



Vegetation Classification and Mapping at Saint-Gaudens National Historic Site, New Hampshire

Natural Resource Technical Report NPS/NER/NRTR—2012/584.1



ON THE COVER

Successional Old Field in Saint-Gaudens National Historic Site (SAGA.AA29).

Photograph by: Sue Gawler.

Vegetation Classification and Mapping at Saint-Gaudens National Historic Site, New Hampshire

Natural Resource Technical Report NPS/NER/NRTR—2012/584.1

Susan C. Gawler¹ and Peter S. Bowman²

¹NatureServe
Eastern Regional Office
11 Avenue de LaFayette
Boston, Massachusetts 02111

²New Hampshire Natural Heritage Bureau
P.O. Box 1856
Concord, NH 03301

**This report has been modified to
remove information of a sensitive nature
protected by resource confidentiality laws
to make it suitable for public distribution.**

May 2012

U.S. Department of the Interior
National Park Service
Natural Resource Stewardship and Science
Fort Collins, Colorado

The National Park Service, Natural Resource Stewardship and Science office in Fort Collins, Colorado publishes a range of reports that address natural resource topics of interest and applicability to a broad audience in the National Park Service and others in natural resource management, including scientists, conservation and environmental constituencies, and the public.

The Natural Resource Technical Report Series is used to disseminate results of scientific studies in the physical, biological, and social sciences for both the advancement of science and the achievement of the National Park Service mission. The series provides contributors with a forum for displaying comprehensive data that are often deleted from journals because of page limitations.

All manuscripts in the series receive the appropriate level of peer review to ensure that the information is scientifically credible, technically accurate, appropriately written for the intended audience, and designed and published in a professional manner.

This report received informal peer review by subject-matter experts who were not directly involved in the collection, analysis, or reporting of the data. Data in this report were collected and analyzed using methods based on established, peer-reviewed protocols and were analyzed and interpreted within the guidelines of the protocols.

Views, statements, findings, conclusions, recommendations, and data in this report do not necessarily reflect views and policies of the National Park Service, U.S. Department of the Interior. Mention of trade names or commercial products does not constitute endorsement or recommendation for use by the U.S. Government.

This report is available from the Natural Resource Publications Management website (<http://www.nature.nps.gov/publications/nrpm/>).

Please cite this publication as:

Gawler, S. C., and P. S. Bowman. 2012. Vegetation classification and mapping at Saint-Gaudens National Historic Site, New Hampshire. Natural Resource Technical Report NPS/NER/NRTR—2012/584.1. National Park Service, Fort Collins, Colorado.

Contents

	Page
Figures.....	vii
Tables.....	ix
Appendixes.....	xi
Acknowledgments.....	xiii
Abstract.....	xv
Introduction.....	1
USGS/NPS Vegetation Characterization Program.....	1
U.S. National Vegetation Classification.....	2
Project Area.....	3
Methods.....	9
Planning and Scoping.....	9
Review of Existing Information.....	9
Aerial Photography Acquisition and Processing.....	9
Field Data Collection and Classification.....	10
Field Survey.....	10
2005 Vegetation Classification and Characterization.....	13
Photointerpretation.....	14
2005 Vegetation Map Preparation.....	14
Accuracy Assessment.....	15
Positional Accuracy Assessment.....	15
Thematic Accuracy Assessment.....	17
Final Vegetation Classification and Revised Final 2007 Map Preparation.....	20

Contents (continued)

	Page
Results.....	21
2005 Vegetation Map Production.....	21
Accuracy Assessment.....	24
Positional Accuracy.....	24
Thematic Accuracy.....	24
Final 2007 Vegetation Map Production.....	24
Vegetation Association Descriptions.....	28
Project Deliverables.....	28
Discussion.....	31
Final Vegetation Classification and Characterization.....	31
Upland Forest Vegetation.....	31
Wetland Vegetation.....	32
Ruderal Vegetation.....	33
Altered Vegetation and Other Land-cover Classes.....	33
Plant Species Records.....	33
Rare Plant Species.....	33
Nonnative Plant Species.....	33
Management Considerations.....	35
Vegetation Map Production.....	35
Conclusions.....	36
Literature Cited.....	37

Figures

	Page
Figure 1. Location of Saint-Gaudens National Historic Site in the Lower New England/Northern Piedmont ecoregion.....	4
Figure 2. Topography and waterbodies at Saint-Gaudens National Historic Site.	6
Figure 3. Location of the 25 vegetation plots sampled at Saint-Gaudens National Historic Site for vegetation classification and mapping.	12
Figure 4. Ground control points used to calculate horizontal positional accuracy of the Saint-Gaudens National Historic Site mosaic (image provided by NCSU).	16
Figure 5. Locations of the 17 accuracy assessment sampling points in Saint-Gaudens National Historic Site.....	18
Figure 6. Saint-Gaudens National Historic Site map classes of 2005.	23
Figure 7. Final 2007 USNVC vegetation map classes and Anderson Level II Categories (modified) of Saint-Gaudens National Historic Site, and locations of Enriched Hardwood Forest Seeps.	27
Figure 8. Blow-Me-Down Pond at Saint-Gaudens National Historic Site.	34

Tables

	Page
Table 1. Summary of key information for the orthorectified photomosaic for Saint-Gaudens National Historic Site.	11
Table 2. Preliminary vegetation classification and plot allocation to vegetation types known to occur in Saint-Gaudens National Historic Site.....	11
Table 3. Thematic accuracy assessment (AA) sampling strategy for Saint-Gaudens National Historic Site based on the 2005 vegetation map.	17
Table 4. Vegetation groups, park-specific common names, USNVC association crosswalks, and corresponding map classes at Saint-Gaudens National Historic Site.	22
Table 5. Final contingency table for 2005 vegetation map accuracy assessment for Saint-Gaudens National Historic Site.	25
Table 6. Number of polygons and mapped hectares for the final 2007 vegetation map classes and Anderson Level II categories (modified) at Saint-Gaudens National Historic Site.....	26
Table 7. Summary of products resulting from the Saint-Gaudens National Historic Site vegetation classification and mapping project.....	29

Appendixes

	Page
Appendix A. Vegetation plot sampling form for Saint-Gaudens National Historic Site.	41
Appendix B. Data dictionary for fields in PLOTS 2.0 Database.	45
Appendix C. Plants observed in Saint-Gaudens National Historic Site during vegetation plot and thematic accuracy assessment sampling.	51
Appendix D. Accuracy assessment data form for Saint-Gaudens National Historic Site.	55
Appendix E. Dichotomous field key to the USNVC vegetation associations and land cover types of Saint-Gaudens National Historic Site. ¹	57
Appendix F. Global and Local descriptions for the USNVC vegetation associations in Saint-Gaudens National Historic Site.....	61
Appendix G. Index of representative photographs of vegetation classification sampling plots and accuracy assessment points at Saint-Gaudens National Historic Site.	123
Appendix H. Bibliography for global vegetation descriptions from the U.S. National Vegetation Classification System.	125

Acknowledgments

We first thank Steve Walasewicz at Saint-Gaudens National Historic Site for his assistance and knowledge that helped to get this project underway. Special thanks to Ben Kimball for his assistance in the field, as well as his expertise in photography, GIS, and report editing. Beth Johnson of the NPS and Lesley Sneddon of NatureServe provided helpful project oversight. Bill Millinor at North Carolina State University (NC State) converted the air photos to an orthorectified computer image. Beth Eastman and Perver Baran, also from NC State, provided text for the orthophoto mosaic processing and reviewed shapefiles for us. Mary Russo and Kristin Snow of NatureServe provided essential data management services for the vegetation type descriptions. Ery Largay of NatureServe converted the draft report into its final version. Brian Mitchell, John Karish, Adam Kozlowski, Kate Miller, and Sarah Lupis Kozlowski from the NPS Inventory and Monitoring Program provided comments and support. We would also like to thank Stephanie Perles (NPS) and Gregory Podniesinski (PA Natural Heritage) who provided us with NPS vegetation mapping sample final reports. In an effort to achieve consistency from state to state, sections of the text in this report were adopted from previously completed NPS vegetation mapping reports (e.g. Perles et al. 2006) with permission. Finally, thanks to NH Heritage staff Dan Spurduto for his review and ecological oversight, and Lionel Chute for help in initiating and administering this project. The National Park Service is gratefully acknowledged for its funding of this project.

Abstract

Vegetation mapping of Saint-Gaudens National Historic Site follows established National Park Service (NPS) protocols under its umbrella agreement with NatureServe and its component network of natural heritage programs. After a scoping session with park staff and field reconnaissance, we developed an initial vegetation classification for Saint-Gaudens NHS based on NatureServe's U.S. National Vegetation Classification (USNVC) and the New Hampshire Natural Heritage Inventory's state types. Twenty-five vegetation plots were sampled in the summer of 2004, covering the range of variation in the vegetation. Plot sampling included information on vegetation structure, composition and individual species cover by vegetation stratum, and environmental setting. Analysis of the plot data and field notes allowed us to finalize the vegetation classification for the park and to map these classes onto an orthorectified composite aerial photo background using on-screen digitizing. Seventeen accuracy assessment points were collected to verify the accuracy of the vegetation map. The overall map accuracy and Kappa index from the accuracy assessment is 86.5%.

Twelve USNVC vegetation associations are described for Saint-Gaudens National Historic Site. Four upland forests are described. The most common forest type within the park is Hemlock - Beech - Oak - Pine Forest, with smaller areas of Semi-rich Northern Hardwood Forest, Hemlock - White Pine Forest, and Successional White Pine Forest. Small Enriched Hardwood Forest Seeps occur as small patches within some of the upland forest associations. Riparian and herbaceous wetland associations are concentrated on the western periphery of the park in association with Blow-Me-Down Pond and Blow-Me-Down Brook. Successional Old Fields occur to the west and northeast of the Saint-Gaudens house. Managed or built-up areas around the home and grounds were classified according to the Anderson Level II (modified) land use classification. Nonnative plant species that occurred in or near the plots were noted.

Detailed descriptions of the local and global expressions of each vegetation association, a field key to vegetation types, a plant species list derived from the plots and accuracy assessment points, metadata for the vegetation map and the plot data, and an index to photographic documentation are included as appendices to this report. Shapefiles of the digital vegetation map, the spatial locations of plot and accuracy assessment points, and the digital orthophoto developed for Saint-Gaudens National Historic Site are also deliverables of this project.

Introduction

Saint-Gaudens National Historic Site (SAGA) is a 63.5 ha (156.9 ac) park located in the town of Cornish, in Sullivan County, New Hampshire, in the temperate northeastern United States. Established in 1964, it commemorates the work of sculptor Augustus Saint-Gaudens and preserves his home, gardens, and studios, as well as 40.5 ha (100 ac) of forests and wetlands on west-facing slopes above the Connecticut River.

In 2004, NatureServe contracted with the New Hampshire Natural Heritage Bureau (NH Heritage) to conduct a survey and produce a map of the vegetation of Saint-Gaudens National Historic Site. NatureServe ecologists planned the sampling, oversaw the field effort, and integrated plot and accuracy assessment data and field information into the U.S. National Vegetation Classification (USNVC) to produce a standardized product for the National Park Service.

The purpose of this project was to produce a standardized map and classification of the vegetation communities and land cover of the Saint-Gaudens National Historic Site and to provide thorough baseline data on the park's vegetation. These products will inform natural resource decision-making, for example, in the development and implementation of the park's General Management Plan, Cultural Landscape Report, and in the Vital Signs monitoring plan. This is part of an effort by the National Park Service to map and describe the national parks across the country using U.S. National Vegetation Classification, through agreements with NatureServe and its component Natural Heritage programs.

USGS/NPS Vegetation Characterization Program

The USGS/NPS Vegetation Characterization Program (VCP) is a cooperative effort by the U.S. Geological Survey (USGS) and the National Park Service (NPS) to classify, describe, and map vegetation communities in more than 280 national park units across the United States. The goal of the VCP is to meet specific information needs identified by the NPS. The VCP, managed by the USGS Center for Biological Informatics in Denver, Colorado, is part of the NPS Inventory and Monitoring Program, a long-term effort to acquire the information needed by park managers in their efforts to maintain ecosystem integrity for all national park units that have a significant natural resource component. Vegetation maps and associated information support a wide variety of resource assessment, park management, and planning needs, and provide a structure for framing and answering critical scientific questions about vegetation communities and their relation to environmental processes across the landscape.

Three major components essential to every mapping project are vegetation classification, vegetation mapping, and map accuracy assessment. Ecology and mapping teams work together to share knowledge and data and to resolve issues to carry out the procedures. Program products meet Federal Geographic Data Committee (FGDC) standards for vegetation classification and metadata and national standards for spatial accuracy and data transfer. Standards include a minimum mapping unit of 0.5 ha and classification accuracy of 80% for each map class. Spatial data products include aerial photography, map classification and description key, spatial database of vegetation communities, hardcopy maps of vegetation communities, metadata for spatial databases, and complete accuracy assessment of the vegetation map. Vegetation information includes vegetation classification, dichotomous field key of vegetation classes, formal

description of each vegetation class, ground photos of vegetation classes, and field data in database format.

U.S. National Vegetation Classification

The U.S. National Vegetation Classification (USNVC) is a hierarchical system with physiognomic features at the highest levels of the hierarchy and floristic features at the lower levels. The physiognomic units have a broad geographic perspective and the floristic units have local and site-specific perspective (Grossman et al. 1998).

The USNVC includes most existing vegetation, whether natural or cultural, but attention is focused on natural vegetation types. “Natural vegetation,” as defined in The Nature Conservancy and Environmental Systems Research Institute (TNC and ESRI 1994 a,b,c), includes types that “occur spontaneously without regular management, maintenance, or planting and have a strong component of native species.” “Cultural” vegetation includes planted/cultivated vegetation types such as orchards, pastures, and vineyards.

The physiognomic-floristic classification includes all upland terrestrial vegetation and all wetland vegetation with rooted vascular plants. The hierarchy has five physiognomic levels and two floristic levels.¹ The physiognomic portion of the classification is based on the United Nations Educational, Scientific, and Cultural Organization (UNESCO) world physiognomic classification of vegetation, which was modified to provide greater consistency at all hierarchical levels and to include additional types (Drake and Faber-Langendoen 1997). At the uppermost level, the USNVC is divided into seven broad physiognomic classes: Forest, Woodland, Shrubland, Dwarf-shrubland, Herbaceous, Sparse (vascular), and Non-vascular. The lowest unit of the physiognomic portion of the classification is the Formation, a type defined by dominance of a given growth form in the uppermost stratum and characteristics of the environment (e.g., cold-deciduous alluvial forests).

The two floristic levels are alliances and associations. The alliance is a physiognomically uniform group of plant associations that share dominant or diagnostic species, usually in the uppermost stratum of the vegetation. For forested types, the alliance is roughly equivalent to the “cover type” of the Society of American Foresters. Alliances also include non-forested types.

The basic unit of the classification system, the association, is roughly equivalent in scale to the plant association of European phytosociologists. The association is a unit of vegetation that is more or less homogeneous in composition and structure and occurs on uniform habitat. Alliances are generally more wide-ranging geographically than are associations, although many monotypic alliances have been classified.

Although associations are defined by the plants that comprise them, they are in fact communities of all the component organisms, including animals, protozoans, bacteria, and fungi. Associations are classified from a rangewide perspective (termed “global” although, in fact, any association

¹ The upper levels of the USNVC, above the Alliance level, have been recently redesigned (i.e. after the classification phase of this project was complete) and accepted as an FGDC standard (FGDC 2008). The Association and Alliance levels remain the same. Work is underway to place USNVC associations appropriately in the revised hierarchy.

only ranges over part of a continent) and are assigned global rarity ranks as well as ranking specifications to be applied to individual occurrences of associations across their range. A map of associations occurring at a site can provide information about the abundance and distribution of each type, the significance of the individual occurrences, as well as providing surrogate information about the location and abundance of individual species characteristic of the association.

The USNVC has been revised and refined since 1998, and is managed by NatureServe in collaboration with the network of Natural Heritage Programs. The classification is housed in the Biotics database and is updated regularly (NatureServe 2007). The upper levels of the USNVC were adopted as a standard by the FGDC to support the production of uniform statistics on vegetation at the national level (FGDC 2008). The USGS/NPS Vegetation Characterization Program adopted the alliance level, and, where possible, the association level, as the mapping unit for national parks.

Project Area

Saint-Gaudens National Historic Site is located in western New Hampshire within the Lower New England / Northern Piedmont Ecoregion near its transition to the Northern Appalachian - Boreal Forest Ecoregion (Figure 1). The Lower New England Ecoregion extends inland from the North Atlantic Coast ecoregion from southwestern Maine to the Maryland/Virginia line (TNC 2001). This ecoregion is distinguished from surrounding ecoregions by particular climatic, geomorphological, and vegetation characteristics. In the modified Bailey's classification of ecological units of the eastern U.S. (Keys et al. 1995), it falls within the Vermont - New Hampshire Uplands section (M212). Sections are further divided into "subsections" using finer-scale physical and biological criteria. Saint-Gaudens National Historic Site falls within the Northern Connecticut River Valley subsection (M212Bb), a narrow north-south band straddling the Connecticut River for over 160 km (99 mi) in New Hampshire and Vermont².

Typical of southern and central New Hampshire, the vegetation of this region consists primarily of upland forests of mixed hardwood-conifer composition. The most common species found in the canopy of these upland forests are *Tsuga canadensis* (eastern hemlock), *Fagus grandifolia* (American beech), *Quercus rubra* (northern red oak), and *Pinus strobus* (eastern white pine), although these species exhibit varying degrees of dominance depending on the age of the canopy trees, disturbance history, and edaphic factors (primarily soil moisture). Other frequent mid to early successional tree species that may be present include *Betula papyrifera* (paper birch), *Acer rubrum* (red maple), *Prunus serotina* (black cherry), *Acer pensylvanicum* (striped maple), and *Populus tremuloides* (quaking aspen). However, in many areas of the Connecticut River valley, the alluvial deposits and carbonate-bearing bedrock produce relatively more calcium-rich soils that support enriched-site natural communities such as Enriched Hardwood Forest Seep and Semi-Rich Northern Hardwood Forest, which in turn may harbor a number of less common plant species.

² The Northern Connecticut River Valley subsection is numbered M211Bb in the more recent and national version of USFS ecological subregions (Cleland et al. 2007).

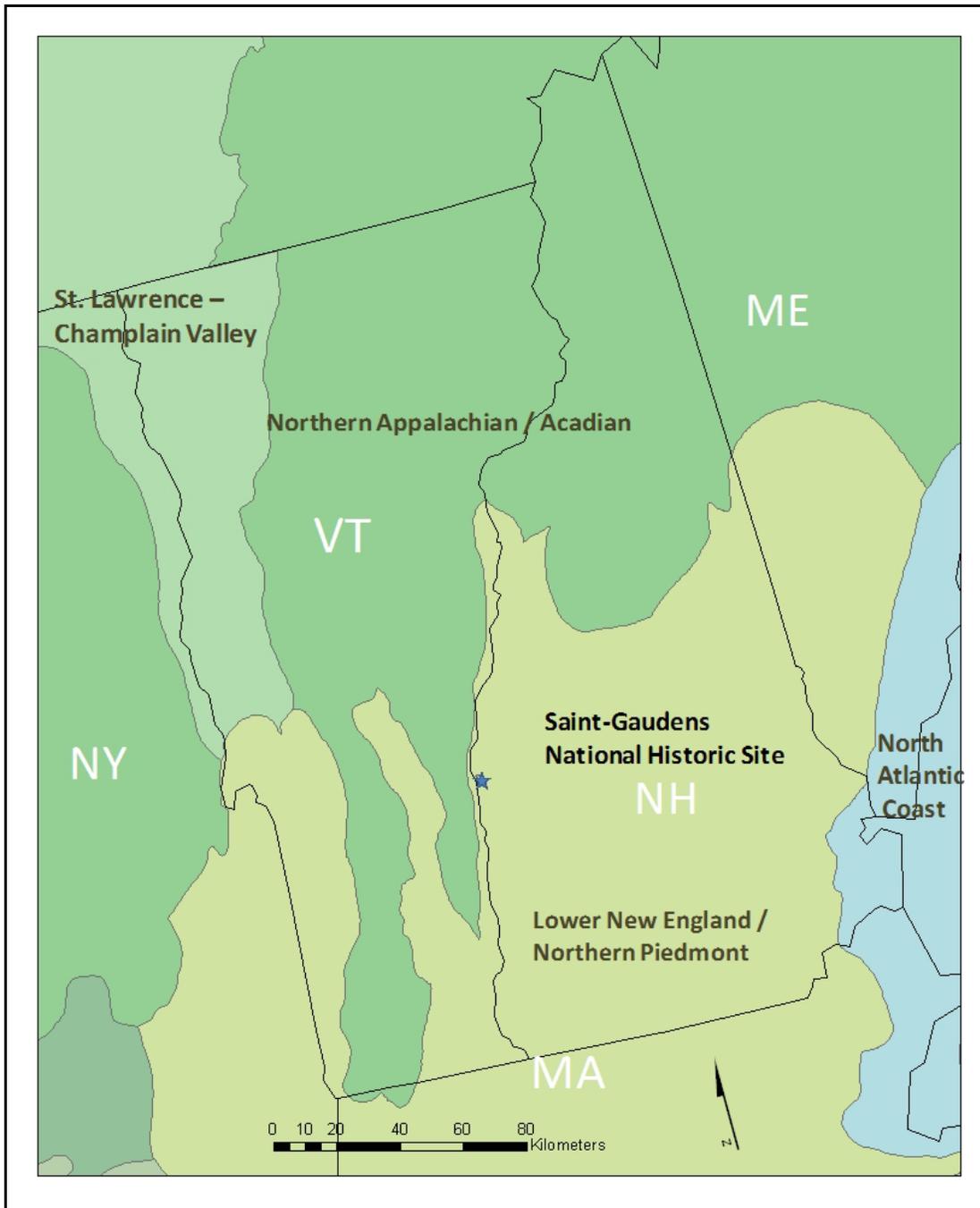


Figure 1. Location of Saint-Gaudens National Historic Site in the Lower New England/Northern Piedmont ecoregion.

