological Monographs* 13:300-320.

Hunt, D. 1997. Long Island oak forest project: Classification justification. Unpublished materials. New York Natural Heritage Program, Latham, NY.

Hunt, D. M. 1999. Natural community descriptions and specifications: Communities known or suspected from Adirondack Nature Conservancy. Unpublished report. New York Natural Heritage Program, Albany, NY. 272 pp.

INAI [Iowa Natural Areas Inventory]. No date. Vegetation classification of Iowa. Iowa Natural Areas Inventory, Iowa Department of Natural Resources, Des Moines, IA.

Karanaukas, M. 2001. A survey of the aquatic invertebrates of the Boston Harbor Islands. Report to the Island Alliance, National Park Service, and the Massachusetts Natural Heritage and Endangered Species Program. Boston, MA.

Kartesz, J. T. 1999. A synonymized checklist and atlas with biological attributes for the vascular flora of the United States, Canada, and Greenland. First edition. In: J. T. Kartesz and C. A. Meacham. Synthesis of the North American Flora, Version 1.0. North Carolina Botanical Garden, Chapel Hill, NC.

Keever, C. 1979. Mechanisms of plant succession on old fields of Lancaster County, Pennsylvania. *Bulletin of the Torrey Botanical Club* 106(4):299-308.

Klotz, L. H. 1986. The vascular flora of Wallops Island and Wallops Mainland, Virginia. *Castanea* 51:306-326.

Kost, M. A., D. A. Albert, J. G. Cohen, B. S. Slaughter, R. K. Schillo, C. R. Weber, and K. A. Chapman. 2007. Natural communities of Michigan: Classification and description. Report No. 2007-21, Michigan Natural Features Inventory, Lansing, MI. 314 pp. [http://web4.msue.msu.edu/mnfi/reports/2007-21_Natural_Communites_of_Michigan_Classification_and_Description.pdf]

Kuchler, A. W. 1956. Notes on the vegetation of southeastern Mount Desert Island, Maine. *University of Kansas Science Bulletin* 38:335-392.

Kunsman, J. 1994. A survey of the aquatic vascular plants of the upper Delaware River. Unpublished report to the National Park Service. Pennsylvania Science Office of The Nature Conservancy. Middletown, PA. 322 pp.

Lea, C., and E. T. Riley. 2005. Relationship of groundwater pH to floristic composition of seepage swamps in the Blue Ridge, Piedmont, and inner Coastal Plain of Maryland, the District of Columbia, and northern Virginia. Unpublished report submitted to the National Park Service, National Capital Region. Washington, DC. 9 pp. plus appendices.

Lee, C. 1985. West Rock to the Barndoor Hills, the traprock ridges of Connecticut. Vegetation of the Connecticut Natural Areas No. 4. State Geological and Natural History Survey of Connecticut, Hartford, CT. 60 pp.

Livingston, R. B., and B. E. Lund. 1982. Microclimates and vegetation of the Holyoke Range, Massachusetts. Unpublished report. Department of Botany, University of Massachusetts, Amherst, MA.

Lundgren, J. 1999. Lower New England - Northern Piedmont Ecoregion Forest Classification. The Nature Conservancy, Conservation Science, Boston, MA. December 1999 Draft. 63 pp.

Lundgren, J. 2000. Lower New England - Northern Piedmont Ecoregion Forest Classification. The Nature Conservancy, Conservation Science, Boston, MA. 72 pp.

Lundgren, J., editor. 2001. Plant communities of the High Allegheny Plateau Ecoregion. Draft revisions to the US National Vegetation Classification, March 2000 subset. Natural Heritage Central Databases. The Association for Biodiversity Information, Arlington, VA, and The Nature Conservancy, Eastern Regional Office, Boston, MA. 71 pp. plus tables.

McCormick, J. 1970. The natural features of Tinicum Marsh, with particular emphasis on vegetation. *In*: Two studies of Tinicum Marsh, Delaware and Philadelphia Counties, Pa. J. F. McCormick, R. R. Grant, Jr., and R. Patrick, eds. The . The Conservation Foundation. Washington, DC. 104 pp.

McCormick, J., and T. Ashbaugh. 1972. Vegetation of a section of Oldmans Creek Tidal Marsh and related areas in Salem and Gloucester counties, New Jersey. *Bulletin of the New Jersey Academy of Science* 17:31-37.

McCoy, K. M., and G. P. Fleming. 2000. Ecological communities of U.S. Army Garrison, Fort Belvoir, Fort Belvoir, Virginia. Natural Heritage Technical Report 00-08, Virginia Department of Conservation and Recreation, Division of Natural Heritage. Unpublished report submitted to the U.S. Army. Richmond, VA. 156 pp. plus appendices.

McDonald, A. 1938. Erosion and its control in Oklahoma Territory. Miscellaneous Publication 301, U.S. Department of Agriculture, Washington, DC.

MENHP [Maine Natural Heritage Program]. 1991. Natural landscapes of Maine: A classification of ecosystems and natural communities. Unpublished document. Office of Comprehensive Planning, Maine Natural Heritage Program, Augusta, ME. 77 pp.

Metzler, K. 1984. Natural community description abstract - southern New England freshwater tidal marsh. Unpublished report. Connecticut Natural Diversity Database, Hartford, CT. 6 pp.

Metzler, K. J., and A. W. H. Damman. 1985. Vegetation patterns in the Connecticut River flood plain in relation to frequency and duration of flooding. *Naturaliste Can. (Rev. Ecol. Syst.)* 112:535-547.

Metzler, K. J., and J. Barrett. 1992. Connecticut community classification. Unpublished draft. Connecticut Department of Environmental Protection, Natural Resources Center, Natural Diversity Database, Hartford, CT..

Metzler, K. J., and J. P. Barrett. 2001. Vegetation classification for Connecticut. Draft 5/21/2001. Connecticut Department of Environmental Protection, Natural Resources Center, Natural Diversity Database, Hartford, CT..

Metzler, K. J., and J. P. Barrett. 2003. Vegetation classification for Connecticut. Draft. State Geological and Natural History Survey of Connecticut, Department of Environmental Protection, Hartford, CT. 137 pp. plus appendix.

Metzler, K. J., and J. P. Barrett. 2004. Vegetation classification for Connecticut. Draft. State Geological and Natural History Survey of Connecticut, Department of Environmental Protection, Hartford, CT.

Metzler, K., and J. Barrett. 1996. Vegetation classification for Connecticut organized into the modified UNESCO hierarchy. Unpublished review draft. Connecticut Natural Diversity Database. Hartford, CT. 48 pp.

MNNHP [Minnesota Natural Heritage Program]. 1993. Minnesota's native vegetation: A key to natural communities. Version 1.5. Minnesota Department of Natural Resources, Natural Heritage Program, St. Paul, MN. 110 pp.

Moore, B., and N. Taylor. 1927. An ecological study of the vegetation of Mount Desert Island, Maine. *Brooklyn Botanical Garden Memoirs* 3:1-151.

Motzkin, G. 1993. Uncommon plant communities of the Connecticut Valley, Massachusetts. Report submitted to the MA Natural Heritage and Endangered Species Program. Division of Fisheries & Wildlife, Boston, MA. 58 pp.

NAP [Northern Appalachian-Boreal Forest Working Group]. 1998. Northern Appalachian-Boreal Working group discussions. The Nature Conservancy, Boston, MA.

NatureServe and E. Russell. 2003. International Classification of Ecological Communities: Terrestrial Vegetation of the United States. Great Swamp National Wildlife Refuge. NatureServe Central Databases. Arlington, VA. Data current as June 2003.

NatureServe Ecology - Southeastern United States. No date. Unpublished data. NatureServe, Durham, NC.

Nelson, J. B. 1986. The natural communities of South Carolina: Initial classification and description. South Carolina Wildlife and Marine Resources Department, Division of Wildlife and Freshwater Fisheries, Columbia, SC. 55 pp.

Nichols, G. E. 1914. The vegetation of Connecticut: III. Plant societies on uplands. *Torreya* 14:167-194.

Nichols, W. F., J. M. Hoy, and D. D. Sperduto. 2001. Open riparian communities and riparian complexes in New Hampshire. New Hampshire Natural Heritage Inventory, DRED Division of Forests and Lands, Concord, NH. 82 pp. plus appendices.

Northern Appalachian Ecology Working Group. 2000. Northern Appalachian / Boreal Ecoregion community classification (Review Draft). The Nature Conservancy, Eastern Conservation Science Center, Boston, MA. 117 pp. plus appendices.

NRCS [Natural Resources Conservation Service]. 2001. Soil survey of Gateway National Recreation Area, New York and New Jersey. USDA Natural Resources Conservation Service and USDI National Park Service, Gateway National Recreation Area in partnership with Cornell University Agricultural Experiment Station and New York City Soil and Water Conservation District. New York, NT.

NRCS [Natural Resources Conservation Service]. 2004. Soil survey of Saratoga County, New York. USDA Natural Resources Conservation Service. Washington, DC. 590 pp.