Soils of this valley are characterized by deep glacio-fluvial and glacial lakebed sediments deposited by the former glacial Lake Hitchcock (Moore et al. 1994). The present-day expression of these sediments is as a series of terraces above the Connecticut River. Groundwater movement through the sediments has produced numerous seeps at the bases of steep, eroding slopes. Beneath the terraces, the underlying bedrock is mapped as the Gile Mountain Formation, a complex geologic unit comprised chiefly of metamorphosed sedimentary rocks, primarily slate (Lyons et al. 1997, Cronan et al. 1981). This formation includes calcite and other carbonate bearing component layers which can contribute to enriched soil conditions, which in turn support establishment of enriched-site natural communities.

Saint-Gaudens National Historic Site itself was established in 1964 to commemorate the work of sculptor Augustus Saint-Gaudens who lived on the estate from 1885–1907 (Wang and Nugranad-Marzilli 2009). The home, gardens, and studios, as well as 40.5 ha (100 ac) of forests, fields, and wetlands overlook the Connecticut River to the southwest. The former estate is located on a glacial terrace above the Connecticut River at 168 m (550 ft) elevation. A forested ravine demarcates the northern boundary of the park. Blow-Me-Up-Brook flows in a westerly direction through this gradually sloping ravine and merges with the south-flowing Blow-Me-Down Brook in the northwest corner of the park. From there, Blow-Me-Down Brook meanders south down a gradual slope, forms a broader floodplain along the western boundary of the park, and then turns to the southeast where the land levels out at the bottom of the hill. Blow-Me-Down Brook continues through marshes and alluvial shrublands to the southeast and into the open water of Blow-Me-Down Pond. From there, the brook flows over the dam and back to the southwest where it eventually enters the Connecticut River (Figure 2). The brooks and pond have dynamic seasonal flooding and drought cycles. Spring snowmelt and fall storms instigate flooding and saturate the soils, while the hot summer sun causes periods of dryness and drought, and the winter brings freezes and thaws.

Blow-Me-Down Pond is 98 m (320 ft) in elevation, averages 1.2 m (3.8 ft) deep, and is dammed at the southern end. It was dammed in the late 1800s as part of a grist mill operation. Saint-Gaudens frequented the pond for swimming and reflection. The pond was also used for skating and ice cutting in the early 1800s. The pond provides habitat for fish and beaver (Cronan et al. 1981). Floating-leaved aquatic species *Potamogeton epihydrus* (ribbonleaf pondweed), *Nuphar lutea* ssp. *variegata* (variegated yellow pond-lily), and *Nymphaea odorata* (American white waterlily) occupy the shallow, permanently flooded portions of Blow-Me-Down Pond.

The majority of the upland soils on the site fall mainly into the Unadilla and Windsor series, both of which are deep and well-drained sandy loams and loamy sands. The most common vegetation communities, including Hemlock - Beech - Oak - Pine Forest, Hemlock - White Pine Forest, White Pine Successional Forest, and Successional Old Field, occur on these upland soils. Wetland soils of the Emergent Marsh - Shrub Swamp System and Blow-Me-Down Pond are deep, mucky, and saturated. The shallow, gravelly alluvium soils associated with Blow-Me-Down and Blow-Me-Up brooks are rocky and poorly drained. The vegetation community Cobble - Sand River Channel occurs on a small gravel bar in Blow-Me-Down Brook in the northwest corner of the park. The Alder - Dogwood Alluvial Thicket occurs on loam and fine- to medium-grained sands subjected to periodic flooding.

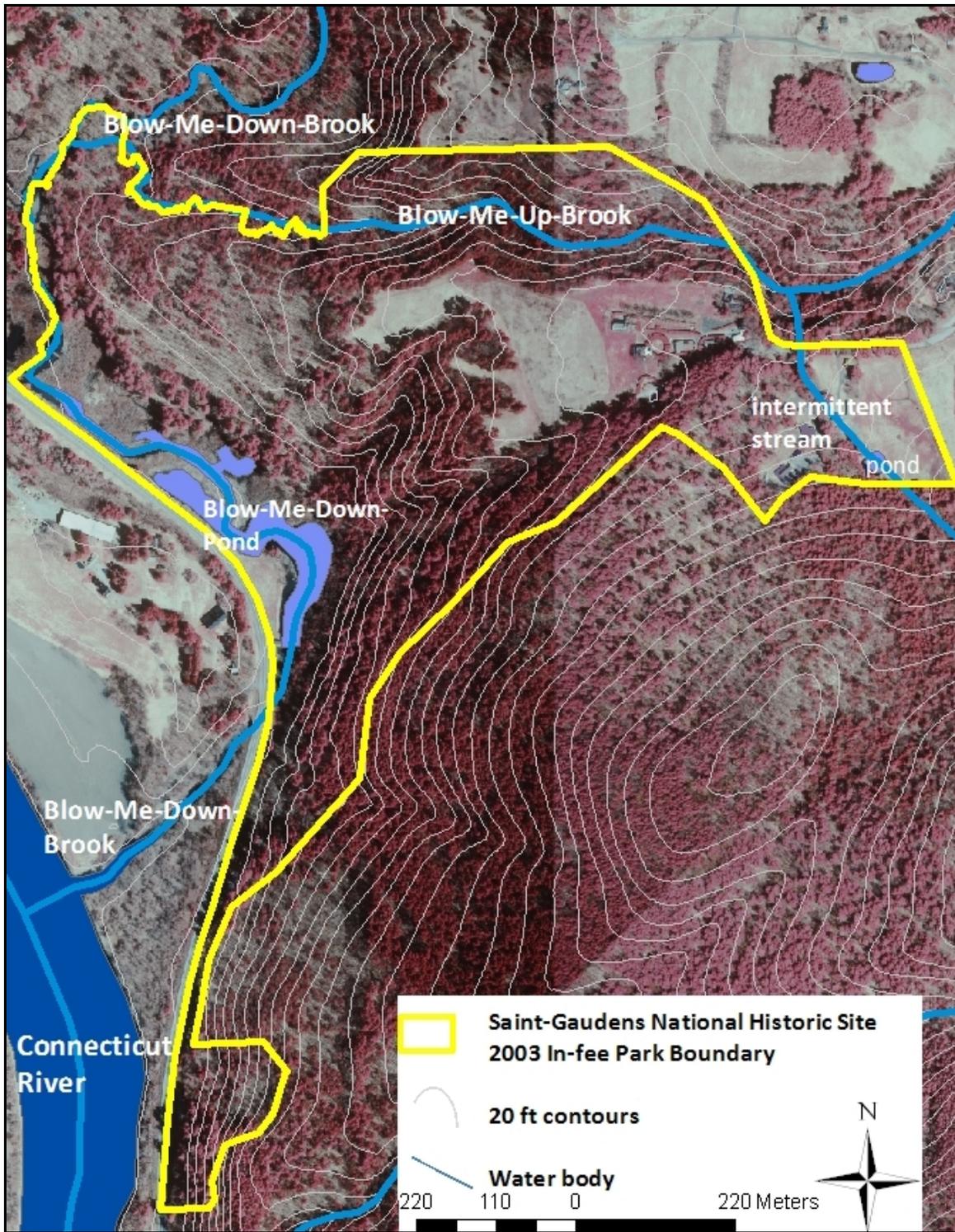


Figure 2. Topography and waterbodies at Saint-Gaudens National Historic Site.

The park has experienced a long history of natural and cultural disturbances. Exotics were planted around the home and garden in the late 1800s. The forests on the estate were logged between 1920 and 1964. Forests were also converted to fields that are currently maintained as fields with annual mowing. Mudslides are common on the steep ravine slopes. Windstorms are common and have left numerous downed trees in the forests over time (Cronan et al. 1981).

The hydrology, topography, soils, surficial geology, underlying bedrock, and cultural history influence the vegetation communities in the park. In turn, the diversity of vegetation communities at Saint-Gaudens National Historic Site provides habitat for 180 plant species and 160 animal species? (Minushkin 1994). This report provides an in-depth review of the vegetation communities at Saint-Gaudens National Historic Site and a map that quantifies their areas and locates them on the ground.

Methods

Planning and Scoping

The Saint-Gaudens National Historic Site vegetation map and classification was created using a combination of existing sources of information, vegetation sampling, ground-truthing, and remote sources. In 2004, NatureServe contracted with ecologist Peter Bowman to conduct a field survey and produce a map of the vegetation of the park. A scoping meeting involving NatureServe staff and contractor, Vermont and New Hampshire Natural Heritage Program staff, and NPS staff was held in May 2004 (in conjunction with Marsh-Billings-Rockefeller National Historical Park staff) to outline the project, identify resources, and plan the approach.

Review of Existing Information

The first step in the survey process was review of existing literature on natural resources at Saint-Gaudens National Historic Site, including information in the New Hampshire Natural Heritage Program database and reports by Cronan et al. (1981) and Gilman and New Hampshire Natural Heritage Program (1997). To identify major ecological gradients and habitat types, existing cover type maps, geologic and soil maps, and wetland maps were reviewed in digital and hard copy formats. Following review of these resources, a reconnaissance trip was made to the property to identify potential community types and correlate them with existing maps and aerial photos.

Aerial Photography Acquisition and Processing

On April 28, 2003, William Frament, USDA Forest Service (Northeastern Area State and Private Forestry, Durham, NH), acquired leaf-off color infrared, stereo pair 1:8,000 scale aerial photography of the Saint-Gaudens National Historic Site. The photography was captured in late April when deciduous trees were mostly bare and the ground was generally free of snow. The image type consists of a raster, 3-band color image. The bands are blue, green and near infrared. Each pixel contains a brightness value ranging from 0–255 per band. Frament subsequently scanned the air photos at 600 dpi with 24-bit color depth and delivered the scanned TIFF files and the hard copy air photos to North Carolina State University (NCSU).

NCSU produced a mosaic of the Saint-Gaudens National Historic Site from 10 color infrared air photos taken in 2003. The 10 scanned images of the air photos were imported into ERDAS Imagine (.img) format where a photo block was created and then orthorectified using a digital elevation model (DEM) and U.S. Geological Survey (USGS) digital orthophoto quarter quadrangles (DOQQ) as ground control. In preparation for this step, the DOQQs were mosaicked to create a single file and the 30-m Digital Elevation Model (DEM) USGS National Elevation Dataset (NED) was acquired for the project area. DEM data were transformed from 30 meters to 10 meters to assist with data comparability. The photo block was manipulated until aerial triangulation produced a single root mean square error (RMSE) of less than one meter. Single-frame orthophotos (one for each air photo) were then generated using Imagine and exported to Imagine .lan format. The orthophotos were imported into ER Mapper's native (.ers) format, and an ER Mapper algorithm was created that contained the color balancing information and the cutlines created for the final mosaic. Using ER Mapper, a band interleaved by line (.bil) image and header file of the final mosaic were generated; the .bil image was converted into Imagine .img format. The final mosaic image was compressed using MrSID software with a 20:1

compression ratio. Key information for the Saint-Gaudens National Historic Site mosaic is summarized in Table 1.

All metadata records for the mosaic were prepared in accordance with the current Federal Geographic Data Committee standards (FGDC 1998a). Metadata were produced in notepad and parsed using the USGS metadata compiler (USGS 2004). After all errors and omissions identified by the parser were corrected, the metadata compiler was used to generate final TXT, HTML, and XML versions of the metadata record which are stored in the air photo archive.

Under the direction of the NPS Northeast Region Inventory & Monitoring Program, the original infrared air photos were placed in the air photo archive maintained at the USGS Earth Observation and Science (EROS) Center. In addition to the aerial photography, USGS EROS was also sent the camera calibration certificate, a shapefile of the photo centers, and FGDC compliant metadata authored by NCSU. FGDC compliant metadata was also written for the final mosaic which was archived at the NPS Northeast Temperate Network office in Woodstock, VT.

Field Data Collection and Classification

Using the preliminary classification developed after reconnaissance trips, a vegetation plot sampling design was devised during the spring of 2004 following USGS/NPS Vegetation Characterization Program guidelines (TNC and ESRI 1994b). Census sampling, where all known vegetation associations are sampled, was used at Saint-Gaudens National Historic Site because of its small size. Plots were allocated to all 12 vegetation types known to occur in the park (Table 2). To the extent possible where different occurrences of an association were present, replicate plots were assigned across each association's environmental range. At least three vegetation plots were placed in each vegetation community, except where limited spatial extent prevented it (i.e. in the cases of small patch types or types where there was only one occurrence of an association in the park). As a result, 25 plots covering all of the vegetation types within the park boundary were sampled.

Field Survey

Covering the full spatial extent of the park, 25 plots were sampled during August and September of 2004; plot locations are shown in Figure 3. NatureServe National Park Vegetation Classification Program plot survey forms were completed for all 25 plots (Appendix A). Completed forms are on file with the NPS and NatureServe. Abbreviated instructions for completing this form and definitions of the fields can be found in the USGS/NPS Vegetation Characterization Program: Field Methods for Vegetation Mapping manual (TNC and ESRI 1994b).

During plot surveys, total cover, height, and characteristic species were documented for each forest structure stratum. Then, segregated by stratum, each species' cover was recorded in the applicable cover class as the class midpoint. A seven-class cover scale was used. Percent cover was estimated for the unvegetated ground surface within categories including bedrock, litter/duff, wood >1 cm, large rocks (cobbles, boulders >10 cm), small rocks (gravel, 0.2–10 cm), sand (0.1–2 mm), and bare soil. The total percent cover sums to 100% of the ground surface, including nonvascular plants and herbaceous plants of low stature occurring at the ground surface. This measure provides an overview of what occurs on the ground in addition to the

Table 1. Summary of key information for the orthorectified photomosaic for Saint-Gaudens National Historic Site.

Title of metadata record:	Saint-Gaudens National Historic Site Color Infrared Orthorectified Photomosaic - Spring (leaf-off) (ERDAS Imagine 8.7 IMG and MrSID formats)
Publication date of mosaic (from metadata):	September 23, 2004
Date aerial photography was acquired:	April 28, 2003 (leaf-off conditions)
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:	10
Archive location of air photos, camera calibration certificate, and shapefile of photocenters	North Carolina State University, Center for Earth Observation
Scanning specifications:	600 dpi, 24-bit color depth
Horizontal positional accuracy of mosaics:	4.6 meters, meets Class 3 National Map Accuracy Standard
Number of ground control points upon which estimated accuracy is based:	19
Method of calculating positional accuracy:	Root mean square error (RMSE)
Archive location of mosaics and metadata:	NPS Northeast Temperate Network Woodstock, VT
Format(s) of archived mosaics:	.img (uncompressed); MrSID (20:1 compression)

Table 2. Preliminary vegetation classification and plot allocation to vegetation types known to occur in Saint-Gaudens National Historic Site.

Preliminary Community Name	USNVC Code	Plots
Aquatic Bed	CEGL002386	1
Alder - Dogwood Alluvial Thicket	CEGL006062	2
Cattail Marsh	CEGL006153	1
Cobble - Sand River Channel	CEGL006536	1
Enriched Hardwood Forest Seep	CEGL006409	1
Hemlock - Beech - Oak - Pine Forest	CEGL006088	7
Hemlock - White Pine Forest	CEGL006328	4
Medium-depth Emergent Marsh	CEGL006519	1
Semi-rich Northern Hardwood Forest	CEGL006211	5
Successional Old Field	CEGL006107	0
White Pine Successional Forest	CEGL007944	0
Tall Graminoid Emergent Marsh ¹	CEGL005174	2
Total		25

¹Common name changed to Bluejoint Wet Meadow in final vegetation classification.

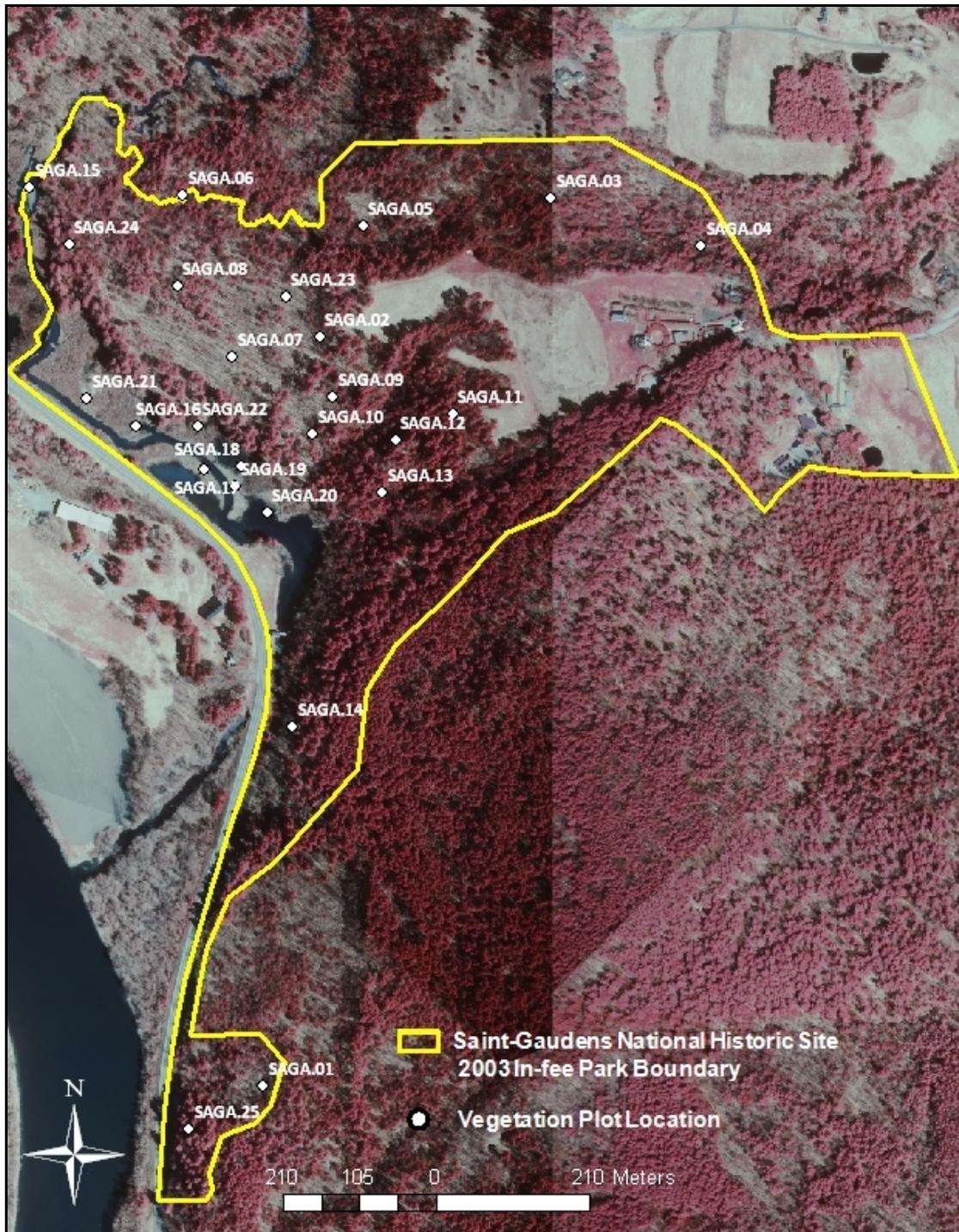


Figure 3. Location of the 25 vegetation plots sampled at Saint-Gaudens National Historic Site for vegetation classification and mapping.

vegetation. Data also included diameter at breast height (dbh) measurements for trees in the plot. Natural disturbance and land use history notes were recorded on each form. Notes were taken on how well the plot represented the surrounding vegetation and any other significant environmental information, such as landscape context, herbivory, stand health, recent disturbance, or evidence of historic disturbance. Additional data were collected on landscape position, adjacent vegetation types, and presence and abundance of nonnative invasive species. Because of archaeological restrictions within the park, soil sampling was discouraged. Information collected on soils was limited to what was visible at the surface. Digital photographs were taken of most vegetation associations. The center location of each plot was recorded with a global positioning system Garmin 12 (GPS) unit, with the datum set to North American 1983 (Conus) and the coordinate system set to Universal Trans-Mercator (UTM) zone 18. The GPS unit was WAAS (Wide-Area Augmentation System) enabled and provided real-time differential correction.

2005 Vegetation Classification and Characterization

Data from the 25 plots were entered into the PLOTS 2.0 database on a Microsoft Access platform. Species were assigned standardized names based on the PLANTS database, Version 3.5, developed by Natural Resources Conservation Service (NRCS) in cooperation with the Biota of North America Program (USDA, NRCS 2006). Plot locations are shown in Figure 3. Metadata for the PLOTS database are included in Appendix B. The common and scientific names of plants observed during the vegetation plot sampling are listed in Appendix C. Some tree and shrub seedlings and immature herbaceous plants could only be identified to the genus and are therefore listed as such in Appendix C.

All of the plots were classified into USNVC association and New Hampshire natural community type based on dominant and characteristic species. Because the park is small and the vegetational variation limited, classification by inspection was feasible. Species abundance data were analyzed using the PC-Ord Multivariate Analysis software package (McCune and Mefford 1999); however, because of the small number of plots, these analyses did not provide any significant insights into the relationships among natural communities at Saint-Gaudens National Historical Site beyond the initial classification. Because the USNVC global description includes species from across the range of the association, a park-specific (local) description was included for each association. Any new information collected about the association during plot sampling was incorporated into the global description as appropriate. Global information was then appended to the local descriptions to provide resource managers with a broader context for the vegetation in the park. Each vegetation association was assigned a park specific common name. If none existed, the U.S. National Vegetation Classification common name was used.