Odum, W. E., T. J. Smith, III, J. K. Hoover, and C. C. McIvor. 1984. The ecology of tidal freshwater marshes of the United States east coast: A community profile. FWS/OBS-83/17. USDI Fish & Wildlife Service, Office of Biological Services, Washington, DC. 176 pp.

Overlease, W. R. 1987. 150 years of vegetation change in Chester County, Pennsylvania. *Bartonia* 53:1-12.

Patterson, Karen D. Personal communication. Ecologist, Virginia Department of Conservation and Recreation, Division of Natural Heritage, Richmond, VA.

Perles, S. J., G. S. Podniesinski, E. A. Zimmerman, W. A. Millinor, L. A. Sneddon. 2006a. Vegetation classification and mapping at Fort Necessity National Battlefield. Technical Report NPS/NER/NRTR--2006/038. National Park Service, Philadelphia, PA.

Perles, S. J., G. S. Podniesinski, E. A. Zimmerman, W. A. Millinor, and L. A. Sneddon. 2006b. Vegetation classification and mapping at Friendship Hill National Historic Site. Technical Report NPS/NER/NRTR--2006/041. National Park Service, Philadelphia, PA.

Perles, S. J., G. S. Podniesinski, W. A. Millinor, and L. A. Sneddon. September 2006c. Vegetation classification and mapping at Gettysburg National Military Park and Eisenhower National Historical Park. Technical Report NPS/NER/NRTR--2006/058. National Park Service, Philadelphia, PA.

Perles, S. J., G. S. Podniesinski, E. Eastman, L. A. Sneddon, and S. C. Gawler. 2007. Classification and mapping of vegetation and fire fuel models at Delaware Water Gap National Recreation Area. Technical Report NPS/NER/NRTR--2007/076. 2 volumes. National Park Service, Philadelphia, PA.

Putnam, N. [1995]. Plant communities of the Meadow River wetlands. Final report submitted to the West Virginia Division of Natural Resources. Elkins, WV.

Rabie, P.A. 2000. Invasive nitrogen fixers. Restoration and Reclamation Review 6:6.3. [http://horticulture.coafes.umn.edu/vd/h5015/rrr.htm]

Rawinski, T. 1984. Natural community description abstract - southern New England calcareous seepage swamp. Unpublished report. The Nature Conservancy, Boston, MA. 6 pp.

Rawinski, T. J., G. P. Fleming, and F. V. Judge. 1994. Forest vegetation of the Ramsey's Draft and Little Laurel Run Research Natural Areas, Virginia: Baseline ecological monitoring and classification. Natural Heritage Technical Report 94-14. Virginia Department of Conservation and Recreation, Division of Natural Heritage, Richmond, VA. 45 pp. plus appendices.

Rawinski, T. J., K. N. Hickman, J. Waller-Eling, G. P. Fleming, C. S. Austin, S. D. Helmick, C. Huber, G. Kappesser, F. C. Huber, Jr., T. Bailey, and T. K. Collins. 1996. Plant communities and ecological land units of the Glenwood Ranger District, George Washington and Jefferson national forests, Virginia. Virginia Department of Conservation and Recreation, Division of Natural Heritage. Natural Heritage Technical Report 96-20. Richmond, VA. 65 pp. plus appendices.

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

Roberts, E. A. 1914. The plant successions of the Holyoke Range. *Botanical Gazette* 58:432-444.

Saltonstall, K. 2002. Cryptic invasion by a non-native genotype of common reed, *Phragmites australis*, into North America. *Proceedings of the National Academy of Sciences* 99(4):2445-2449.

Schafale, M. 1998. Fourth approximation guide. High mountain communities. March 1998 draft. North Carolina Natural Heritage Program, Raleigh, NC.

Schafale, M. 2000. Fourth approximation guide. Coastal Plain. January 2000 draft. North Carolina Natural Heritage Program, Raleigh, NC.

Schafale, M. 2003. Fourth approximation guide. Coastal Plain communities. March 2003 draft North Carolina Natural Heritage Program, Raleigh, NC.

Schafale, M. P., and A. S. Weakley. 1990. Classification of the natural communities of North Carolina. Third approximation. North Carolina Department of Environment, Health, and Natural Resources, Division of Parks and Recreation, Natural Heritage Program, Raleigh, NC. 325 pp.

Schmalzer, P. A., and H. R. DeSelm. 1982. Vegetation, endangered and threatened plants, critical plant habitats and vascular flora of the Obed Wild and Scenic River. Unpublished report. USDI National Park Service, Obed Wild and Scenic River. 2 volumes. Wartburg, TN. 369 pp.