A park-specific dichotomous key was created for the vegetation associations to guide accuracy assessment and for use by park natural resource managers and others (Appendix D). A dichotomous key is a tool structured by a series of couplets, two statements that describe different, mutually exclusive characteristics of the associations. Choosing the statement that best fits the association in question leads the user to the correct association. The dichotomous key should be used in conjunction with the detailed vegetation association descriptions to confirm that the association selected with the key is appropriate.

Photointerpretation

Aerial photograph interpretation is the act of examining aerial photographs to identify vegetation types (Avery 1978). The digital orthophoto mosaic was examined onscreen in ArcGIS 9.0 (ESRI 1999–2004). Once the natural community types were established, GPS points of the plots were overlaid on the 2004 CIR aerial photos using ArcView GIS software. These data layers were utilized to map the natural communities using on-screen digitizing techniques. The minimum mapping unit used was 0.5 ha (1.24 ac). Stereo pairs were used to double check photosignatures during the digitizing process. Polygons that represented other land uses, such as buildings and roads, were attributed with cultural map class names.¹ The park boundary initially obtained and used for mapping the vegetation in 2005 represented Saint-Gaudens National Historic Site as it existed prior to 1999 and does not include a 2.6 ha (6.5 ac) parcel acquired in 1999 adjacent to and east of the park maintenance buildings. A more contemporary boundary (2003) was used for the final 2007 vegetation map that includes the missing parcel. All figures in this report show the 2003 in-fee boundary for the park.

Information gathered during reconnaissance visits and plot sampling informed the photointerpretation, which led to the drawing of 21 polygons in the 2005 Saint-Gaudens National Historic Site vegetation map. Since the mapping did not rely entirely on aerial photointerpretation alone, a separate aerial photograph interpretation key is not provided.

2005 Vegetation Map Preparation

Following the development of the vegetation classification, the vegetation map was further edited and refined in 2005 to develop an association-level vegetation map. Using ArcGIS 9.0, polygon boundaries were revised onscreen based on the plot data and additional informal field observations collected while in the field during plot sampling. Field notes and limited field mapping supplemented the GIS mapping. Given the large amount of time used in gathering plot data, further ground-truthing was minimal. Each polygon was attributed with the name of a USNVC association or a land use/land cover map class based on plot data, field observations, aerial photography signatures, and topographic maps.

The vegetation is mapped to the association level with one exception—because of their small size and interdigitization on the landscape, three of the herbaceous wetland communities, Bluejoint Wet Meadow (CEGL005174), Medium-depth Emergent Marsh (CEGL006519), and Cattail Marsh (CEGL006513) were mapped as a single map class: the Emergent Marsh - Shrub Swamp System. The Enriched Hardwood Forest Seeps, small occurrences within upland forests that are distinguished by their herb flora, are less than the minimum mapping unit (0.5 ha) and were not mapped.

The shapefile was projected in Universal Transverse Mercator (UTM) Zone 18 North, North American Datum (NAD) 1983. After the vegetation association map was completed, the thematic accuracy of this map was assessed.

¹ In early versions of the vegetation map, the cultural land use map classes were not crosswalked to Anderson Level II categories (Anderson et al. 1976). They were crosswalked in the revised final 2007 vegetation map.

Accuracy Assessment

Two sources of potential error in the vegetation map include: 1) horizontal positional accuracy, in which a location on the photomosaic does not accurately align with the same location on the ground due to errors in orthorectification or triangulation; and 2) thematic accuracy, in which the vegetation type assigned to a particular location on the map does not correctly represent the vegetation at the same location in the park. The USGS/NPS Vegetation Characterization Program protocols (TNC and ESRI 1994c) were followed to assess the positional and thematic accuracy of the Saint-Gaudens National Historic Site vegetation map.

Positional Accuracy Assessment

The horizontal positional accuracy of the orthorectified mosaic was assessed using guidelines of the USGS/NPS Vegetation Characterization Program (ESRI, NCGIA, and TNC 1994). Well-defined positional accuracy ground control points, spaced throughout all quadrants of the mosaic, were placed on the final 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.

For each plotted ground control point, field staff noted any alterations to the location in the field, and then recorded the coordinates with a Trimble Pro XRS global positioning system unit with real-time differential correction and a minimum of 120 (180 if field conditions were poor) fixes per point. Mapped ground control points that were physically inaccessible were also noted. The field crew correctly located and collected accuracy assessment data at 21 ground control points.

Prior to calculating accuracy, two ground control points were identified as outliers with SAS's JMP program and removed. The field-collected "true" or "reference" coordinates for the remaining 19 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 4 shows the distribution of the 19 ground control points within the park and surrounding area. This illustration shows both the 2003 park boundary and the authorized boundary, representing the area within which the U.S. Congress has authorized the National Park Service to acquire property for the park. (Park personnel created the digital representations of both boundaries, and their positional accuracies have not been assessed.)

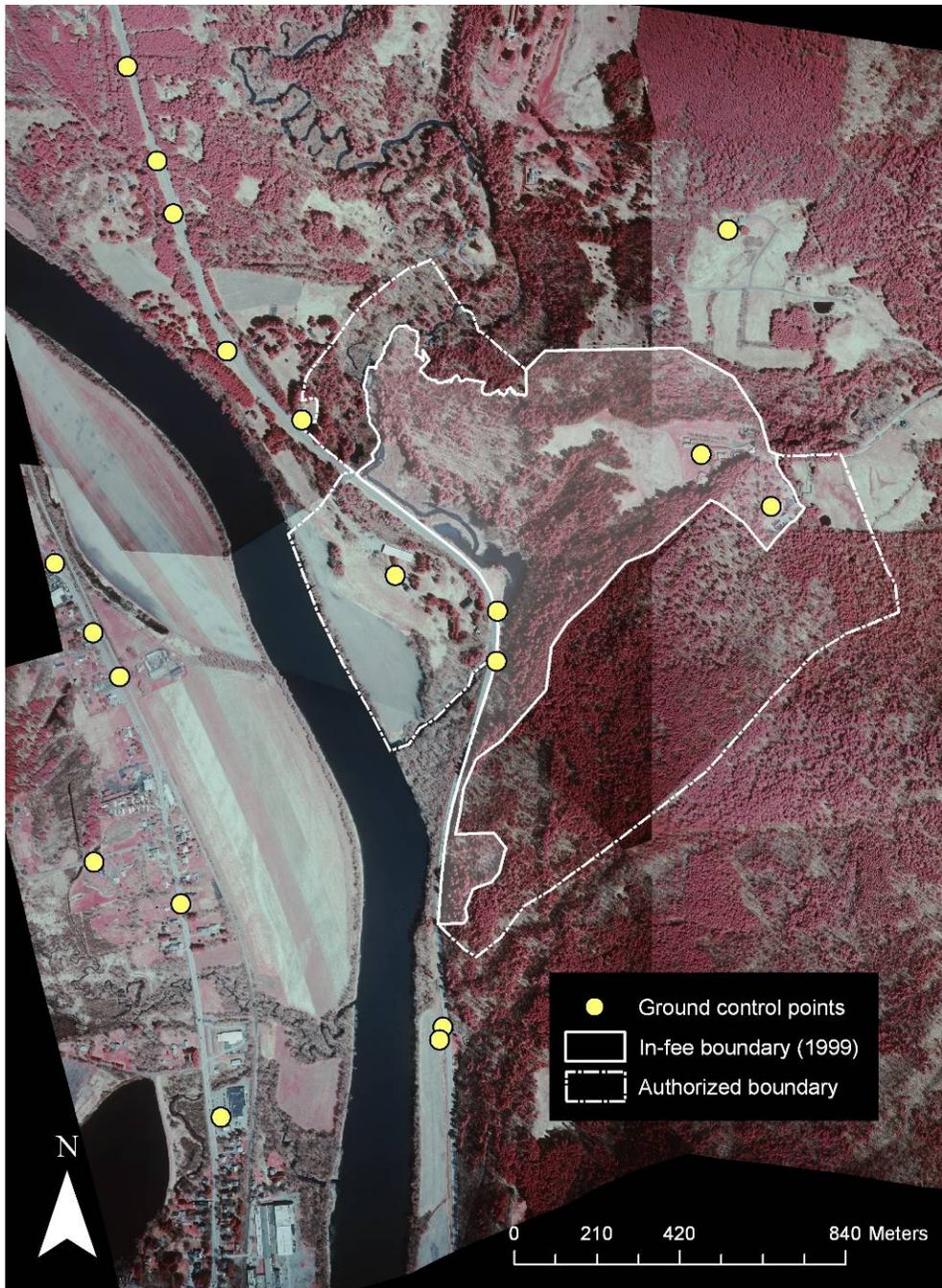


Figure 4. Ground control points used to calculate horizontal positional accuracy of the Saint-Gaudens National Historic Site mosaic (image provided by NCSU).

Thematic Accuracy Assessment

The thematic accuracy of the 2005 vegetation map was assessed by NatureServe vegetation ecologist, Susan C. Gawler, in October 2006. For each association and map class unit, the number of points to be assessed was determined using a slightly modified version of the accuracy assessment methodology outlined in the USGS/NPS Vegetation Characterization Program protocols (ESRI and NCGIA 1994). The protocol was modified because Saint-Gaudens National Historic Site is such a small park, with only 21 polygons in its vegetation map. A census sampling strategy was used in which one accuracy assessment point was assigned to each polygon because there was sufficient time and funding to visit every polygon in the small park.

Twenty-one accuracy assessment points were generated using Hawth's Analysis Tools in ArcGIS, one for each polygon in the 2005 vegetation map. Polygon borders were buffered by 10 meters to exclude ecotonal areas that may be of ambiguous classification; additionally, potential accuracy assessment points within the buffers were excluded. Polygons classified as land uses were not sampled. Data on a total of 17 accuracy assessment plots were collected. Table 3 shows the allocation of the accuracy assessment points among the vegetation associations in the 2005 vegetation map; Figure 5 depicts the locations of the points in the park.

Field Methods: Accuracy assessment field work was conducted in October 2006. A Garmin GPSMap 60CSX unit was programmed with coordinates of the selected sampling locations. Using the GPS and the aerial photos with unlabeled polygons, the ecologist navigated to each point. Data were collected using a standardized field form (Appendix D). Vegetation data included average height and percent cover of each stratum, as well as dominant species of each stratum. Percent cover was estimated for the unvegetated ground surface within categories, including bedrock, litter/duff, wood >1cm, large rocks (cobbles, boulders >10cm), small rocks

Table 3. Thematic accuracy assessment (AA) sampling strategy for Saint-Gaudens National Historic Site based on the 2005 vegetation map.

Vegetation Map Class Name / Land Use Map Class Name¹	Number of Polygons in 2005 Map	Number of AA Points Sampled
Alder - Dogwood Alluvial Thicket	4	1
Aquatic Bed ²	1	0
Cobble - Sand River Channel ²	1	0
Emergent Marsh - Shrub Swamp System ³	1	1
Hemlock - Beech - Oak - Pine Forest	5	5
Hemlock - White Pine Forest	3	3
Semi-rich Northern Hardwood Forest	2	2
Successional Old Field	1	1
White Pine Successional Forest	1	1
Agricultural Land (and buildings)	2	3
Total	21	17

¹In the 2005 vegetation map, the cultural land use map classes were not crosswalked to Anderson Level II categories (Anderson et al. 1976). They were crosswalked in the revised final 2007 vegetation map.

²Aquatic Bed and Cobble - Sand River Channel were not sampled in the accuracy assessment because they occur as small patches that are less than the minimum mapping unit (0.5 ha). They were visually checked in the field.

³This map class consists of three associations that are small patch and interdigitated on the landscape: Bluejoint Wet Meadow (CEGL005174), Medium-depth Emergent Marsh (CEGL006519), and Cattail Marsh (CEGL006513)

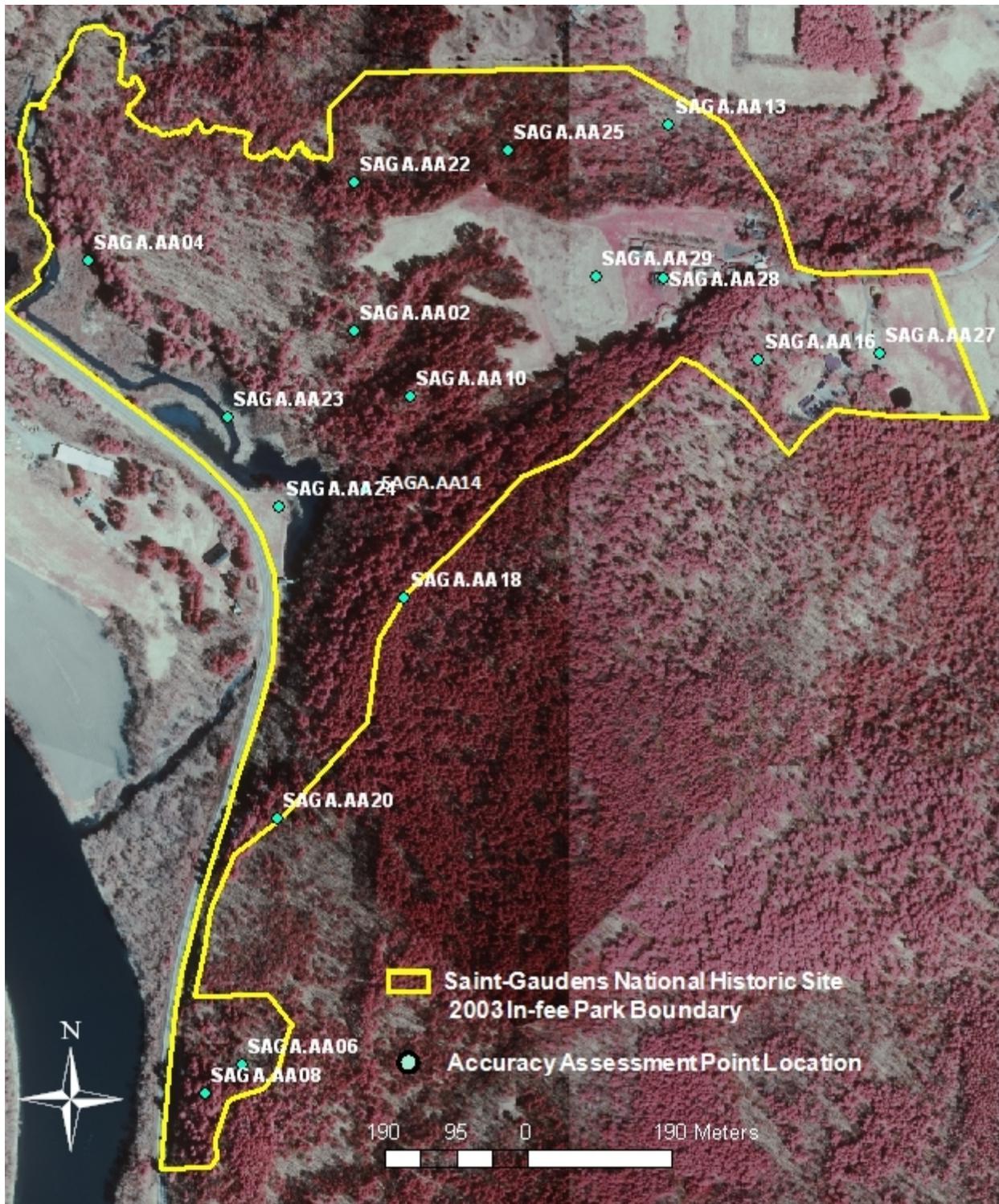


Figure 5. Locations of the 17 accuracy assessment sampling points in Saint-Gaudens National Historic Site.

(gravel, 0.2–10cm), sand (0.1–2mm), and bare soil. The total percent cover sums to 100% of the unvegetated surface and provides an overview of what occurs on the ground in addition to the vegetation. Other environmental data such as topographic position, hydrologic regime, or unusual features that further aided identification to association were collected. Using the dichotomous key to associations (Appendix E), the polygon was assigned to the appropriate association (hereafter referred to as the “first call”). If the classification decision was ambiguous, a comments field was completed to describe the reason for ambiguity, and a “second call” was noted. The ecologist also noted whether the sampling point was characteristic of the polygon as a whole or whether the point was atypical of the polygon.

Data Analysis: Data from the 17 accuracy assessment points were then entered into the NatureServe PLOTS 2.0 Database System on a Microsoft Access platform during the winter of 2006. In the PLOTS database, species found at the accuracy assessment points were assigned standardized codes based on the PLANTS 3.5 Database (USDA, NRCS 2006). The common and scientific names of plants observed during thematic accuracy assessment sampling are listed in Appendix C.

GPS data points were downloaded into an ArcGIS 9.0 shapefile to compare the field identification of each accuracy assessment point to the mapped identity in the draft vegetation map. The point coverage was overlain on the 2005 vegetation map layer and comparisons were made between the association name on the field form and the corresponding association name on the vegetation map. An Excel table was produced to illustrate the comparisons for every point. The senior author also reviewed every field data sheet to ensure that the classification concept was correctly applied. Additional columns were added to the table to record second calls where the initial identification was ambiguous.

The thematic accuracy was then tabulated using a contingency matrix that compared the mapped vegetation associations with the actual vegetation associations observed in the field. Overall percent accuracy and the Kappa index were calculated (TNC and ESRI 1994c). Overall percent accuracy was calculated by dividing the number of correctly classified accuracy assessment points by the total number of accuracy assessment points. The Kappa index is the preferred method of reporting overall thematic accuracy because it takes into account that a certain number of correct classifications will occur by chance (Foody 1992). The USGS/NPS vegetation mapping protocol requires that the Kappa index of vegetation association maps exceed 80% (TNC and ESRI 1994c).

User’s accuracy and producer’s accuracy were calculated for each map class. The former reflects errors of commission (errors of inclusion) and is calculated by dividing the number of correctly classified samples of a map class by the total number of accuracy assessment points that were attributed to that map class. Producer’s accuracy reflects errors of omission (errors of exclusion) and is calculated by dividing the number of correctly classified samples of a map class (same numerator as in user’s accuracy) by the total number of accuracy assessment points in polygons of that map class. User’s accuracy reflects the degree to which the map reflects what is actually on the ground, while producer’s accuracy reflects the probability that field samples have been correctly attributed. Overall accuracy (all classes) was also calculated in the contingency table.

Final Vegetation Classification and Revised Final 2007 Map Preparation

Based on the results of the accuracy assessment analyses, the 2005 association-level map was revised in 2007 to correct errors discovered during accuracy assessment. All of the USNVC attributions for the polygons in the 2005 vegetation map were updated to match the final USNVC call for the accuracy assessment points and plots. NCSU cleaned the final 2007 shapefile to remove gaps and overlaps in the polygon linework. In the final 2007 revision, accuracy assessment data, plot data, field observations, aerial photography signatures, and topographic maps were used to revise polygon boundaries and attributes.

Results

2005 Vegetation Map Production

Twelve USNVC associations were identified from reconnaissance work and plot sampling (Table 4). Ten are natural and two are successional. Seven occur in wetlands and five occur in uplands. The 2005 vegetation map is composed of 10 map classes, including nine classes representing 11 vegetation associations and one class representing a cultural unit (Table 4, Figure 6). Vegetation map classes are equivalent to the association level of the USNVC, with one exception; three of the herbaceous wetland communities—Bluejoint Wet Meadow (CEGL005174), Medium-depth Emergent Marsh (CEGL006519), and Cattail Marsh (CEGL006513)—were mapped as a single map class, the Emergent Marsh - Shrub Swamp System, because of their small size and interdigitization on the landscape.

The Enriched Hardwood Forest Seeps, small occurrences within upland forests that are distinguished by their herb flora, are less than the minimum mapping unit were not mapped in the 2005 vegetation map because they could not be seen under the forest canopy in the photointerpretation. However, the locations of the seeps are documented by GIS coordinates.

The 2005 vegetation map did not use the Anderson Level II land use classification. Polygons representing areas of altered vegetation and cultural features centered at the home and the old mill were labeled as Agricultural Land (Other). These polygons contain mowed fields, lawns, buildings, parking areas, the maintenance area, gardens, and the mill on Blow-Me-Down Pond and the surrounding lawn. Neither Blow-Me-Down Brook nor Blow-Me-Up Brook is mapped in the 2005 vegetation map.

The 2005 vegetation map used the 1999 park boundary shapefile for mapping; as a result, the polygons are not flush with the 2003 boundary shown in Figure 5 and the parcel in the northeast corner of the park was not included in the vegetation map.

Table 4. Vegetation groups, park-specific common names, USNVC association crosswalks, and corresponding map classes at Saint-Gaudens National Historic Site.

Group	SAGA name	USNVC association	USNVC code	Map class
Upland Forest	Semi-rich Northern Hardwood Forest	<i>Acer saccharum</i> - (<i>Fraxinus americana</i>) / <i>Arisaema triphyllum</i> Forest	CEGL006211	Semi-rich Northern Hardwood Forest
	Hemlock - White Pine Forest	<i>Pinus strobus</i> - <i>Tsuga canadensis</i> Lower New England / Northern Piedmont Forest	CEGL006328	Hemlock - White Pine Forest
	White Pine Successional Forest	<i>Pinus strobus</i> Successional Forest	CGL007944	White Pine Successional Forest
	Hemlock - Beech - Oak - Pine Forest	<i>Tsuga canadensis</i> - <i>Fagus grandifolia</i> - <i>Quercus rubra</i> Forest	CEGL006088	Hemlock - Beech - Oak - Pine Forest
Forest Seep	Enriched Hardwood Forest Seep	<i>Onoclea sensibilis</i> - (<i>Adiantum pedatum</i>) - <i>Impatiens capensis</i> - <i>Carex plantaginea</i> Herbaceous Vegetation	CEGL006409	Enriched Hardwood Forest Seep
Riparian	Alder - Dogwood Alluvial Thicket	<i>Alnus incana</i> - <i>Cornus sericea</i> / <i>Clematis virginiana</i> Shrubland	CEGL006062	Alder - Dogwood Alluvial Thicket
	Cobble - Sand River Channel	<i>Carex torta</i> - <i>Apocynum cannabinum</i> - <i>Cyperus</i> spp. Herbaceous Vegetation	CEGL006536	Cobble - Sand River Channel
Herbaceous Wetland	Bluejoint Wet Meadow	<i>Calamagrostis canadensis</i> - <i>Phalaris arundinacea</i> Herbaceous Vegetation	CEGL005174	Emergent Marsh - Shrub Swamp System
	Medium-depth Emergent Marsh	<i>Calamagrostis canadensis</i> - <i>Scirpus</i> spp. - <i>Dulichium arundinaceum</i> Herbaceous Vegetation	CEGL006519	Emergent Marsh - Shrub Swamp System
	Cattail Marsh	<i>Typha</i> (<i>angustifolia</i> , <i>latifolia</i>) - (<i>Schoenoplectus</i> spp.) Eastern Herbaceous Vegetation	CEGL006153	Emergent Marsh - Shrub Swamp System
	Aquatic Bed	<i>Nuphar lutea</i> ssp. <i>advena</i> - <i>Nymphaea odorata</i> Herbaceous Vegetation	CEGL002386	Aquatic Bed
Herbaceous Upland	Successional Old Field	<i>Dactylis glomerata</i> - <i>Phleum pratense</i> - <i>Festuca</i> spp.- <i>Solidago</i> spp. Herbaceous Vegetation	CEGL006107	Successional Old Field

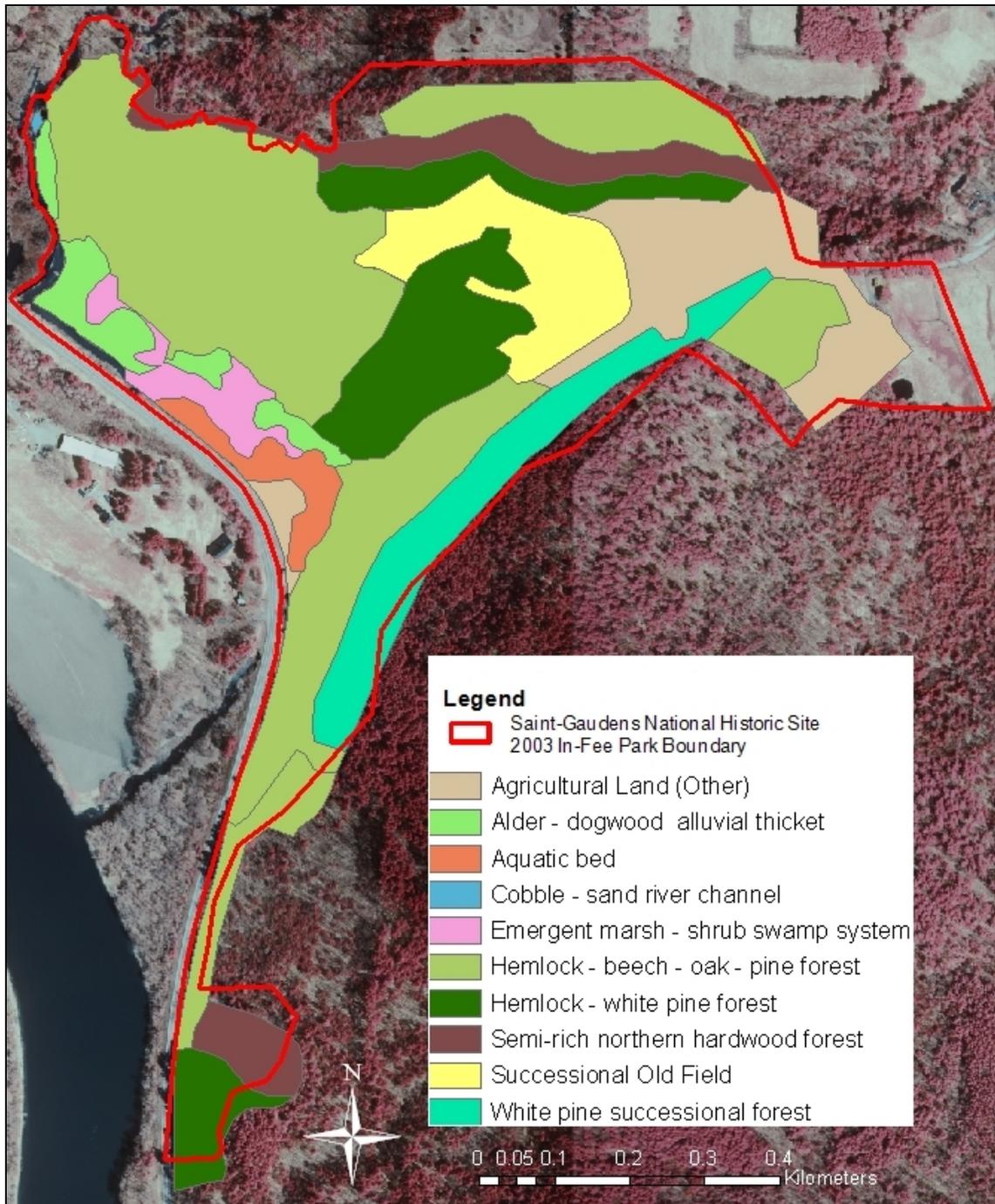


Figure 6. Saint-Gaudens National Historic Site map classes of 2005.

Accuracy Assessment

Positional Accuracy

The final horizontal positional accuracy of the Saint-Gaudens National Historic Site mosaic is 4.6 meters, which meets Class 3 National Map Accuracy Standards (FGDC 1998b). A copy of the spreadsheet containing the x and y coordinates for each ground control point and the accuracy calculation formula is included in the air photo archive maintained at the USGS Earth Observation Science (EROS) Center.

Thematic Accuracy

The initial analysis comparing strictly the first call field identification with the mapped polygon of the 2005 association-level vegetation map resulted in an overall accuracy of 88.9% with a Kappa index of 86.5% (Table 5). The individual class accuracies were 100% except for Hemlock - Beech - Oak - Pine Forest at 71% and Semi-rich Northern Hardwood Forest at 0%, both which fell below the 80% required by the USGS/NPS vegetation mapping protocol. The latter accuracy results require some explanation.

At Saint-Gaudens National Historic Site the Semi-rich Northern Hardwood Forest occurs as fairly small patches within the surrounding Hemlock - Beech - Oak - Pine Forest; therefore, the two polygons mapped as Semi-rich Northern Hardwood Forest are really patches of that type interspersed with the much more common Hemlock - Beech - Oak - Pine Forest. The two accuracy assessment points assigned to the polygons classified as Semi-rich Northern Hardwood Forest happened to fall onto areas of Hemlock - Beech - Oak - Pine Forest and were classed as such. The typical approach, given this situation, would be to disregard the map class for Semi-rich Northern Hardwood Forest and map it all as Hemlock - Beech - Oak - Pine Forest. However, given the size of the park and the fact that the Semi-rich Northern Hardwood Forest contains important floristic diversity lacking from most Hemlock - Beech - Oak - Pine Forest, we deemed it important to recognize the type even though it generally occurs in quite small patches.

Final 2007 Vegetation Map Production

Based on the results of the accuracy assessment analyses, the 2005 association-level map was revised in 2007 to correct errors discovered during accuracy assessment and to update the vegetation map to NPS vegetation mapping standards. All of the USNVC attributions for the polygons in the 2005 vegetation map were updated to match the final USNVC call for the accuracy assessment points and plots. Polygon linework was extended to the 2003 in-fee boundary edge. NCSU cleaned the final 2007 shapefile to remove gaps and overlaps in the polygon linework. A summary of the distribution and abundance of the map classes is provided in Table 6 and the resulting final 2007 vegetation map is shown in Figure 7.

In the final 2007 vegetation map, the vegetation classes (nine) and land cover categories (two) were divided into a total of 24 polygons. Eleven USNVC vegetation associations are grouped into nine map classes. A twelfth association, Enriched Hardwood Forest Seep, was mappable only as points rather than polygons due to its small patch size being less than the minimum map unit size. They were not included in the 2005 vegetation map. The vegetation map classes are equivalent to the association level of the U.S. National Vegetation Classification (USNVC), with one exception; the Emergent Marsh - Shrub Swamp System map class consists of three small patch USNVC associations: Bluejoint Wet Meadow, Cattail Marsh, and Medium-depth

Table 5. Final contingency table for 2005 vegetation map accuracy assessment for Saint-Gaudens National Historic Site.

Field Call		Mapped as									Total	% Correct (producer's accuracy)
		AG	ADT	AQ	EM-SS System	HBOP	HWP	NHS	OF	WPS		
Built-up Land / Agricultural Field	AG	3									3	100%
Alder - Dogwood Alluvial Thicket	ADT		1								1	100%
Aquatic Bed ¹	AQ			(1)							(1)	100%
Emergent Marsh - Shrub Swamp System ²	EM-SS System				1						1	100%
Hemlock - Beech - Oak - Pine Forest	HBOP					5		2			5	71%
Hemlock - White Pine Forest	HWP						3				3	100%
Semi-rich Northern Hardwood Forest	NHS					2		0			2	0%
Successional Old Field	OF								1		1	100%
White Pine Successional Forest	WPS									1	1	100%
Total ³		3	1	(1)	1	7	3	0	1	1	17	
% Correct (user's accuracy)		100%	100%	100%	100%	71%	100%	0%	100%	100%		

Thematic Accuracy	88.9
Kappa Index	86.5

¹Visual check of polygon, no data taken.

²Consists of 3 USNVC associations: Bluejoint Wet Meadow, Medium-depth Emergent Marsh, and Cattail Marsh.

³Cobble - Sand River Channel and Enriched Hardwood Forest Seep not included in accuracy assessment because they occur as small patches that are less than the minimum mapping unit (0.5 ha).

Table 6. Number of polygons and mapped hectares for the final 2007 vegetation map classes and Anderson Level II categories (modified) at Saint-Gaudens National Historic Site.

Map Class Name Vegetation Map Class	Number of Polygons	Mapped Hectares within park boundary (change from 2005)
Alder - Dogwood Alluvial Thicket	4	2.0
Aquatic Bed	1	1.3
Cobble - Sand River Channel	1	0.04
Emergent Marsh - Shrub Swamp System	1	1.5
Hemlock - Beech - Oak - Pine Forest	6	27.1 (+0.34)
Hemlock - White Pine Forest	3	8.3
Semi-rich Northern Hardwood Forest	2	4.5
Successional Old Field	2	6.0 (+1.79)
White Pine Successional Forest	1	5.3
Anderson Level II Category (modified)		
Other Urban or Built-up Land	2	6.6
Stream	1	0.9 (+0.9)
Total	24 ¹	63.5

¹ Corrections made in 2007 to the 2005 map (total of 21 polygons) required classification of three additional polygons. The first polygon was added to include Blow-Me-Down Brook along the park's northwestern corner. The second polygon was added to include the field in the northeastern corner of the park. The third polygon was added to include the stand of Hemlock - Beech - Oak - Pine Forest in the northeastern corner of the park.

Emergent Marsh. These occur as an integrated mosaic on the landscape and are better represented as one map unit (1.45 ha [3.6 ac]) rather than individual map units less than the minimum map unit (0.5 ha [1.24 ac]).

The 2005 vegetation map did not use Anderson Level II land use classes as required as a mapping standard under the protocol. Instead, polygons representing areas of altered vegetation and cultural features centered at the home and the old mill were labeled as Agricultural Land (Other). In 2007, these two polygons in the 2005 vegetation map were renamed “Other Urban or Built-up Land” from the Anderson land use classification (Anderson 1976). These polygons contain mowed fields, lawns, buildings, parking areas, the maintenance area, gardens, and the mill on Blow-Me-Down Pond and the surrounding lawn.

Neither Blow-Me-Down Brook nor Blow-Me-Up Brook is mapped in the 2005 vegetation map. One polygon depicting Blow-Me-Down Brook was added to the final 2007 vegetation map and called “Stream” from the Anderson Land Use classification because it could be seen in the orthophoto mosaic. Blow-Me-Up Brook, however, could not be discerned in the orthophoto because it occurs under the forest canopy in the northern portion of the park and therefore was not added to the final 2007 vegetation map. Figure 2 is included to show the location of this and other streams, rivers, and ponds in the park.

The 2005 vegetation map used the incorrect park boundary file (1999 boundary) for mapping. The correct boundary (2003 in-fee) was used in the development of the final 2007 vegetation map; however, a 6.5 ac parcel in the northeast corner of the park was not mapped. In 2011, two polygons (one Successional Old Field and one Hemlock - Beech - Oak - Pine Forest) were added to the final 2007 vegetation map in the northeast corner of the park.

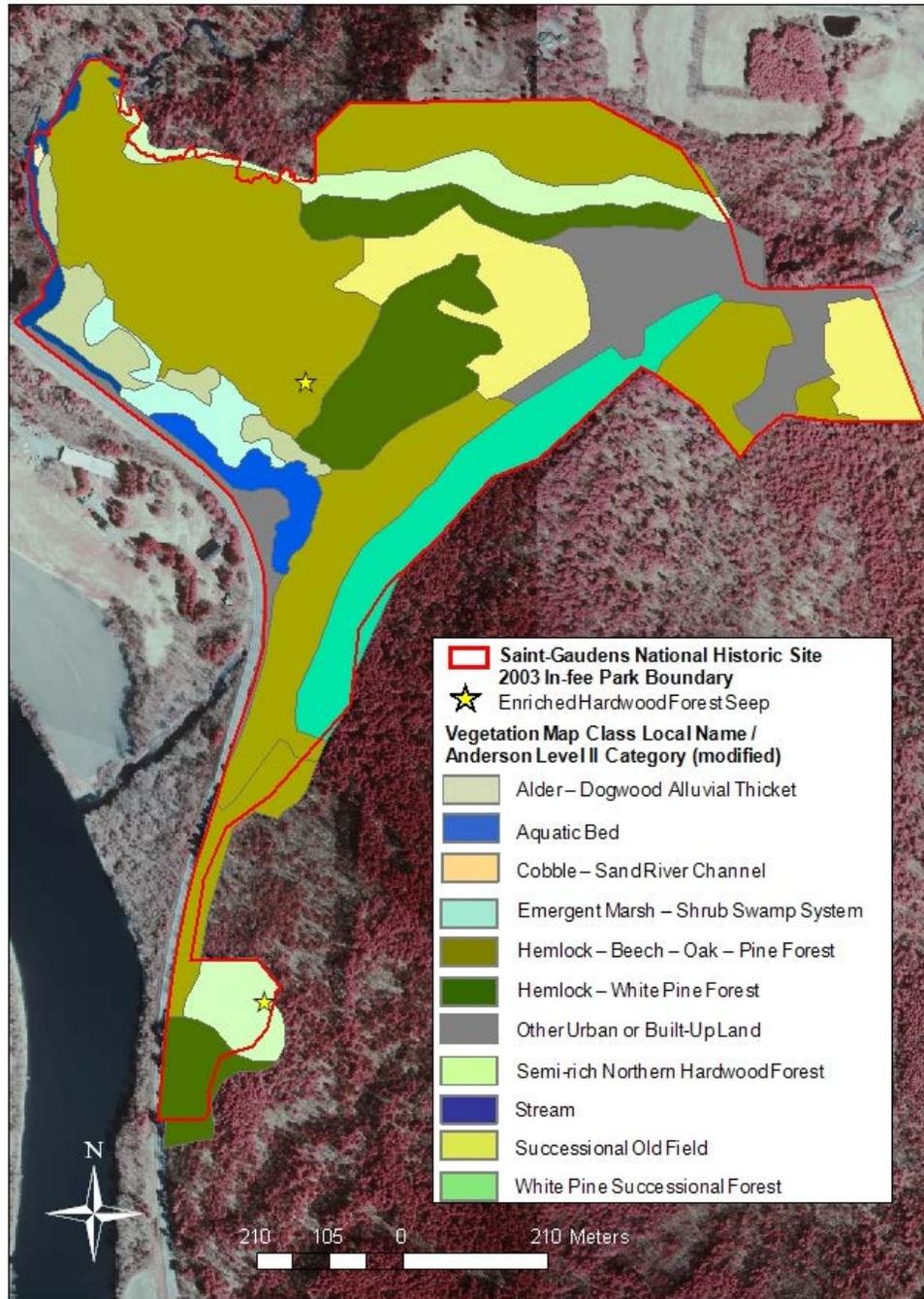


Figure 7. Final 2007 USNVC vegetation map classes and Anderson Level II Categories (modified) of Saint-Gaudens National Historic Site, and locations of Enriched Hardwood Forest Seeps.

Metadata for the vegetation association shapefile, the plot location shapefile, the accuracy assessment sampling point location shapefile, and the digital photomosaic were prepared according to FGDC standards and have been provided as a deliverable along with this report.

Vegetation Association Descriptions

Detailed local and global descriptions for the 12 vegetation associations were written based on the plot and accuracy assessment data and the ecologists' field experiences at Saint-Gaudens National Historic Site (Appendix F). The association descriptions contain information on their occurrence at Saint-Gaudens National Historic Site ("Local Description") and rangewide ("Global Information"). The local descriptions are specific to their expressions at Saint-Gaudens National Historic Site, although the community names have largely been taken from *Natural Communities of New Hampshire* (Sperduto and Nichols 2004).

Vascular plant species nomenclature within the local and global descriptions follows the nationally standardized PLANTS 3.5 Database (USDA, NRCS 2006). 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 the PLANTS 3.5 Database (USDA, NRCS 2006) common names that are used within the local description information and throughout the rest of the report.

A dichotomous key was also developed for these vegetation associations (Appendix E). The dichotomous key should be used in conjunction with the detailed vegetation association descriptions to confirm that the association selected with the key is appropriate. This key and the park-specific vegetation association descriptions were used in the thematic accuracy assessment and may be used by park resource managers and others to identify vegetation associations in the park. Representative photographs of the vegetation types are provided after the descriptions when available. An index to these photos is provided in Appendix G. A bibliography for the sources cited in the USNVC global vegetation descriptions is provided in Appendix H.

Project Deliverables

Products of the vegetation mapping project are shown in Table 7. All products have been delivered to the National Park Service Northeast Temperate Inventory and Monitoring Network by NatureServe with this report.

Table 7. Summary of products resulting from the Saint-Gaudens National Historic Site vegetation classification and mapping project.

Product	FGDC-compliant spatial metadata
Aerial photos, including flight line map and photoindex	Yes
Photomosaic in digital format	Yes
Annotated field forms with vegetation plot sampling data	Not Applicable
Vegetation plot sampling data in the PLOTS 2.0 database	Yes
Differentially corrected GPS locations of vegetation plots	Yes
Annotated field forms with thematic accuracy assessment data	Not Applicable
Thematic accuracy assessment data in the PLOTS 2.0 database	Yes
Differentially corrected GPS locations of thematic accuracy assessment sampling points	Yes
Digital photos representative of vegetation types	Not Applicable
Final map of vegetation associations as paper copy and in digital format	Yes
Final report as paper copy and in digital format	Not Applicable

Discussion

Final Vegetation Classification and Characterization

This study at Saint-Gaudens National Historic Site identified 12 USNVC vegetation associations: Alder - Dogwood Alluvial Thicket, Aquatic Bed, Bluejoint Wet Meadow, Cattail Marsh, Cobble - Sand River Channel, Enriched Hardwood Forest Seep, Hemlock - Beech - Oak - Pine Forest, Hemlock - White Pine Forest, Medium-depth Emergent Marsh, Semi-rich Northern Hardwood Forest, Successional Old Field, and White Pine Successional Forest. These vegetation types are influenced by the environmental settings and past land uses in the park. None of the vegetation associations visited and mapped in Saint-Gaudens NHS are rare in New Hampshire or in the New England region. The map classes and component vegetation associations are presented below in order of highest to lowest acreage within the park.

Upland Forest Vegetation

Hemlock - Beech - Oak - Pine Forest (27.1 ha [67 ac]) is the most common forest type in the park, and is expressed in two variants in the field. The typical variant is generally found on the drier mid to upper portions of gentle to moderately steep slopes. It is dominated by a variable mixture of red maple (*Acer rubrum*), American beech (*Fagus grandifolia*), northern red oak (*Quercus rubra*), and eastern hemlock (*Tsuga canadensis*). The compact till/low river terrace variant is restricted to the series of level terraces above Blow-Me-Down Pond. These terraces are generally more mesic than the typical variant sites and occasionally contain low swales or vernal pools. It is characterized by red maple with northern red oak and/or eastern white pine (*Pinus strobus*), and has little or no eastern hemlock and American beech. These variants are also documented in the New Hampshire state vegetation classification (Sperduto and Nichols 2004).

Hemlock - White Pine Forest is the next most common upland forest in the park (8.3 ha [20.5 ac]). It is co-dominated by eastern hemlock and eastern white pine and can be distinguished from other upland forest communities by continuous conifer cover. It can further be distinguished from eastern white pine dominated forests by the clear co-dominance of eastern hemlock in the canopy. The largest patch of this type at Saint-Gaudens National Historic Site is centered on the steep ravines in the middle of the park. Smaller patches are found on the steep slopes above Blow-Me-Up Brook and on steep, west-facing slopes at the southern end of the park.