Schotz, Al. Personal communication. Community Ecologist. Alabama Natural Heritage Program. Huntingdon College, Massey Hall, 1500 East Fairview Avenue, Montgomery, AL 36106-2148.

Shank, L. K., and J. Shreiner. 1999. Globally threatened calcareous riverside seep and calcareous riverside outcrop communities along the New Jersey shoreline of the Delaware River: Summary of rare plant census, community sampling, and recommended monitoring protocol. Department of Environmental Protection, Division of Parks and Forestry, Office of Natural Lands Management, Trenton, NJ. 220 pp.

Shreve, F., M. A. Chrysler, F. H. Blodgett, and F. W. Besley. 1910. The plant life of Maryland. Maryland Weather Service. Special Publication, Volume III. The Johns Hopkins Press, Baltimore, MD. 533 pp.

Smith, T. L. 1983. Natural ecological communities of Pennsylvania. Draft, revised 1991. Pennsylvania Natural Diversity Inventory, Middletown, PA.

Sneddon, L. A., K. J. Metzler, and M. Anderson. 1995. A classification and description of natural community alliances and selected community elements of the Delaware Estuary. In: L. E. Dove and R. M. Nyman, editors. Living resources of the Delaware Estuary. The Delaware Estuary Program. 530 pp. plus appendices.

Soil Conservation Service. 1987. Soil survey of Nassau County, New York. USDA Soil Conservation Service. Washington, DC. 156 pp.

Southeastern Ecology Working Group of NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Terrestrial Vegetation. NatureServe, Durham, NC.

Sperduto, D. D. 1997a. The natural communities of New Hampshire: A guide and classification. The New Hampshire Natural Heritage Inventory, Concord, NH. 126 pp.

Sperduto, D. D. 1997b. A preliminary classification of natural communities in the New Hampshire Coastal Lowlands Ecoregion. NH Natural Heritage Inventory / The Nature Conservancy, Division of Forests and Lands, Department of Resources and Economic Development, Concord, NH.

Sperduto, D. D. 2000a. Natural communities of New Hampshire: A guide and classification. Near final unformatted draft without pictures and illustrations; includes upland classification. New Hampshire Natural Heritage Inventory, DRED Division of Forests and Lands, Concord, NH. 127 pp.

Sperduto, D. D. 2000b. A classification of wetland natural communities in New Hampshire. New Hampshire Natural Heritage Inventory, Department of Resources and Economic Development, Division of Forests and Lands. Concord, NH. 156 pp.

Sperduto, D. D., W. F. Nichols, K. F. Crowley, and D. A. Bechtel. 2000c. Black gum (*Nyssa sylvatica* Marsh) in New Hampshire. New Hampshire Natural Heritage Inventory, Concord, NH.

Sperduto, D. D., and W. F. Nichols. 2004. Natural communities of New Hampshire: A guide and classification. New Hampshire Natural Heritage Inventory, DRED Division of Forests and Lands, Concord, NH. 242 pp.

Steury, B. W. 1999. Annotated list of vascular plants from a nontidal barrier wetland along the Chesapeake Bay in Calvert County, Maryland. *Castanea* 64(2):187-200.

Swain, P. C., and J. B. Kearsley. 2000. Classification of natural communities of Massachusetts. July 2000 draft. Natural Heritage and Endangered Species Program, Massachusetts Division of Fisheries and Wildlife. Westborough, MA.

Swain, P. C., and J. B. Kearsley. 2001. Classification of natural communities of Massachusetts. September 2001 draft. Natural Heritage and Endangered Species Program, Massachusetts Division of Fisheries and Wildlife. Westborough, MA.

TDNH [Tennessee Division of Natural Heritage] Unpublished data. Tennessee Division of Natural Heritage, 14th Floor, L&C Tower, 401 Church Street, Nashville, TN 37243-0447. 615-532-0431

Thompson, E. 1996. Natural communities of Vermont uplands and wetland. Nongame and Natural Heritage Program, Department of Fish and Wildlife in cooperation with The Nature Conservancy, Vermont chapter. Montpelier, VT. 34 pp.

Thompson, E. H., and E. R. Sorenson. 2000. Wetland, woodland, wildland: A guide to the natural communities of Vermont. The Nature Conservancy and the Vermont Department of Fish and Wildlife. University Press of New England, Hanover, NH. 456 pp.

Thompson, E., and J. Jenkins. 1992. Summary of field data from Minuteman National Park plant communities study. A report prepared under a contract with the Massachusetts Natural Heritage and Endangered Species Program for the National Park Service. Lexington, MA, 39 pp.