The third natural upland forest type in the park is Semi-rich Northern Hardwood Forest (4.5 ha [11.1 ac]). This association occurs as small (mostly <1 ac) inclusions within the surrounding Hemlock - Beech - Oak - Pine Forest on low terraces adjacent to Blow-Me-Up Brook. The canopy is dominated by a mixture of tree species, including sugar maple (*Acer saccharum*), American basswood (*Tilia americana*), white ash (*Fraxinus americana*), and yellow birch (*Betula alleghaniensis*). The exotic herbs broadleaf helleborine (*Epipactis helleborine*) and wall lettuce (*Mycelis muralis*) are both frequent in this community. Although not currently considered invasive, their presence and cover should be monitored to identify any change in their abundances.

Wetland Vegetation

The Alder - Dogwood Alluvial Thicket borders Blow-Me-Down Brook and Blow-Me-Down Pond in the western part of the park [2.0 ha (5.0 ac)]. This shrub thicket occurs on loam and fine- to medium-grained sands subjected to periodic flooding. It is characterized by a shrub layer dominated by silky dogwood (*Cornus amomum*), with gray alder (*Alnus incana*) occurring as a codominant. The invasive exotic Morrow's honeysuckle (*Lonicera morrowii*) is also consistently present in low abundance. A diverse herbaceous layer is present beneath the shrub canopy, including sensitive fern (*Onoclea sensibilis*), smallspike false nettle (*Boehmeria cylindrica*), spiked muhly (*Muhlenbergia glomerata*), bluejoint (*Calamagrostis canadensis*), fowl mannagrass (*Glyceria striata*), jewelweed (*Impatiens capensis*), goldenrods (*Solidago* spp.), and sedges (*Carex* spp.).

The Emergent Marsh - Shrub Swamp System is one polygon that consists of a mosaic of three emergent marsh associations: Bluejoint Wet Meadow, Medium-depth Emergent Marsh, and Cattail Marsh. It covers 1.5 ha (3.7 ac) adjacent to Blow-Me-Down Pond and Blow-Me-Down Brook. Bluejoint Wet Meadow, dominated by bluejoint, broadleaf cattail (*Typha latifolia*), common boneset (*Eupatorium perfoliatum*), Canada bluegrass (*Poa compressa*), smallspike false nettle, jewelweed, and Virginia water horehound (*Lycopus virginicus*), occupies about 30% of the polygon. It occurs in narrow bands along the stream channel. The wetland shrubs speckled alder and silky dogwood are present, but low in cover. The invasive exotic purple loosestrife (*Lythrum salicaria*) is frequent in this community. Bluejoint Wet Meadow is found in higher and drier environmental settings than Medium-depth Emergent Marsh and Cattail Marsh.

The Aquatic Bed association, dominated by the aquatic plant species ribbonleaf pondweed (*Potamogeton epihydrus*), variegated yellow pond-lily (*Nuphar lutea* ssp. *variegata*) and American white waterlily (*Nymphaea odorata*), occupies shallow (0.5–1.5 m depth), permanently flooded portions of Blow-Me-Down Pond [1.3 ha (3.2 ac)]. Vegetation cover varies widely from zero (open water) to as much as 70%. This association also occurs in small (below minimum mapping unit) open water areas of the adjacent Emergent Marsh - Shrub Swamp System polygon.

Cobble - Sand River Channel is a very small patch vegetation association that is restricted to a small gravel bar in Blow-Me-Down Brook [0.04 ha (0.1 ac)]. Its open character is maintained by flooding and ice-scour, and the lack of soil development leads to sparse vegetation cover. What vegetation is there is a sparse mix of tree seedlings, shrubs, and herbs on a substrate of fine gravel and sand. American sycamore (*Platanus occidentalis*) seedlings are the most abundant woody vegetation and comprise a shrub layer that ranges from 10–25% cover. Herbs include Canada goldenrod (*Solidago canadensis*), common boneset, deertongue (*Dichanthelium clandestinum*), creeping bentgrass (*Agrostis stolonifera*), Mexican muhly (*Muhlenbergia mexicana*), and flat-top goldentop (*Euthamia graminifolia*). Although the sole occurrence of this community is very small, it is distinct and discrete enough to be easily mapped within Blow-Me-Down Brook in the northwest corner of the park.

The Enriched Hardwood Forest Seep is an herbaceous wetland community characterized by common ladyfern (*Athyrium filix-femina*), sensitive fern, and jewelweed. It occurs in small patches (<0.01 ha) on lower slopes, at slope breaks within the matrix forest types.

Ruderal Vegetation

The White Pine Successional Forest is found on a gentle to moderate slope along the southeast edge of the park. It is represented by a single polygon (5.3 ha [13.1 ac]). Eastern white pine forms an almost monotypic canopy, mixed with minor amounts of northern red oak and eastern hemlock. It will likely become Hemlock - Beech - Oak - Pine Forest as succession proceeds.

There are two Successional Old Field polygons, occupying 6.0 ha (14.8 ac) to the west and to the east of the Saint-Gaudens house. These fields are maintained annually. Common grasses include timothy (*Phleum pretense*) and bentgrass (*Agrostis* sp.), with typical old-field forbs including goldenrods (*Solidago* spp.) and hawkweed (*Hieracium* sp.). The vegetation will succeed to forest if it is not maintained.

Altered Vegetation and Other Land-cover Classes

Two polygons attributed to the “Other Urban or Built-up Land” map class contain lawns, buildings, parking areas, the maintenance area, gardens, and the mill on Blow-Me-Down Pond and surrounding lawn. Blow-Me-Down Pond is covered by the vegetation association Aquatic Bed and is not designated as a pond in the vegetation map. Blow-Me-Down Brook was added to the final 2007 vegetation map and called “Stream.” Blow-Me-Up Brook, however, could not be discerned in the orthophoto because it occurs under the forest canopy and therefore was not added to the final 2007 vegetation map.

Plant Species Records

A total of 180 vascular plant species were recorded in the vegetation surveys in 2004 and 2006. These are listed in Appendix C. Eight out of the 180 are nonnative. This project was not intended to provide a complete species account of the park flora, but is a good start towards such a goal.

Rare Plant Species

No federally listed plant species were observed during this study (S1–S3).

Nonnative Plant Species

At Saint-Gaudens National Historic Site, the natural communities are not currently suffering serious adverse impacts from the presence of nonnative plant species. However, there are some developing nonnative problems in the wetlands surrounding Blow-Me-Down Pond, and there are scattered occurrences in the Enriched Hardwood Forest Seeps and Semi-Rich Northern Hardwood Forest. The following section describes nonnative species that were seen in 2004.

Japanese barberry (*Berberis thunbergii*) was found as scattered shrubs primarily in areas of seepage near the base of slopes and among ferns in an Enriched Hardwood Forest Seep. Although it is currently restricted to these areas, this plant is notoriously invasive and has been documented invading dry upland forests (Ehrenfeld 1987). Efforts should be made to control this species wherever possible. Common barberry (*Berberis vulgaris*) is also present and is not native (Kartesz 1999, New Hampshire Department of Agriculture Markets and Food, Plant Industry Division & New Hampshire Invasive Species Committee 2005).

Broadleaf helleborine (*Epipactis helleborine*), a nonnative orchid, is widespread in New Hampshire in moist woodlands. Although it is not generally considered invasive, it is frequent enough in the Enriched Hardwood Forest Seeps and Semi-Rich Northern Hardwood Forest at Saint-Gaudens National Historic Site to warrant monitoring.

Wall-lettuce (*Mycelis muralis*) is a nonnative annual or biennial herb in the aster family. Much like broadleaf helleborine, it is not known to be invasive, but is frequent in areas of seepage or soil enrichment at Saint-Gaudens National Historic Site, particularly along Blow-Me-Up Brook (Figure 2). This species is not common in New Hampshire, and it should be monitored for changes in population size.

Occurrences of Japanese honeysuckle (*Lonicera japonica*) at Saint-Gaudens National Historic Site are significant, as this nonnative species was not noted by Gilman in 1997. It has only recently been seen in the state, primarily along the seacoast in southeastern New Hampshire. At Saint-Gaudens NHS, it is presently in very low numbers, mainly in the Semi-rich Northern Hardwood Forest along Blow-Me-Up Brook. Given this species' potential for spread, infestations should be controlled whenever found.

Morrow's honeysuckle (*Lonicera morrowii*), a nonnative tall shrub, is frequent in the Alder - Dogwood Alluvial Thicket surrounding Blow-Me-Down Pond and Blow-Me-Down Brook (Figure 2; Figure 8). It produces red berries which are dispersed by a variety of animals. Its location in the wetlands, interspersed with silky dogwood (*Cornus amomum*) and gray alder (*Alnus incana*), would make it difficult to perform control activities.



Figure 8. Blow-Me-Down Pond at Saint-Gaudens National Historic Site.

Purple loosestrife (*Lythrum salicaria*), a nonnative tall perennial herb, is frequent in the Alder - Dogwood Alluvial Thicket and the Emergent Marsh - Shrub Swamp System which consists of three herbaceous wetland communities, Bluejoint Wet Meadow, Medium-depth Emergent Marsh, and Cattail Marsh, around Blow-Me-Down Pond (Figure 2; Figure 8). The impact of this species is well-documented (Bender 1987), and Saint-Gaudens NHS staff have already taken steps to implement biological control of purple loosestrife in and around the pond.

Coltsfoot (*Tussilago farfara*), a nonnative weedy herb, is recognized by its large, tomentose (woolly) leaves, shaped roughly like a horse's hoof. At Saint-Gaudens National Historic Site, it is present along Blow-Me-Up Brook, particularly on areas of soil disturbance resulting from sediment deposition or windthrow (Figure 2). Because it is not a particularly aggressive invader, control of this species is probably not a high priority.

Management Considerations

The forested slopes and wetlands of Saint-Gaudens National Historic Site comprise a protected natural area of good quality. Other than the monitoring and control of the few invasive plant species, management requirements in the natural areas should be minimal.

In at least one location, brush and other garden wastes were discarded into the ravine of Blow-Me-Up Brook. This practice should be discontinued, as piles of brush can shade out native vegetation, as well as potentially introduce propagules of nonnative plant species.

Any future expansion of the Saint-Gaudens National Historic Site recreational trail network should take into account the ecology and topography of the site. The forests of the park occur on unconsolidated glacio-fluvial sediments, which in some areas form steep, highly erodible slopes. Additional trails, if planned, should be routed to avoid these areas.

Decisions on the restoration of the mill pond area (Figure 8) will need to take into account historic and cultural priorities as well as natural resources. Any sediment removal should attempt to minimize impacts to Alder - Dogwood Alluvial Thicket, Aquatic Bed, Bluejoint Wet Meadow, Cattail Marsh, Cobble - Sand River Channel, and Medium-depth Emergent Marsh communities.

Vegetation Map Production

The final vegetation map for Saint-Gaudens National Historic Site includes nine vegetation association map classes, one of which is an aggregated map class of three associations, and two Anderson Level II Categories (modified) (Figure 7). This map is based on aerial photography that was flown in April 2003, vegetation plot data collected in 2004, and accuracy assessment data collected in 2006. Since that time, the vegetation continues to change due to natural and human related disturbances. Continued natural succession will influence the mapped vegetations. Management of invasive species and woody plants would also alter the vegetation. Despite these continual changes, the vegetation map produced by this project provides crucial baseline data for park resource managers.

The vegetation and cover of Saint-Gaudens National Historic Site was divided into 21 polygons of the nine map classes. Hemlock - Beech - Oak - Pine Forest is the most extensive type at the park, both in the number of polygons and their total and maximum acreage. Hemlock - White Pine Forest is a distant second in total acreage, with Semi-rich Northern Hardwood Forest and White Pine Successional Forest close behind. Other vegetation types, aside from the managed lands of the home and grounds, comprise a more minor part of the total vegetation but provide important habitat diversity (Table 6). Two Anderson Level II Category (modified) classes accounted for three additional polygons.

It is important to note that the vegetation attributions listed in the attribute table of the final vegetation association / map class shapefile were determined by the hierarchical nature of the

USNVC. Based on the USNVC, each polygon and point was attributed with the appropriate formation, formation code, alliance code, alliance scientific and English names, association code, scientific and English names, and local park-specific names for the polygon's USNVC association.

Conclusions

The proposed map classes provide the user with a pragmatic balance between acceptable accuracy while retaining sufficient detail. The vegetation map provides baseline data for long-term vegetation monitoring. It can be updated with additional field data over time. Newly developed environmental data layers can be interpreted with the aid of the aerial photos and orthophotos to further refine the map for the park. The current map can be used to inform management plans for the park.

The vegetation map, detailed vegetation association descriptions, and dichotomous key are essential tools for managing and monitoring the natural communities in the park. These standardized products provide a baseline for assessing the ecological integrity, acreages, and locations of the vegetation communities within the park. Keeping the map up to date should be a high priority for park resource managers because the vegetation will change in response to various disturbances, natural succession, and management. The vegetation map can be used to develop interpretive trails, field guides, and help resource managers identify priority areas for resource protection, restoration, and environmental education. The U.S. National Vegetation Classification can also be used in conjunction with the vegetation map to help describe desired vegetation communities for future vegetation management projects and provide a framework for ecological integrity assessments.

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. U.S. Government Printing Office, Washington. (A 2001 digital version based on Optical Character Recognition.)
- 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.
- Avery, T. E. 1978. Forester's Guide to Aerial Photo Interpretation. U.S. Department of Agriculture, U.S. Forest Service. Agriculture Handbook 308. 40 pp.
- Bender, J. 1987. Element Stewardship Abstract for *Lythrum salicaria*. The Nature Conservancy, Arlington, VA. Available at: <http://tncweeds.ucdavis.edu/esadocs/documnts/lythsal.html>.
- Cleland, D. T., J. A. Freeouf, J. E. Keys, Jr., G. J. Nowacki, C. Carpenter, and W. H. McNab. 2007. Ecological Subregions: Sections and Subsections of the Conterminous United States [1:3,500,000] [CD-ROM]. Sloan, A. M., cartog. Gen. Tech. Report WO-76. Washington, DC: U.S. Department of Agriculture, Forest Service.
- Cronan, C. S., M. A. Davis, M. R. DesMeules, J. R. Litton, P. Nothnagle, and R. Parnell. 1981. A natural resource inventory at Saint-Gaudens National Historic Site. National Park Service, Boston, MA.
- Cowardin, L. M., V. Carter, F. C. Golet, and E. T. LaRoe. 1979. Classification of wetlands and deepwater habitats of the United States. U. S. Department of the Interior, Fish and Wildlife Service, Washington, DC. Jamestown, ND: Northern Prairie Wildlife Research Center Online. <http://www.npwrc.usgs.gov/resource/1998/classwet/classwet.htm> (Version 04DEC98).
- Ehrenfeld, J. G. 1987. Invasion of deciduous forest preserves in the New York metropolitan region by Japanese barberry (*Berberis thunbergii* DC.) *Bulletin Torrey Botanical Club* 124:210–215.
- Environmental Systems Research Institute, National Center for Geographic Information and Analysis, and The Nature Conservancy (ESRI, NCGIA, and TNC). 1994. Accuracy assessment procedures, USGS/NPS Vegetation Characterization Program. Retrieved October 2001 from <http://biology.usgs.gov/npsveg/aa/aa.html>.
- Federal Geographic Data Committee (FGDC). 1998a. Content standard for digital geospatial metadata (FGDC-STD-001-1998). Retrieved October 2001 from <http://www.fgdc.gov/metadata/contstan.html>.

- Federal Geographic Data Committee (FGDC). 1998b. Geospatial positioning accuracy standards, Part 3: National Standard for Spatial Data Accuracy. (FGDC-STD-007.3-1998). Retrieved October 2001 from http://www.fgdc.gov/standards/status/sub1_3.html.
- Federal Geographic Data Committee (FGDC). 2008. National Vegetation Classification Standard, Version 2. Vegetation Subcommittee. FGDC-STD-005-2008 (Version 2).
- Foody, G. M. 1992. On the compensation for chance agreement in image classification accuracy assessment. *Photogrammetric Engineering and Remote Sensing*. 58(10):1459–1460.
- Gilman, A. V., and New Hampshire Natural Heritage Program. 1997. Native and naturalized vascular plants, natural communities, and selected fauna of the Saint-Gaudens National Historic Site. New Hampshire Natural Heritage Program, Department of Resources and Economic Development, Concord, NH.
- Grossman, D. H., D. Faber-Longendoen, A. S. Weakley, M. Anderson, P. Bourgeron, R. Crawford, K. Goodin, S. Landaal, K. Metzler, K. D. Patterson, M. Pyne, M. Reid, and L. Sneddon. 1998. International classification of ecological communities: terrestrial vegetation of the United States. Volume I. The U.S. National Vegetation Classification System: development, status and applications. The Nature Conservancy, Arlington, VA, USA. 126 pp.
- 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.
- Keys, J. E., Jr., C. A. Carpenter, S. L. Hooks, F. G. Koenig, W. H. McNab, W. E. Russell, and M-L. Smith. 1995. Ecological units of the eastern United States - first approximation (map and booklet of map unit tables). Presentation scale 1:3,500,000, colored. USDA Forest Service, Atlanta, GA.
- Lyons, J. B., W. A. Bothner, R. H. Moench, and J. B. Thompson. 1997. Bedrock Geologic Map of New Hampshire. U.S. Geological Survey in cooperation with the U.S. Department of Energy and the State of New Hampshire.
- McCune, B., and M. Mefford. 1999. PC-ORD. Multivariate Analysis of Ecological Data, version 4. MjM Software Design, Gleneden Beach, Oregon, USA.
- 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>.
- Minushkin, J. 1994. Phase 1 Inventory and Monitoring Status of Natural Resource Inventories for the North Atlantic Region. Department of the Interior. National Park Service. North Atlantic Region. Boston, MA.

- Moore, R. B., C. D. Johnson, and E. M. Douglas. 1994. *Geohydrology and Water Quality of Stratified-Drift Aquifers in the Lower Connecticut River Basin, Southwestern New Hampshire*. U.S. Geological Survey, Bow, NH.
- NatureServe. 2007. NatureServe Explorer. Available at: <http://www.natureserve.org/explorer/>.
- New Hampshire Department of Agriculture Markets and Food, Plant Industry Division & New Hampshire Invasive Species Committee. 2005. *Guide to Upland Invasive Species in New Hampshire*. <http://extension.unh.edu/forestry/Docs/invasive.pdf>.
- Perles, S. J., G. S. Podniesinski, W. A. Millinor, and L. A. Sneddon. September 2006. *Vegetation classification and mapping at Gettysburg National Military Park and Eisenhower National Historic Park*. Technical Report NPS/NER/NRTR--2006/058. National Park Service, Philadelphia, PA
- Sperduto, D. D., and W. F. Nichols. 2004. *Natural Communities of New Hampshire*. NH Natural Heritage Bureau, Concord, NH. Pub. UNH Cooperative Extension, Durham, NH.
- The Nature Conservancy (TNC). 2001. *Designing a Geography of Hope: A Practitioner's Handbook to Ecoregional Conservation Planning*. Volume I, Second Edition. April 2000. Ecoregion map updated 2001 available at http://gis.tnc.org/data/MapbookWebsite/map_page.php?map_id=27.
- The Nature Conservancy and Environmental Systems Research Institute (TNC and ESRI). 1994a. *NBS/NPS Vegetation Mapping Program: Standardized U.S. National Vegetation Classification System*. 188 pp. Report to the National Biological Survey and the National Park Service. Arlington, VA and Redlands, CA. <<http://biology.usgs.gov/npsveg/standards.html>.
- The Nature Conservancy and Environmental Systems Research Institute (TNC and ESRI). 1994 b. *NBS/NPS Vegetation Mapping Program: Field Methods for Vegetation Mapping*. 92 pp. Report to the National Biological Survey and the National Park Service. Arlington, VA and Redlands, CA. <<http://biology.usgs.gov/npsveg/standards.html>.
- The Nature Conservancy and Environmental Systems Research Institute (TNC and ESRI). 1994c. *USGS/NPS Vegetation Characterization Program: Accuracy Assessment Procedures*. 71 pp. Report to the National Biological Survey and the National Park Service. Arlington, VA and Redlands, CA. <<http://biology.usgs.gov/npsveg/standards.html>.
- United States Department of Agriculture, National Resources Conservation Service (USDA, NRCS). 2006. *The PLANTS Database*, Version 3.5 (<http://plants.usda.gov>). Data compiled from various sources by Mark W. Skinner. [National Plant Data Center](http://plants.usda.gov), Baton Rouge, LA 70874-4490 USA.
- United States Geological Survey (USGS). 2004. *Tools for creation of formal metadata, a compiler for formal metadata*. Retrieved June 2004 from <http://geology.usgs.gov/tools/metadata/tools/doc/mp.html>.

Wang, Y. Q., and J. Nugranad-Marzilli. 2009. Land cover change in Northeast Temperate Network parks 1973–2002. Natural Resource Technical Report NPS/NETN/NRTR—2009/238. National Park Service, Fort Collins, Colorado.

Soil Taxon/Description:			Soil Profile notes Depth examined: _____ Horizons, colors, depth to obstruction, depth to water table, depth to mottling, etcetera.
Soil Texture	Soil Drainage	Unvegetated Surface (please use cover scale below)	
___ sand	___ rapidly drained	___ bedrock	
___ sandy loam	___ well drained	___ large rocks (cobbles, boulders >10 cm)	
___ loam	___ moderately well drained	___ small rocks/gravel (0.2–10 cm)	
___ silt loam	___ somewhat poorly drained	___ sand (0.1–2 mm)	
___ silt	___ poorly drained	___ litter, duff	
___ clay loam	___ very poorly drained	___ wood (>1 cm)	
___ clay		___ bare soil	
___ peat		___ water	
Soil pH:	Soil Stoniness	Other: _____	
	___ v. little (<1%)		
	___ moderate (2–20%)		
	___ very stony (20–50%)		
	___ exceedingly stony (>50%)		

Additional environment notes:

Vegetation Description

Leaf phenology (of dominant stratum)	Leaf type (of dominant stratum)	Physiognomic class	Cover classes: Strata & Unveg. Surface	Height classes for strata
<u>Trees and Shrubs</u>	___ Broad-leaved	___ Forest	5%	<0.5 m
% Evergreen: _____	___ Needle-leaved	___ Woodland	10%	0.5–1 m
% Deciduous: _____	___ Microphyllous	___ Shrubland	20%	1–2 m
___ Evergreen	___ Graminoid	___ Dwarf Shrubland	30%	2–5 m
___ Cold–deciduous	___ Forb	___ Herbaceous	40%	5–10 m
___ Mixed	___ Pteridophyte	___ Nonvascular	50%	10–15 m
<u>Herbs</u>	___ Nonvascular	___ Sparsely Vegetated	60%	15–20 m
___ Annual			70%	20–35 m
___ Perennial			80%	35–50 m
			90%	>50 m
			100%	

Stratum	Height*	Cover*	Characteristic / diagnostic species <i>*please use height and cover classes from table above</i>
T1 Emergent			
T2 Canopy			
T3 Sub-canopy			
S1 Tall Shrub			
S2 Short Shrub			
H Herbaceous			
N Nonvascular			
V Vine/Liana			

ADDITIONAL NOTES *(continue as needed on reverse)*

Brief word picture of community:
Topographic sketch:
Adjacent vegetation type(s):
Known/inferred land-use history:
Animal use evidence
Natural disturbance evidence:
Invasive species notes:
Other anthropogenic disturbance comments
Other Comments

Appendix B. Data dictionary for fields in PLOTS 2.0 Database. This data dictionary describes the primary tables and their variables in the Plots 2.0 database holding the vegetation plots data.

Table	Field	Definition	Comment
Plots	Plot Code	unique identifier assigned by PLOTS using 4-letter park code and sequential numbers	
Plots	County		
Plots	SubPlot	was plot a sub-unit of a larger plot?	
Plots	SubPlot Parent Code	identifier of larger plot if this is a subplot	n/a at SAGA
Plots	Air Photo Number	reference number for aerial photo that covers the plot area	
Plots	Polygon Code	identifier of polygon on vegetation map in which plot falls	
Plots	Provisional Community Name	community name assigned in field or before final analyses	
Plots	Classified Community Name	standard association name from the National Vegetation Classification	
Plots	USNVC ELCODE	standard element code from the National Vegetation Classification	
Plots	Sublocation	narrative for location of plot within the park	
Plots	Quad Name	name of USGS 7.5' quadrangle in which plot falls	
Plots	Quad Code	standardized code for USGS quadrangle	
Plots	Coord System	coordinate system used for geographic location of plots: "1" if UTM, "2" if latitude/longitude	
Plots	GPS File	name of file in which coordinates are stored	
Plots	GPS Techniques	type of GPS unit used to secure location plus any applicable comments	
Plots	Field UTM X	X UTM coordinate as recorded in field	not used at SAGA
Plots	Field UTM Y	Y UTM coordinate as recorded in field	not used at SAGA
Plots	Corrected UTM X	corrected X UTM coordinate if post-processing is used	not used at SAGA
Plots	Corrected UTM Y	corrected Y UTM coordinate if post-processing is used	not used at SAGA
Plots	UTM Zone	UTM zone	18 for all of SAGA
Plots	Corrected Lat	Latitude	decimal degrees for SAGA
Plots	Corrected Long	Longitude	decimal degrees for SAGA
Plots	Survey Date	date field data were taken	
Plots	Surveyors	field personnel	
Plots	Plot Directions	detailed directions to plot using ground landmarks	

Table	Field	Definition	Comment
Plots	X Dimension	length of side of plot in m	
Plots	Y Dimension	width of plot in m	
Plots	Plot Shape	square, rectangular, round, etc.	square for SAGA
Plots	Photos	yes/no	
Plots	Roll Number	roll number for film photos	
Plots	Frame Number	frame number for film photos; file name for digital photos	
Plots	Permanent	is plot permanent? Yes/no	
Plots	Representativeness	narrative for how representative of community plot seems to be	
Plots	Elevation	plot average elevation above mean sea level	in feet for SAGA
Plots	Elevation Units	"1" = meters, "2" = feet	
Plots	GPS Datum	Datum used by GPS	NAD83 for SAGA
Plots	GPS Accuracy	as recorded in field	
Plots	Slope	slope category (pick-list)	Flat = 0°; Gentle = 0–5°; Moderate = 6–14°; Somewhat steep = 15–25°; Steep = 27–45°; Very steep = 45–69°; Abrupt = 70–100°; Overhanging/sheltered = 100°
Plots	Precise Slope	slope measurement	in degrees
Plots	Aspect	aspect category (pick-list)	Flat; Variable; N 338-22°; NE 23-67°; E 68-112°; SE 113-157°; S 158-202°; SW 203-247°; W 248-292°; NW 293-337°
Plots	Precise Aspect	measured aspect in True degrees	
Plots	Topo Position	topographic position of plot (pick-list)	Crest/Summit/Ridge; Upper/Shoulder Slope; High Plateau ; Middle Slope; Slope step (terraced); Lower Slope; Toe slope; Low level/terrace; Channel wall; Channel bed; Depression
Plots	Landform	landform on which plot occurs (pick-list)	Bar; Basin; Beach; Bluff/bank; Channel; Cliff; Cove; Delta; Dome; Drumlin; Dune; Escarpment; Esker; Estuary; Flat; Floodplain; Gorge; Hill; Kame ; Kettle; Lake /pond; Ledge; Moraine; Mountain; Outwash plain; Oxbow; Plain; Plateau; Ravine; Ridge; Saddle; Swale; Talus; Terrace; Valley; Other
Plots	Surficial Geology	geologic setting (pick-list)	Bedrock; Talus; Glacial till; Moraine; Esker/outwash; Glacial delta; Lacustrine;/fluvial; Marine; Aeolian; Other
Plots	Cowardin System	broad wetland classification from Cowardin 1979	Upland, Palustrine, Estuarine, Riverine, Lacustrine
Plots	Hydro Regime	hydrologic regime (wetlands only)	Permanently Flooded; Semipermanently Flooded; Seasonally Flooded; Saturated; Temporarily Flooded; Intermittently Flooded; Tidally Flooded
Plots	Salinity/Halinity		n/a for SAGA
Plots	Hydrology Evidence	notes on evidence used to deduce hydrologic regime	
Plots	Environmental Comments	narrative description of the habitat	

Table	Field	Definition	Comment
Plots	Landscape Comments	narrative description of the surrounding area	
Plots	Soil Taxon/Description	narrative of soil profile	
Plots	Soil Texture	soil texture class	sand; sandy loam; loam; silt loam; silt; clay loam; clay; peat; muck
Plots	Soil Depth	depth to obstruction	
Plots	Soil Depth Units	1=meters, 2=cm, 3=feet, 4=inches	
Plots	Soil Drainage	drainage category (pick-list)	rapidly drained; well drained; moderately well drained; somewhat poorly drained; poorly drained; very poorly drained
Plots	% Bedrock	% unvegetated ground surface covered	
Plots	% Large Rocks	% unvegetated ground surface covered	
Plots	% Small Rocks	% unvegetated ground surface covered	
Plots	% Sand	% unvegetated ground surface covered	
Plots	% Litter, Duff	% unvegetated ground surface covered	
Plots	% Wood	% unvegetated ground surface covered	
Plots	% Water	% unvegetated ground surface covered	
Plots	% Bare Soil	% unvegetated ground surface covered	
Plots	% Other	if "other" is used as a ground surface cover category	
Plots	% Other Description	if "other" is used as a ground surface cover category	
Plots	Leaf Type	Of dominant stratum	Broad-leaved, Needle-leaved, Microphyllous, Graminoid, Broad-leaved herbaceous, Pteridophyte, Nonvascular
Plots	Physio Class	physiognomic Class according to USNVC hierarchy; applies to dominant stratum (highest stratum with at least 25% cover)	Forest (>60% tree canopy -crowns overlapping), Woodland (25%–60% open tree canopy), Shrubland (<25% trees, and shrubby cover >0.5 m tall greater than other strata), Dwarf Shrubland (<25% trees, and shrubby cover <0.5 m tall greater than other strata), Herbaceous (herb cover exceeds that of other strata), Nonvascular (nonvascular cover exceeds that of other strata), or Sparse vegetation (total vegetation <25%)
Plots	T1 Hgt	height of emergent tree layer	in meters if applicable
Plots	T1 Cover	% cover of emergent tree layer	cover classes (for all strata): 5%, 10%, 20%, 30%, 40%, 50%, 60%, 70%, 80%, 90%, 100%
Plots	T2 Hgt	height of tree canopy layer	
Plots	T2 Cover	% cover of tree canopy layer	
Plots	T3 Hgt	height of tree subcanopy layer	
Plots	T3 Cover	% cover of tree subcanopy layer	

Table	Field	Definition	Comment
Plots	S1 Hgt	height of tall shrub layer	
Plots	S1 Cover	% cover of tall shrub layer	
Plots	S2 Hgt	height of short shrub layer	
Plots	S2 Cover	% cover of short shrub layer	
Plots	S3 Hgt	height of dwarf shrub layer	
Plots	S3 Cover	% cover of dwarf shrub layer	
Plots	H Hgt	height of herb layer	
Plots	H Cover	% cover of herb layer	
Plots	N Cover	% cover of non-vascular layer	
Plots	V Hgt	height of vine layer, if present	
Plots	V Cover	% cover of vine layer	
Plots	Other Measure2 Defined	Explanation of other measurement used for species presence	
Plots	Animal Use Evidence		
Plots	Disturbance Comments	narrative on natural and anthropogenic disturbance	
Plots	Other Comments		
Plots	Update	When record was last updated (using Plots 2.0 interface)	does not apply to values directly manipulated in tables
Plots	User	initials of person entering record	
Plots	Species Counter	number of plant species recorded in plot	
Plots	Optional Fields Defined	narrative defining any optional fields that are used	
Plots	Opt1		
Plots	Opt2		
Plots	Opt3		
Plots	Opt4		
Plots	Opt5		
Plots-Species	Plot Code	unique identifier assigned by PLOTS using 4-letter park code and sequential numbers	provides link to Plots table
Plots-Species	Plot Species Counter	Unique integer sequence for species within this plot	
Plots-Species	Plant Symbol	from USDA Plants db table	
Plots-Species	Scientific Name	Accepted Latin name of the plant species	
Plots-Species	Common Name		
Plots-Species	Family		
Plots-Species	Specimen Number	if collected	
Plots-Species	Used PLANTS	Yes if name came from the PLANTS database	
Plots-Species	Source	From Plant List table: SS or NS	
Plots-Species	Within Plot	yes/no: Species is present within the Plot boundaries	
Plots-Species	Stratum Sort	Major sort order of strata	to sort from highest to lowest or vice versa
Plots-Species	Diagnostic	yes/no: Species is a known diagnostic for the community	

Table	Field	Definition	Comment
Plots-Species	Range Cover	midpoint of cover class	cover classes (for all strata): < 1 / 1-5% / 6-10% / 11-25% / 26-50% / 51-75% / 76-100%
Plots-Species	Real Cover	if % cover measured directly	
Plots-Species	Other Measure1	Other measure of species presence	
Plots-Species	Other Measure2	Other measure of species presence	not used at SAGA
Plots-Species	DBH	Diameter at breast height for all trees above 10 cm diameter (comma delimited)	recorded on field forms
Plots-Species	Update	When record was last updated (using Plots 2.0 interface)	does not apply to values directly manipulated in tables
Plots-Species	User	initials of person entering record	
Updated Plant Names	Sci Name original	Scientific name for plant used on field form and in original Plots db delivered by contractor NHHI	
Updated Plant Names	Scientific Name	Accepted scientific name for plant, used in Plots-Species table	

Appendix C. Plants observed in Saint-Gaudens National Historic Site during vegetation plot and thematic accuracy assessment sampling.

Nomenclature follows the PLANTS 3.5 Database developed by the Natural Resources Conservation Service in cooperation with the Biota of North America Program (United States Department of Agriculture, National Resources Conservation Service 2006). 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. Species with an asterisk (*) were observed during vegetation plot sampling, but were not sampled within plots. The plant list in Gilman and NHNHP 1997 contains additional plant species found in the park. Plants with an “e” after it denote exotic plants in the park (New Hampshire Department of Agriculture Markets and Food, Plant Industry Division & New Hampshire Invasive Species Committee 2005).

Family	Scientific Name	Common Name
Aceraceae	<i>Acer pensylvanicum</i>	striped maple
	<i>Acer rubrum</i>	red maple
	<i>Acer saccharum</i>	sugar maple
Anacardiaceae	<i>Toxicodendron radicans</i>	eastern poison ivy
Apocynaceae	<i>Apocynum androsaemifolium</i>	spreading dogbane
Aquifoliaceae	<i>Ilex verticillata</i>	common winterberry
Araceae	<i>Arisaema triphyllum</i>	Jack in the pulpit
Araliaceae	<i>Aralia nudicaulis</i>	wild sarsaparilla
Asteraceae	<i>Bidens frondosa</i>	devil's beggartick
	<i>Eupatorium maculatum</i>	spotted joeypyeweed
	<i>Eupatorium perfoliatum</i>	common boneset
	<i>Eurybia divaricata</i>	white wood aster
	<i>Euthamia graminifolia</i>	flat-top goldentop
	<i>Hieracium</i> spp.*	hawkweed
	<i>Mycelis muralis</i> ^e	wall-lettuce
	<i>Oclemena acuminata</i>	whorled wood aster
	<i>Prenanthes alba</i>	white rattlesnakeroot
	<i>Solidago caesia</i>	wreath goldenrod
	<i>Solidago canadensis</i>	Canada goldenrod
	<i>Solidago flexicaulis</i>	zigzag goldenrod
	<i>Solidago</i> spp.	goldenrod
	<i>Symphotrichum lateriflorum</i>	calico aster
	<i>Symphotrichum novae-angliae</i>	New England aster
	<i>Tussilago farfara</i> ^e	coltsfoot
	Balsaminaceae	<i>Impatiens capensis</i>
Berberidaceae	<i>Berberis thunbergii</i> ^p	Japanese barberry
	<i>Berberis vulgaris</i> ^e	common barberry
Betulaceae	<i>Alnus incana</i>	gray alder
	<i>Betula alleghaniensis</i>	yellow birch
	<i>Betula lenta</i>	sweet birch
	<i>Betula papyrifera</i>	paper birch
	<i>Carpinus caroliniana</i>	American hornbeam
	<i>Corylus cornuta</i>	beaked hazelnut
	<i>Ostrya virginiana</i>	hophornbeam
Brassicaceae	<i>Cardamine diphylla</i>	crinkleroot

Family	Scientific Name	Common Name
Caprifoliaceae	<i>Lonicera canadensis</i>	American fly honeysuckle
	<i>Lonicera japonica</i> ^o	Japanese honeysuckle
	<i>Lonicera morrowii</i> ^o	Morrow's honeysuckle
	<i>Viburnum acerifolium</i>	mapleleaf viburnum
	<i>Viburnum lantanoides</i>	hobblebush
Clusiaceae	<i>Hypericum boreale</i>	northern St. Johnswort
	<i>Hypericum perforatum</i>	common St. Johnswort
	<i>Triadenum virginicum</i>	Virginia marsh St. Johnswort
Cornaceae	<i>Cornus alternifolia</i>	alternateleaf dogwood
	<i>Cornus amomum</i>	silky dogwood
	<i>Cornus sericea</i>	redosier dogwood
Crassulaceae	<i>Penthorum sedoides</i>	ditch stonecrop
Cyperaceae	<i>Carex arctata</i>	drooping woodland sedge
	<i>Carex debilis</i>	white edge sedge
	<i>Carex gynandra</i>	nodding sedge
	<i>Carex lacustris</i>	hairy sedge
	<i>Carex lupulina</i>	hop sedge
	<i>Carex plantaginea</i>	plantainleaf sedge
	<i>Carex platyphylla</i>	broadleaf sedge
	<i>Carex projecta</i>	necklace sedge
	<i>Carex rosea</i>	rosy sedge
	<i>Carex scabrata</i>	eastern rough sedge
	<i>Carex</i> spp.	sedge
	<i>Carex stricta</i>	upright sedge
	<i>Cyperus strigosus</i>	strawcolored flatsedge
	<i>Dulichium arundinaceum</i>	threeway sedge
	<i>Scirpus cyperinus</i>	woolgrass
<i>Scirpus microcarpus</i>	panicled bulrush	
Dennstaedtiaceae	<i>Dennstaedtia punctilobula</i>	eastern hayscented fern
	<i>Pteridium aquilinum</i>	western brackenfern
Dryopteridaceae	<i>Athyrium filix-femina</i>	common ladyfern
	<i>Deparia acrostichoides</i>	silver false spleenwort
	<i>Dryopteris carthusiana</i>	spinulose woodfern
	<i>Dryopteris cristata</i>	crested woodfern
	<i>Dryopteris intermedia</i>	intermediate woodfern
	<i>Dryopteris marginalis</i>	marginal woodfern
	<i>Gymnocarpium dryopteris</i>	western oakfern
	<i>Matteuccia struthiopteris</i>	ostrich fern
	<i>Onoclea sensibilis</i>	sensitive fern
	<i>Polystichum acrostichoides</i>	Christmas fern
Equisetaceae	<i>Equisetum arvense</i>	field horsetail
	<i>Equisetum hyemale</i>	scouringrush horsetail
	<i>Equisetum scirpoides</i>	dwarf scouringrush
Fabaceae	<i>Amphicarpaea bracteata</i>	American hogpeanut
	<i>Apios americana</i>	groundnut
	<i>Desmodium glutinosum</i>	pointedleaf ticktrefoil
Fagaceae	<i>Trifolium</i> sp.	clover
	<i>Fagus grandifolia</i>	American beech
	<i>Quercus rubra</i>	northern red oak
Hamamelidaceae	<i>Hamamelis virginiana</i>	American witchhazel

Family	Scientific Name	Common Name
Juglandaceae	<i>Carya cordiformis</i>	bitternut hickory
	<i>Carya ovata</i>	shagbark hickory
	<i>Carya</i> spp.	hickory
Juncaceae	<i>Juncus effuses</i>	common rush
Lamiaceae	<i>Lycopus americanus</i>	American water horehound
	<i>Lycopus virginicus</i>	Virginia water horehound
Liliaceae	<i>Maianthemum canadense</i>	Canada mayflower
	<i>Maianthemum racemosum</i>	feathery false lily of the valley
	<i>Medeola virginiana</i>	Indian cucumber
	<i>Trillium erectum</i>	red trillium
	<i>Trillium undulatum</i>	painted trillium
Lycopodiaceae	<i>Uvularia sessilifolia</i>	sessileleaf bellwort
	<i>Lycopodium annotinum</i>	stiff clubmoss
	<i>Lycopodium clavatum</i>	running clubmoss
	<i>Lycopodium digitatum</i>	fan clubmoss
Lycopodiaceae	<i>Lycopodium obscurum</i>	rare clubmoss
	<i>Lycopodium tristachyum</i>	deeproot clubmoss
	<i>Lycopodium digitatum</i>	fan clubmoss
Lythraceae	<i>Lythrum salicaria</i> [°]	purple loosestrife
Monotropaceae	<i>Monotropa hypopithys</i>	pinemap
	<i>Monotropa uniflora</i>	Indianpipe
Nymphaeaceae	<i>Nuphar lutea</i> ssp. <i>variegata</i>	variegated yellow pond-lily
	<i>Nymphaea odorata</i> *	American white waterlily
Oleaceae	<i>Fraxinus americana</i>	white ash
	<i>Fraxinus nigra</i>	black ash
Onagraceae	<i>Circaea lutetiana</i>	broadleaf enchanter's nightshade
Orchidaceae	<i>Epipactis helleborine</i> [°]	broadleaf helleborine
Osmundaceae	<i>Osmunda cinnamomea</i>	cinnamon fern
	<i>Osmunda claytoniana</i>	interrupted fern
	<i>Osmunda regalis</i>	royal fern
Oxalidaceae	<i>Oxalis Montana</i>	mountain woodsorrel
	<i>Oxalis stricta</i>	common yellow oxalis
Pinaceae	<i>Pinus strobus</i>	eastern white pine
	<i>Tsuga canadensis</i>	eastern hemlock
Platanaceae	<i>Platanus occidentalis</i>	American sycamore
Poaceae	<i>Agrostis</i> spp.*	bentgrass
	<i>Agrostis stolonifera</i>	creeping bentgrass
	<i>Bromus ciliates</i>	fringed brome
	<i>Calamagrostis canadensis</i>	bluejoint
	<i>Dichanthelium clandestinum</i>	deertongue
	<i>Elymus riparius</i>	riverbank wildrye
	<i>Glyceria striata</i>	fowl mannagrass
	<i>Leersia virginica</i>	whitegrass
	<i>Muhlenbergia glomerata</i>	spiked muhly
	<i>Muhlenbergia mexicana</i>	Mexican muhly
	<i>Oryzopsis asperifolia</i>	roughleaf ricegrass
	<i>Poa compressa</i>	Canada bluegrass
	<i>Phleum pretense</i> *	timothy
	Polygalaceae	<i>Polygala paucifolia</i>
Polygonaceae	<i>Polygonum arifolium</i>	halberdleaf tearthumb
	<i>Polygonum sagittatum</i>	arrowleaf tearthumb
	<i>Polygonum scandens</i>	climbing false buckwheat

Family	Scientific Name	Common Name
Polypodiaceae	<i>Polypodium virginianum</i>	rock polypody
Potamogetonaceae	<i>Potamogeton epihydrus</i>	ribbonleaf pondweed
	<i>Potamogeton</i> spp.*	pondweed
Primulaceae	<i>Lysimachia ciliata</i>	fringed loosestrife
	<i>Lysimachia nummularia</i>	creeping jenny
	<i>Lysimachia terrestris</i>	earth loosestrife
	<i>Trientalis borealis</i>	starflower
Pteridaceae	<i>Adiantum pedatum</i>	northern maidenhair
Pyrolaceae	<i>Pyrola elliptica</i>	waxflower shinleaf
Ranunculaceae	<i>Actaea pachypoda</i>	white baneberry
	<i>Clematis virginiana</i>	devil's darning needles
	<i>Hepatica nobilis</i> var. <i>obtusata</i> *	roundlobe hepatica
	<i>Ranunculus abortivus</i>	littleleaf buttercup
	<i>Ranunculus hispidus</i>	bristly buttercup
	<i>Thalictrum pubescens</i>	king of the meadow
Rosaceae	<i>Agrimonia gryposepala</i>	tall hairy agrimony
	<i>Amelanchier</i> sp.	serviceberry
	<i>Geum canadense</i>	white avens
	<i>Prunus serotina</i>	black cherry
	<i>Prunus virginiana</i>	chokecherry
	<i>Rosa</i> sp.	rose
	<i>Rubus odoratus</i>	purpleflowering raspberry
	<i>Spiraea alba</i>	white meadowsweet
Rubiaceae	<i>Galium tinctorium</i>	stiff marsh bedstraw
	<i>Galium triflorum</i>	fragrant bedstraw
	<i>Mitchella repens</i>	partridgeberry
Salicaceae	<i>Populus grandidentata</i>	bigtooth aspen
	<i>Populus tremuloides</i>	quaking aspen
	<i>Salix</i> sp.	willow
Saxifragaceae	<i>Tiarella cordifolia</i>	heartleaf foamflower
Scrophulariaceae	<i>Chelone glabra</i>	white turtlehead
	<i>Veronica officinalis</i>	common gypsyweed
Solanaceae	<i>Solanum dulcamara</i>	climbing nightshade
Taxaceae	<i>Taxus canadensis</i>	Canada yew
Thelypteridaceae	<i>Phegopteris connectilis</i>	long beechfern
	<i>Thelypteris noveboracensis</i>	New York fern
Tiliaceae	<i>Tilia Americana</i>	American basswood
Typhaceae	<i>Typha latifolia</i>	broadleaf cattail
Ulmaceae	<i>Ulmus americana</i>	American elm
	<i>Ulmus rubra</i>	slippery elm
Urticaceae	<i>Boehmeria cylindrica</i>	smallspike false nettle
Vitaceae	<i>Parthenocissus quinquefolia</i>	Virginia creeper
	<i>Vitis</i> sp.	grape

Appendix D. Accuracy assessment data form for Saint-Gaudens National Historic Site.