Tiner, R. W., Jr. 1985. Wetlands of Delaware. Cooperative publication of USDI Fish & Wildlife Service, National Wetlands Inventory, Newton Corner, MA, and Delaware Department of Natural Resources and Environmental Control, Dover, DE. 77 pp.

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

Vanderhorst, J. 2000. Plant communities of Harper's Ferry National Historical Park: Analysis, characterization, and mapping. West Virginia Natural Heritage Program, West Virginia Division of Natural Resources, Elkins, WV. 37 pp.

Vanderhorst, J. 2001a. Plant community classification and mapping of the Camp Dawson Collective Training Area, Preston County, West Virginia. West Virginia Natural Heritage Program, West Virginia Division of Natural Resources, Elkins, WV. 101 pp.

Vanderhorst, J. 2001b. Plant communities of the New River Gorge National River, West Virginia: Northern and southern thirds. Non-game Wildlife and Natural Heritage Program, West Virginia Division of Natural Resources. Elkins, WV. 146 pp.

Vanderhorst, J. P., J. Jeuck, and S. C. Gawler. 2007. Vegetation classification and mapping of New River Gorge National River, West Virginia. Technical Report NPS/NER/NRTR-2007/092. National Park Service. Philadelphia, PA. 50 pp. + appendices

Vanderhorst, J. P., B. P. Streets, J. Jeuck, and S. C. Gawler. 2008.Vegetation Classification and Mapping of Bluestone National Scenic River, West Virginia. Technical Report NPS/NER/NRTR—2008/106. National Park Service. Philadelphia, PA. 44 pp. + appendices.

VDNH [Virginia Division of Natural Heritage]. 2003. The natural communities of Virginia: Hierarchical classification of community types. Unpublished document, working list of November 2003. Virginia Department of Conservation and Recreation, Division of Natural Heritage, Ecology Group, Richmond, VA.

Vogelmann, H. W. 1976. An unusual black gum swamp in Maine. *Rhodora* 78:326-327.

Walbridge, M. R. 1982. Vegetation patterning and community distribution in four high-elevation headwater wetlands in West Virginia. M.S. thesis, West Virginia University, Morgantown, WV.

Walbridge, M. R., and G. E. Lang. 1982. Major plant communities and patterns of community distribution in four wetlands of the unglaciated Appalachian region. In: R. B. MacDonald, editor. Proceedings of the Symposium on Wetlands of the Unglaciated Appalachian Region. West Virginia University, Morgantown.

Walton, D. P., C. M. Jesse, and N. J. Putnam. 1996. Plant communities of the Ohio River riparian zone. Natural Heritage Program, West Virginia Division of Natural Resources, Elkins.

Walz, K. S. 1996. Final report: Ecological community inventory of High Mountain Park, Wayne Township, Passaic County, New Jersey. The Nature Conservancy, New Jersey Field Office, Chester. 120 pp.

Wharton, C. H. 1978. The natural environments of Georgia. Georgia Department of Natural Resources, Atlanta. 227 pp.

White, J., and M. Madany. 1978. Classification of natural communities in Illinois. Pages 311-405 in: Natural Areas Inventory technical report: Volume I, survey methods and results. Illinois Natural Areas Inventory, Urbana, IL.

Wieland, R. G. 1994a. Marine and estuarine habitat types and associated ecological communities of the Mississippi Coast. Mississippi Department of Wildlife, Fisheries, and Parks. Museum of Natural Science. Museum Technical Report 25. Jackson, MS. 270 pp.

Windisch, A. G. 1993. Natural community inventory of Picatinny Arsenal, New Jersey. Unpublished report prepared for Picatinny Arsenal, U.S. Department of Defense. The Nature Conservancy, Eastern Heritage Task Force, Trenton, NJ.

Windisch, A. G. 1995. Natural community inventory of Mashipacong Bogs site, New Jersey. New Jersey Natural Heritage Program, Office of Natural Lands Management, Division of Parks and Forestry. Trenton, NJ.

Wyckoff, P. H. and S. L. Webb 1996. Understory influence of the invasive Norway maple (*Acer platanoides*). *Bulletin of the Torrey Botanical Club* 123(3):197-205.

Young, J., G. Fleming, P. Townsend, and J. Foster. 2006. Vegetation of Shenandoah National Park in relation to environmental gradients. Final Report (v.1.1). Research technical report prepared for USDI, National Park Service. USGS/NPS Vegetation Mapping Program. Leetown, WV. 92 pp. plus appendices.

Zebryk, T. 1990. Vegetation and site characteristics of a *Nyssa*-dominated wetland in central Massachusetts. Unpublished report, draft 3. Harvard Forest, Harvard University, Petersham, MA.

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