**National Park Vegetation Characterization Program: Accuracy Assessment Point Identifiers/Locators
Saint-Gaudens National Historic Site (SAGA) - NH**

Identifiers/Locators

Field Point Code _____	Database Point Code _____	
Primary Map Unit _____	Assoc Code/Name _____	
Secondary Map Unit _____	Assoc Code/Name _____	
Other Map Unit / Assoc within 50 m _____		
Key or Classification Comments: _____		
GPS file name _____	Field UTM X _____ m E	Field UTM Y _____ m N
GPS Error _____ m	GPS unit: Garmin GPSMAP 60CSx, WAAS enabled, internal processing	
<i>please do not complete the following information when in the field</i>		
Corrected UTM X _____ m E	Corrected UTM Y _____ m N	UTM Zone 19
Survey Date _____	Area Surveyed: 25-m radius circle	
Surveyors _____	Other (describe) _____	
Park Site Name: _____		
Quad Name _____	Quad Code _____	

Environmental Description

Elevation _____ m	Slope _____	Aspect _____
Topographic Position _____		
Landform _____		
Environmental Comments (including hydrology): _____	Unvegetated Surface: <i>(please use the cover scale below)</i> <input type="checkbox"/> Bedrock <input type="checkbox"/> Litter, Duff <input type="checkbox"/> Wood (>1 cm) <input type="checkbox"/> Large Rocks (cobbles, boulders >10 cm) <input type="checkbox"/> Small Rocks (gravel, 0.2–10 cm) <input type="checkbox"/> Sand (0.1–2 mm) <input type="checkbox"/> Bare Soil Other: _____	

Vegetation Description

Leaf Phenology (of dominant stratum)	Leaf Type (of dominant stratum)	Physiognomic Class	Cover Scale for Unvegetated Surface	
<u>Trees and Shrubs</u>	_____ Broad-leaved	_____ Forest	01	5%
_____ Evergreen	_____ Needle-leaved	_____ Woodland	02	10%
_____ Cold-deciduous	_____ Mixed Broad/Needle-leaved	_____ Shrubland	03	20%
_____ Mixed evergreen - cold-deciduous	_____ Graminoid	_____ Dwarf Shrubland	04	30%
_____ % evergreen _____ % deciduous	_____ Forb	_____ Herbaceous	05	40%
	_____ Pteridophyte	_____ Nonvascular	06	50%
<u>Herbs</u>		_____ Sparsely Vegetated	07	60%
_____ Annual			08	70%
_____ Perennial			09	80%
			10	90%
			11	100%

Stratum	Height	Cover Class	Cominant / Characteristic Species (mark dominants "D" and diagnostic or character istic species "**")	Cover Class
T1 Emergent	_____	_____	_____	_____
T2 Canopy	_____	_____	_____	_____
T3 Sub-canopy	_____	_____	_____	_____
S1 Tall shrub	_____	_____	_____	_____
S2 Short shrub	_____	_____	_____	_____
S3 Dwarf-shrub	_____	_____	_____	_____
H Herbaceous	_____	_____	_____	_____
N Nonvascular	_____	_____	_____	_____
V Vine/Liana	_____	_____	_____	_____

Comments:	Cover Scale:		Height Scale:	
	Strata and Species Strata			
	01	5%	01	<0.5 m
	02	10%	02	0.5–1 m
	03	20%	03	1–2 m
	04	30%	04	2–5 m
	05	40%	05	5–10 m
	06	50%	06	10–15 m
	07	60%	07	15–20 m
	08	70%	08	20–35 m
	09	80%	09	35–50 m
10	90%	10	>50 m	
	11	100%		

Appendix E. Dichotomous field key to the USNVC vegetation associations and land cover types of Saint-Gaudens National Historic Site.¹

1	Areas lacking naturally occurring or ruderal vegetation, such as streams, buildings, gardens, and grounds.....	2
	Naturally occurring or ruderal vegetation communities	3
2	Open water	Stream
	Openings adjacent to buildings, with extensive horticultural plantings.....	Other Urban or Built-up Land
3	Forest communities: trees dominant, canopy >25%	4
	Non-forested communities: shrubs or herbaceous species dominate	8
4	Canopy is dominated by one or more of the following species: sugar maple (<i>Acer saccharum</i>), white ash (<i>Fraxinus americana</i>) and American basswood (<i>Tilia americana</i>)	5
	Canopy dominants do not include sugar maple, white ash, or American basswood	6
5	Community is a small seepage wetland occupying less than 500 m ² and overtopped primarily by adjacent upland forest, with saturated, mucky soils, having one or more of the following herbaceous species with at least 10% cover: northern maidenhair (<i>Adiantum pedatum</i>), plantainleaf sedge (<i>Carex plantaginea</i>), or broadleaf sedge (<i>Carex platyphylla</i>)	Enriched Hardwood Forest Seep (CEGL006409)
	Community is a moist upland forest with herbaceous species listed above absent or sparse	Semi-rich Northern Hardwood Forest (CEGL006211)
6	Canopy and understory strongly dominated by eastern white pine (<i>Pinus strobus</i>); eastern hemlock (<i>Tsuga canadensis</i>), and American beech (<i>Fagus grandifolia</i>); northern red oak (<i>Quercus rubra</i>) may be present, but in far smaller amounts than eastern white pine.....	White Pine Successional Forest (CEGL007944)
	Canopy not strongly dominated by eastern white pine.....	7

¹ Key lists the local (park-specific) common name for the vegetation type, followed by a cross-reference to the USNVC global type's identifying database code, followed by the map class name when it is different from the local common name. Map units for cultural features are listed without a corresponding USNVC database code.

7
 Northern red oak (*Quercus rubra*) is dominant or codominant in the canopy **Hemlock - Beech - Oak - Pine Forest (CEGL006088)**
 Eastern hemlock (*Tsuga canadensis*) is the dominant canopy species; northern red oak is sparse or absent..... **Hemlock - White Pine Forest (CEGL006328)**

8
 Upland herbaceous vegetation of successional old field located west of Saint-Gaudens house dominated by *Phleum pratense* (timothy) and *Agrostis* spp. (bentgrass), with typical old-field forbs including *Solidago* spp. (goldenrod) and *Hieracium* spp. (hawkweed)..... **Successional Old Field (CEGL006107)**
 Wetland vegetation9

9
 Community is characterized by open water and floating aquatic or submersed vegetation **Aquatic Bed (CEGL002386)**
 Vegetation is characterized by woody plants or persistent emergent herbaceous plants; not open water10

10
 Sparse mix of tree seedlings, shrubs, and herbs on a substrate of fine gravel and sand river deposits; *Platanus occidentalis* (American sycamore) seedlings 10–25% cover..... **Cobble - Sand River Channel (CEGL006536)**
 Vegetation including gray alder (*Alnus incana*), cattail (*Typha latifolia*), blue joint (*Calamagrostis canadensis*), and others growing on organic or fine-grained mineral soils11

11
 Vegetation is characterized by dense cover of tall shrubs **Alder - Dogwood Alluvial Thicket (CEGL006062)**
 Vegetation is characterized persistent emergent herbaceous vegetation; woody species cover is less than 10%12

12
 Broadleaf cattail (*Typha latifolia*) is sole dominant species; semi-permanently flooded hydrology **Cattail Marsh (CEGL006153)**
 mapped as **Emergent Marsh - Shrub Swamp System**
 Broadleaf cattail is codominant with other species or is present in low abundance13

13

Community occurs on seasonally flooded depositional bars adjacent to stream channel;
dominant species include the grasses bluejoint (*Calamagrostis canadensis*) and
Canada bluegrass (*Poa compressa*) **Bluejoint Wet Meadow (CEGL005174)**

mapped as **Emergent Marsh - Shrub Swamp System**

Community has longer inundation period than above, separated from
channel by depositional bar; dominant species include threeway
sedge (*Dulichium arundinaceum*) and whitegrass (*Leersia*
virginica)..... **Medium-depth Emergent Marsh (CEGL006519)**

mapped as **Emergent Marsh - Shrub Swamp System**

Appendix F. Global and Local descriptions for the USNVC vegetation associations in Saint-Gaudens National Historic Site. Note: Map class names are the same as the common names of the associations except for the three associations indicated otherwise.

Table of Contents

	Page
Alder - Dogwood Alluvial Thicket.....	63
Aquatic Bed	69
Bluejoint Wet Meadow	73
Cattail Marsh.....	79
Cobble - Sand River Channel	83
Enriched Hardwood Forest Seep	89
Hemlock - Beech - Oak - Pine Forest	93
Hemlock - White Pine Forest.....	99
Medium-depth Emergent Marsh.....	105
Semi-rich Northern Hardwood Forest	111
Successional Old Field.....	115
White Pine Successional Forest.....	119

COMMON NAME (PARK-SPECIFIC): ALDER - DOGWOOD ALLUVIAL THICKET

SYNONYMS

USNVC English Name: Gray Alder - (Silky Dogwood, Red-osier Dogwood) / Virgin's-bower Shrubland

USNVC Scientific Name: *Alnus incana* - *Cornus (amomum, sericea)* / *Clematis virginiana* Shrubland

USNVC Identifier: CEGL006062

LOCAL INFORMATION

Environmental Description: This broadly defined community occurs as shrub thickets on loam and fine- to medium-grained sands subjected to periodic flooding. At Saint-Gaudens National Historic Site, most of the open wetlands associated with the pond and brook fall into this category.

Vegetation Description: This community is characterized by a shrub layer dominated by *Cornus amomum* (silky dogwood), with *Alnus incana* (gray alder) occurring as a codominant, with cover ranging from 60–70%. The invasive exotic *Lonicera morrowii* (Morrow's honeysuckle) is also consistently present in low abundance (5–10% cover). A diverse herbaceous layer is present beneath the shrub canopy, as well as in numerous small openings scattered throughout the thicket, and ranges broadly between 40–70% cover. Herbs that may be present include *Onoclea sensibilis* (sensitive fern), *Boehmeria cylindrica* (smallspike false nettle), *Muhlenbergia glomerata* (spiked muhly), *Calamagrostis canadensis* (bluejoint), *Glyceria striata* (fowl mannagrass), *Impatiens capensis* (jewelweed), *Solidago* spp. (goldenrod), and *Carex* spp. (sedge).

Most Abundant Species:

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Tall shrub/sapling	Broad-leaved deciduous shrub	<i>Alnus incana</i> (gray alder)
		<i>Cornus amomum</i> (silky dogwood)
Herb (field)	Forb	<i>Boehmeria cylindrica</i> (smallspike false nettle)
Herb (field)	Graminoid	<i>Muhlenbergia glomerata</i> (spiked muhly)
Herb (field)	Fern or fern ally	<i>Onoclea sensibilis</i> (sensitive fern)

Characteristic Species: *Alnus incana* (gray alder), *Cornus amomum* (silky dogwood).

Other Noteworthy Species: Information not available.

Subnational Distribution with Crosswalk Data:

<u>State</u>	<u>SRank</u>	<u>Rel</u>	<u>Conf</u>	<u>SName</u>	<u>Reference</u>
NH	SNR*	F	.	Alder - Dogwood - Arrowwood Alluvial Thicket	Sperduto and Nichols 2004
NH	SNR*	F	.	Alder Alluvial Shrubland	Sperduto and Nichols 2004

Local Range: This community occurs along Blow-Me-Down Pond and Blow-Me-Down Brook.

Classification Comments: Information not available.

Other Comments: The exotic shrub *Lonicera morrowii* (Morrow's honeysuckle) is invasive, and potential control options should be considered.

Local Description Authors: P. Bowman.

Plots: SAGA.21, SAGA.22. AA point: SAGA.AA04.

Saint-Gaudens National Historic Site Inventory Notes: Information not available.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Shrubland (III)
Physiognomic Subclass	Deciduous shrubland (III.B.)
Physiognomic Group	Cold-deciduous shrubland (III.B.2.)
Physiognomic Subgroup	Natural/Semi-natural cold-deciduous shrubland (III.B.2.N.)
Formation	Temporarily flooded cold-deciduous shrubland (III.B.2.N.d.)
Alliance	<i>Alnus incana</i> Temporarily Flooded Shrubland Alliance (A.950)
Alliance (English name)	Gray Alder Temporarily Flooded Shrubland Alliance
Association	<i>Alnus incana</i> - <i>Cornus (amomum, sericea)</i> / <i>Clematis virginiana</i> Shrubland
Association (English name)	Gray Alder - (Silky Dogwood, Red-osier Dogwood) / Virgin's-bower Shrubland
Ecological System(s):	Boreal Ice-Scour Rivershore (CES103.589). Laurentian-Acadian Floodplain Forest (CES201.587).

GLOBAL DESCRIPTION

Concept Summary: These shrublands occur along large streams and rivers in New England, northern New York and western Pennsylvania. They are found on river-margin alluvial deposits of moderate-energy reaches, where the flooding regime prevents forests from developing. The setting can range from flats to moderately steep banks; soils are usually sandy or silty and have little organic matter. Most are temporarily flooded, and the soils may not remain saturated through the entire growing season. Tall shrubs (1.5–3 m in height) dominate the vegetation, usually forming at least 50% cover and often creating a dense thicket. The amount of lower shrub and herb vegetation varies inversely with the tall-shrub canopy. Bryophytes are usually sparse but may be locally abundant in some settings. *Alnus incana* (gray alder) is a constant and usually dominant shrub. In some cases, *Alnus serrulata* (hazel alder) (in more temperate settings) or *Alnus viridis* (green alder) (in more boreal settings) may occur with or in place of *Alnus incana* (gray alder). The ability of alders to bend under strong currents and their nitrogen-fixing root nodules may give alders a competitive advantage over other shrubs in this setting. *Cornus sericea* (red-osier dogwood) or *Cornus amomum* (silky dogwood), along with *Salix* (willow) spp., are frequent associates and may dominate in some areas. *Viburnum nudum* var. *cassinoides* (withe-rod) is occasional but not abundant. *Acer rubrum* (red maple), *Prunus serotina* (black cherry), *Ulmus americana* (American elm), and/or *Acer saccharinum* (silver maple) may be present, as sparse individuals; in more southerly examples of this type, *Acer negundo* (box-elder) and *Salix nigra* (black willow) may occur. *Spiraea alba* (white meadowsweet) is usually present and may be abundant as a lower shrub. *Clematis virginiana* (devil's darning needles) is a typical vine, often clambering in tangles on the shrubs. This type is distinguished from other northeastern *Alnus* (alder)-dominated associations by its alluvial setting. Although common, this association is little studied and comprehensive surveys have yet to be undertaken.

Environmental Description: These shrublands occur along large streams and rivers in New England, northern New York and western Pennsylvania. They are found on river-margin alluvial deposits of moderate-energy reaches, where the flooding regime prevents forests from developing. The setting can range from flats to moderately steep banks; soils are usually sandy or silty. Most are temporarily flooded, and the soils may not remain saturated through the entire growing season.

Vegetation Description: Tall shrubs (1.5–3 m in height) dominate the vegetation, usually forming at least 50% cover and often creating a dense thicket. The amount of lower shrub and herb vegetation varies inversely with the tall-shrub canopy. Bryophytes are usually sparse but may be locally abundant in some settings. *Alnus incana* (gray alder) is a constant and usually

dominant shrub. In some cases, *Alnus serrulata* (hazel alder) (in more temperate settings) or *Alnus viridis* (green alder) (in more boreal settings) may occur with or in place of *Alnus incana* (gray alder). The ability of alders to bend under strong currents and their nitrogen-fixing root nodules may give alders a competitive advantage over other shrubs in this setting. *Cornus sericea* (red-osier dogwood) or *Cornus amomum* (silky dogwood), along with *Salix* (willow) spp., are frequent associates and may dominate in some areas. *Viburnum nudum* var. *cassinoides* (withe-rod) is occasional but not abundant. *Acer rubrum* (red maple), *Prunus serotina* (black cherry), *Ulmus americana* (American elm), and/or *Acer saccharinum* (silver maple) may be present as sparse individuals; in more southerly examples of this type, *Acer negundo* (box-elder) and *Salix nigra* (black willow) may occur. *Spiraea alba* (white meadowsweet) is usually present and may be abundant as a lower shrub. *Clematis virginiana* (devil's darning needles) is a typical vine, often clambering in tangles on the shrubs. Common herbs include *Doellingeria umbellata* (parasol whitetop), *Calamagrostis canadensis* (bluejoint), *Boehmeria cylindrica* (small-spike false nettle), *Elymus riparius* (riverbank wildrye), *Elymus virginicus* (Virginia wildrye), *Eupatorium maculatum* (spotted joepeyeweed), *Iris versicolor* (harlequin blueflag), *Lycopus uniflorus* (northern bugleweed), *Lysimachia ciliata* (fringed loosestrife), *Lysimachia terrestris* (earth loosestrife), *Osmunda claytoniana* (interrupted fern), *Matteuccia struthiopteris* (ostrich fern), *Muhlenbergia glomerata* (spiked muhly), *Onoclea sensibilis* (sensitive fern), and *Thalictrum pubescens* (king-of-the-meadow).

Most Abundant Species:

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Shrub/sapling (tall & short)	Vine/Liana	<i>Clematis virginiana</i> (devil's darning needles)
Tall shrub/sapling	Broad-leaved deciduous shrub	<i>Alnus incana</i> (gray alder)
Short shrub/sapling	Broad-leaved deciduous shrub	<i>Spiraea alba</i> (white meadowsweet)
Herb (field)	Forb	<i>Boehmeria cylindrica</i> (small-spike false nettle)
Herb (field)	Graminoid	<i>Calamagrostis canadensis</i> (bluejoint)
Herb (field)	Fern or fern ally	<i>Onoclea sensibilis</i> (sensitive fern)

Characteristic Species: *Alnus incana* (gray alder), *Clematis virginiana* (devil's darning needles).

Other Noteworthy Species:

<u>Species</u>	<u>GRank</u>	<u>Type</u>	<u>Note</u>
<i>Pedicularis furbishiae</i> (St. Johns River lousewort)	G2	plant	Federally listed endangered; globally imperiled

USFWS Wetland System: Palustrine.

DISTRIBUTION

Range: This shrub swamp of moderate- to high-energy floodplains occurs in northern New England.

States/Provinces: CT, MA, ME:S2S3, NH, NY, PA, RI, VT.

Federal Lands: NPS (Acadia, Saint-Gaudens); USFWS (Aroostook, Erie, Great Meadows, Nulhegan Basin).

CONSERVATION STATUS

Rank: G4G5 (1-Dec-1997).

Reasons: Information not available.

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 2 - Moderate.

Comments: This type is currently broadly defined, as detailed studies of riparian shrublands in the Northeast are few. Stands dominated by *Alnus* (alder) versus those dominated by *Salix* (willow) and *Cornus* (dogwood) appear different and may be separable as distinct types with additional survey data. Likewise, higher-energy *Alnus* (alder) thickets close to the channel may be distinct from lower-energy thickets in alluvium that is further removed from the channel, but additional data are needed.

Similar Associations:

Alnus (incana ssp. rugosa, serrulata) - Cornus amomum Shrubland (CEGL006337)--freshwater tidal settings.
Alnus incana Swamp Shrubland (CEGL002381)--saturated basin swamp settings.
Alnus incana ssp. rugosa - Nemopanthus mucronatus / Sphagnum spp. Shrubland (CEGL006158)--peatland settings.
Cornus (amomum, sericea) - Viburnum dentatum - Rosa multiflora Shrubland (CEGL006576).

Related Concepts:

Alluvial Shrub Swamp/Woodland (Thompson 1996)
Palustrine Broad-leaved Deciduous Scrub/Shrub and Forested Wetland, Seasonally Flooded (PSS/FO1C)
(Cowardin et al. 1979)

SOURCES

Description Authors: S. C. Gawler.

References: Cowardin et al. 1979, Eastern Ecology Working Group n.d., Enser 1999, Gawler 2002, Nichols et al. 2001, Sperduto and Nichols 2004, Swain and Kearsley 2000, Thompson 1996, Thompson and Sorenson 2000.



Figure 9. Alder - Dogwood Alluvial Thicket in Saint-Gaudens National Historic Site (SAGA.21). September 2004. NAD 1983 / UTM easting 4819688, northing 711916.



Figure 10. Alder - Dogwood Alluvial Thicket in Saint-Gaudens National Historic Site (SAGA.22). September 2004. NAD 1983 / UTM easting 4819650, northing 712067.

COMMON NAME (PARK-SPECIFIC): AQUATIC BED

SYNONYMS

USNVC English Name: Broadleaf Pond-lily - American White Water-lily Herbaceous Vegetation

USNVC Scientific Name: *Nuphar advena* - *Nymphaea odorata* Herbaceous Vegetation

USNVC Identifier: C EGL002386

LOCAL INFORMATION

Environmental Description: This community occupies shallow (0.5–1.5 m depth), permanently flooded portions of Blow-Me-Down Pond.

Vegetation Description: The primary floating-leaved aquatic species in this community are *Potamogeton* (pondweed) spp., particularly *Potamogeton epihydrus* (ribbonleaf pondweed). *Nuphar lutea* ssp. *variegata* (variegated yellow pond-lily) and *Nymphaea odorata* (American white waterlily) are also present in lower numbers. The amount of vegetative cover varies widely from unvegetated open water to as much as 70%.

Most Abundant Species:

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Floating aquatic	Aquatic herb (floating & submergent)	<i>Potamogeton epihydrus</i> (ribbonleaf pondweed)

Characteristic Species: *Potamogeton epihydrus* (ribbonleaf pondweed).

Other Noteworthy Species: Information not available.

Subnational Distribution with Crosswalk Data:

<u>State</u>	<u>SRank</u>	<u>Rel</u>	<u>Conf</u>	<u>SName</u>	<u>Reference</u>
NH	SNR	=	1	Aquatic Bed	Sperduto and Nichols 2004

Local Range: Most of the occurrence of this community is in southern portion of the park and in open water areas of the adjacent Emergent Marsh - Shrub Swamp System polygon.

Classification Comments: Information not available.

Other Comments: Information not available.

Local Description Authors: P. Bowman.

Plots: SAGA.20.

Saint-Gaudens National Historic Site Inventory Notes: Information not available.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Herbaceous Vegetation (V)
Physiognomic Subclass	Hydromorphic-rooted vegetation (V.C.)
Physiognomic Group	Temperate or subpolar hydromorphic-rooted vegetation (V.C.2.)
Physiognomic Subgroup	Natural/Semi-natural temperate or subpolar hydromorphic-rooted vegetation (V.C.2.N.)
Formation	Permanently flooded temperate or subpolar hydromorphic-rooted vegetation (V.C.2.N.a.)
Alliance	<i>Nymphaea odorata</i> - <i>Nuphar</i> spp. Permanently Flooded Temperate Herbaceous Alliance (A.1984)
Alliance (English name)	American White Water-lily - Yellow Pond-lily species Permanently Flooded Temperate Herbaceous Alliance
Association	<i>Nuphar advena</i> - <i>Nymphaea odorata</i> Herbaceous Vegetation
Association (English name)	Broadleaf Pond-lily - American White Water-lily Herbaceous Vegetation

Ecological System(s):

Atlantic Coastal Plain Northern Bog (CES203.893).
Great Lakes Freshwater Estuary and Delta (CES202.033).
Eastern Great Plains Wet Meadow, Prairie & Marsh (CES205.687).
East Gulf Coastal Plain Large River Floodplain Forest (CES203.489).
Northern Great Lakes Coastal Marsh (CES201.722).
North-Central Interior Floodplain (CES202.694).
North-Central Interior Freshwater Marsh (CES202.899).
Texas-Louisiana Coastal Prairie Pondshore (CES203.541).
Laurentian-Acadian Freshwater Marsh (CES201.594).
Red River Large Floodplain Forest (CES203.065).
Central Interior Highlands and Appalachian Sinkhole and Depression Pond (CES202.018).
West Gulf Coastal Plain Large River Floodplain Forest (CES203.488).
South-Central Interior Large Floodplain (CES202.705).
South-Central Interior Small Stream and Riparian (CES202.706).

GLOBAL DESCRIPTION

Concept Summary: This rooted aquatic or open marsh community occupies shallow-water depressions, oxbow ponds, backwater sloughs of river floodplains, slow-moving streams, ponds, and small lakes throughout the central and eastern United States. It is dominated by rooted, floating-leaved aquatic species, with both submergent and emergent aquatics also present. *Nuphar advena* (yellow pond-lily) and *Nymphaea odorata* (American white waterlily) are dominants, either in combination together, or each singly. Other species present include *Brasenia schreberi* (watershield), various *Potamogeton* (pondweed) and *Stuckenia* (pondweed) spp., *Eleocharis robbinsii* (Robbins' spikerush) and other *Eleocharis* (spikerush) spp., *Polygonum amphibium* (water knotweed), *Polygonum amphibium* var. *emersum* (longroot smartweed), *Sparganium americanum* (American bur-reed), *Lemna* (duckweed) spp., *Spirodela polyrrhiza* (common duckmeat), *Typha latifolia* (broadleaf cattail), and *Saururus cernuus* (lizard's-tail). Submerged aquatics more common in the southern part of the range include *Cabomba caroliniana* (Carolina fanwort), *Ceratophyllum demersum* (coon's-tail), and *Heteranthera dubia* (grassleaf mudplantain).

Environmental Description: This community occupies shallow-water depressions, oxbow ponds, sluggish streams, and backwater sloughs of river floodplains, ponds (natural and artificial), and small lakes. In pools and slow-flowing stretches of river, at Obed River (TN), *Nuphar lutea* ssp. *advena* is rooted in sandy substrate (Schmalzer and DeSelm 1982).

Vegetation Description: This community is dominated by rooted, floating-leaved aquatic species, with both submergent and emergent aquatics also present. *Nuphar advena* (yellow pond-lily) and *Nymphaea odorata* (American white waterlily) are dominants, either in combination together, or each singly. Other species present include *Brasenia schreberi* (watershield), various *Potamogeton* (pondweed) and *Stuckenia* (pondweed) spp., *Eleocharis robbinsii* (Robbins' spikerush) and other *Eleocharis* (spikerush) spp., *Polygonum amphibium* (water knotweed), *Polygonum amphibium* var. *emersum* (longroot smartweed), *Sparganium americanum* (American bur-reed), *Lemna* (duckweed) spp., *Spirodela polyrrhiza* (common duckmeat), *Typha latifolia* (broadleaf cattail), and *Saururus cernuus* (lizard's-tail) (Anderson 1982, G. Fleming pers. comm.). Submerged aquatic species more common in the southern part of the range include *Cabomba caroliniana* (Carolina fanwort), *Ceratophyllum demersum* (coon's-tail), and *Heteranthera dubia* (grassleaf mudplantain). This broadly conceived type may include ponds, or zones of ponds, dominated by *Nymphaea odorata* (American white waterlily), with or without *Nuphar advena* (yellow pond-lily).

Most Abundant Species:

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Floating aquatic	Aquatic herb (floating & submergent)	<i>Nuphar advena</i> (yellow pond-lily) <i>Nymphaea odorata</i> (American white waterlily)

Characteristic Species: *Nuphar advena* (yellow pond-lily), *Nymphaea odorata* (American white waterlily).

Other Noteworthy Species: Information not available.

USFWS Wetland System: Lacustrine.

DISTRIBUTION

Range: This rooted aquatic community occupies shallow, quiet waters throughout the central and eastern United States, extending from Maine to Ontario and Minnesota, south to Oklahoma and east to Georgia.

States/Provinces: AL, AR, CT, DE, FL, GA, IA:SU, IL, IN, KY, LA, MA, MD, ME, MI, MN, MO, MS, NC, NH, NJ:S4, NY, OH, OK, ON, PA, RI, SC, TN, TX, VA, VT, WI, WV.

Federal Lands: DOD (Fort Benning); NPS (Acadia, C&O Canal?, Carl Sandburg Home, Effigy Mounds, Indiana Dunes, Minute Man, Natchez Trace, Obed, Ozark Riverways, Saint Croix, Saint-Gaudens, Shiloh); USFS (Angelina, Chequamegon, Chequamegon-Nicolet, Conecuh, Davy Crockett, Kisatchie, Nicolet, Ocala, Ozark, Sabine, Sam Houston?, Talladega, Talladega (Oakmulgee), Talladega [Talladega]); USFWS (Back Bay, Erie, Great Swamp, Reelfoot).

CONSERVATION STATUS

Rank: G4G5 (15-Oct-2002).

Reasons: The dominant species in stands of this vegetation are widespread across the eastern and central United States and adjacent Canada. This is not a rare or imperiled vegetation type, even though its occurrence is poorly documented. Stands may occur in natural lakes and ponds or in artificial impoundments.

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 2 - Moderate.

Comments: Can occur in mostly natural ponded wetlands as well as artifactual ones such as borrow pits. On the Conecuh National Forest (Alabama), vegetation of this association occurs in Gum Pond and Open Pond as a mix of *Nymphaea odorata* (American white waterlily) and *Nuphar advena* (yellow pond-lily).

Similar Associations:

Equisetum fluviatile - (*Eleocharis palustris*) Herbaceous Vegetation (CEGL005258).

Nuphar advena Tidal Herbaceous Vegetation (CEGL004472).

Nuphar polysepala Herbaceous Vegetation (CEGL002001).

Semipermanent Impoundment (CEGL006581).

Related Concepts:

Nuphar advena - *Nymphaea odorata* Herbaceous Vegetation (Clancy 1996)

Freshwater Marsh (Nelson 1985)

Inland Emergent Marsh (Chapman et al. 1989)

L5D2a11a. *Nuphar lutea* (Foti et al. 1994)

New England coastal plain pondshore (Rawinski 1984)

Open Water/Aquatic Bed Veg., Natural Impoundment Pond (Ambrose 1990a)

Open water marsh with floating-leaved plants (NAP pers. comm. 1998)

SOURCES

Description Authors: D. Faber-Langendoen, mod. C. W. Nordman, S. C. Gawler, M. Pyne.

References: Ambrose 1990a, Anderson 1982, Breden et al. 2001, Chapman et al. 1989, Clancy 1996, FNAI 1990, Fike 1999, Fleming et al. 2001, Foti et al. 1994, Gawler 2002, Harrison 2004, Hoagland 2000, INAI unpubl. data, Midwestern Ecology Working Group n.d., NAP pers. comm. 1998, NatureServe Ecology - Southeastern U.S. unpubl. data, Nelson 1985, Peet et al. unpubl. data 2002, Penfound 1953, Rawinski 1984, Schafale and Weakley 1990, Schmalzer and DeSelm 1982, Schotz pers. comm., Sperduto and Nichols 2004, Swain and Kearsley 2001, TDNH unpubl. data, Thompson and Jenkins 1992, WNHIP unpubl. data, Zanoni et al. 1979.



Figure 11. Aquatic Bed in Saint-Gaudens National Historic Site (SAGA.20). September 2004. NAD 1983 / UTM easting 4819531, northing 712162.

COMMON NAME (PARK-SPECIFIC): BLUEJOINT WET MEADOW
MAP CLASS NAME: EMERGENT MARSH - SHRUB SWAMP SYSTEM

SYNONYMS

USNVC English Name: Bluejoint - Reed Canarygrass Herbaceous Vegetation
USNVC Scientific Name: *Calamagrostis canadensis* - *Phalaris arundinacea* Herbaceous Vegetation
USNVC Identifier: C EGL005174

LOCAL INFORMATION

Environmental Description: This is an emergent marsh that occurs in narrow bands along the stream channel as part of the Blow-Me-Down Pond wetland system, on depositional bars that consist of moist, firm soils.

Vegetation Description: The vegetation is dominated by typical marsh plants at 70–90% cover and include *Calamagrostis canadensis* (bluejoint), *Typha latifolia* (broadleaf cattail), *Eupatorium perfoliatum* (common boneset), *Poa compressa* (Canada bluegrass), *Boehmeria cylindrica* (smallspike false nettle), *Impatiens capensis* (jewelweed), and *Lycopus virginicus* (Virginia water horehound). The wetland shrubs *Alnus incana* (gray alder) and *Cornus amomum* (silky dogwood) are also present in low numbers (1–5% cover). The invasive exotic *Lythrum salicaria* (purple loosestrife) is frequent in this community (10–25% cover).

Most Abundant Species:

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Herb (field)	Forb	<i>Lythrum salicaria</i> (purple loosestrife)
Herb (field)	Graminoid	<i>Calamagrostis canadensis</i> (bluejoint)
		<i>Poa compressa</i> (Canada bluegrass)

Characteristic Species: *Calamagrostis canadensis* (bluejoint), *Poa compressa* (Canada bluegrass).

Other Noteworthy Species: Information not available.

Subnational Distribution with Crosswalk Data:

<u>State</u>	<u>SRank</u>	<u>Rel</u>	<u>Conf</u>	<u>SName</u>	<u>Reference</u>
NH	SNR	.	.	[not crosswalked]	.

Local Range: Because of the small size of the occurrences, this is one of three wetland communities that comprise a single, emergent marsh unit on the community map. This community occupies approximately 30% of the polygon.

Classification Comments: This community occurs as part of mosaic with Medium-depth Emergent Marsh and Cattail Marsh but is found on higher and drier conditions than either of the other two types.

Other Comments: The invasive forb *Lythrum salicaria* (purple loosestrife) is a significant component in this community. However, the park has already begun using biocontrol techniques in an attempt to reduce the abundance of this species at the site.

Local Description Authors: P. Bowman.

Plots: SAGA.17, SAGA.19. AA point: SAGA.AA23.

Saint-Gaudens National Historic Site Inventory Notes: Information not available.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Herbaceous Vegetation (V)
Physiognomic Subclass	Perennial graminoid vegetation (V.A.)
Physiognomic Group	Temperate or subpolar grassland (V.A.5.)
Physiognomic Subgroup	Natural/Semi-natural temperate or subpolar grassland (V.A.5.N.)
Formation	Seasonally flooded temperate or subpolar grassland (V.A.5.N.k.)
Alliance	<i>Calamagrostis canadensis</i> Seasonally Flooded Herbaceous Alliance (A.1400)
Alliance (English name)	Bluejoint Seasonally Flooded Herbaceous Alliance
Association	<i>Calamagrostis canadensis</i> - <i>Phalaris arundinacea</i> Herbaceous Vegetation
Association (English name)	Bluejoint - Reed Canarygrass Herbaceous Vegetation
Ecological System(s):	Eastern Great Plains Wet Meadow, Prairie and Marsh (CES205.687). Eastern Boreal Floodplain (CES103.588). North-Central Interior Wet Meadow-Shrub Swamp (CES202.701). Laurentian-Acadian Wet Meadow-Shrub Swamp (CES201.582). Central Appalachian River Floodplain (CES202.608). High Allegheny Wetland (CES202.069).

GLOBAL DESCRIPTION

Concept Summary: This wet meadow vegetation is widespread in the northeastern and midwestern United States and central and eastern Canada. Stands occur on the floodplains of small streams, in poorly drained depressions, beaver meadows, levees, and lakeshores. Soils are typically mineral soil or well-decomposed peat, with a thick root mat. Water regime varies between temporarily and seasonally flooded. Graminoid cover is typically dense and can form hummocky microtopography. *Calamagrostis canadensis* (bluejoint) is dominant, often occurring in almost pure stands or with tall sedges, such as *Carex aquatilis* (water sedge), *Carex lacustris* (hairy sedge), *Carex utriculata* (Northwest Territory sedge), and *Carex stricta* (upright sedge). In fen transitions, *Carex lasiocarpa* (woollyfruit sedge) can be present. *Agrostis gigantea* (redtop), *Glyceria grandis* (American mannagrass), *Poa palustris* (fowl bluegrass), *Poa compressa* (Canada bluegrass), *Scirpus cyperinus* (woolgrass), and *Typha latifolia* (broadleaf cattail) are sometimes abundant. Forbs include *Campanula aparinoides* (marsh bellflower), *Epilobium leptophyllum* (bog willowherb), *Eupatorium maculatum* (spotted joepeyweed), *Eupatorium perfoliatum* (common boneset), *Impatiens capensis* (jewelweed), *Iris versicolor* (harlequin blueflag), *Polygonum amphibium* (water knotweed), and *Comarum palustre* (purple marshlocks). Scattered shrubs, such as *Viburnum nudum* (possumhaw), *Viburnum dentatum* (southern arrowwood), *Spiraea alba* (white meadowsweet), *Cornus amomum* (silky dogwood), *Alnus incana* (gray alder), or *Alnus serrulata* (hazel alder), may be present. *Phalaris arundinacea* (reed canarygrass) and/or *Lythrum salicaria* (purple loosestrife) may be present, especially in disturbed examples.

Environmental Description: Stands occur on the floodplains of small streams, in poorly drained depressions, beaver meadows, levees, and lakeshores. Soils are typically mineral soil or well-decomposed peat or peat silt loam with a thick root mat. Water regime varies between temporarily and seasonally flooded.

Vegetation Description: Graminoid cover is typically dense and can form hummocky microtopography. *Calamagrostis canadensis* (bluejoint) is dominant, often occurring in almost pure stands or with tall sedges, such as *Carex aquatilis* (water sedge), *Carex lacustris* (hairy sedge), *Carex rostrata* (beaked sedge), and *Carex stricta* (upright sedge). In fen transitions, *Carex lasiocarpa* (woollyfruit sedge) can be present. *Agrostis gigantea* (redtop), *Glyceria grandis* (American mannagrass), *Poa palustris* (fowl bluegrass), *Poa compressa* (Canada

bluegrass), *Scirpus cyperinus* (woolgrass), and *Typha latifolia* (broadleaf cattail) are sometimes abundant. Forbs include *Campanula aparinoides* (marsh bellflower), *Epilobium leptophyllum* (bog willowherb), *Eupatorium maculatum* (spotted joeypyeweed), *Eupatorium perfoliatum* (common boneset), *Iris versicolor* (harlequin blueflag), *Polygonum amphibium* (water knotweed), and *Comarum palustre* (purple marshlocks). Scattered shrubs, such as *Viburnum nudum* (possumhaw), *Viburnum dentatum* (southern arrow-wood), *Spiraea alba* (white meadowsweet), *Cornus amomum* (silky dogwood), *Alnus incana* (gray alder), or *Alnus serrulata* (hazel alder), may be present. *Lythrum salicaria* (purple loosestrife) may be present, especially in disturbed examples.

Most Abundant Species:

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Herb (field)	Graminoid	<i>Calamagrostis canadensis</i> (bluejoint)

Characteristic Species: *Calamagrostis canadensis* (bluejoint).

Other Noteworthy Species:

<u>Species</u>	<u>GRank</u>	<u>Type</u>	<u>Note</u>
<i>Polemonium vanbruntiae</i> (Vanbrunt's polemonium)	G3G4	plant	

USFWS Wetland System: Palustrine.

DISTRIBUTION

Range: This wet meadow vegetation is widely distributed in the northeastern and midwestern United States and south-central and southeastern Canada. It ranges from Maine south to West Virginia and possibly Virginia and west to Minnesota.

States/Provinces: CT, DE, MA, MD, ME, MI, MN, NH, NJ, NY, ON, PA, RI, VA?, VT, WI, WV:S2.

Federal Lands: NPS (Apostle Islands, Grand Portage, Isle Royale, Minute Man, Pictured Rocks, Saint Croix, Saint-Gaudens, Sleeping Bear Dunes, Valley Forge, Voyageurs); USFS (Monongahela); USFWS (Assabet River?, Canaan Valley, Great Meadows?).

CONSERVATION STATUS

Rank: G4G5 (31-Mar-2000).

Reasons: This type is widespread throughout the northeastern and upper midwestern United States and central/southern Canada.

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 2 - Moderate.

Comments: This type can grade into sedge meadows. A guideline of <50% sedges may be suggested as a criterion for the definition of this type compared to sedge meadow types. Harris et al. (1996) suggest that the bluejoint meadow type is drier than sedge meadows and less peaty than shore fens.

Similar Associations:

Calamagrostis canadensis - *Doellingeria umbellata* - *Spartina pectinata* Herbaceous Vegetation (CEGL006427).

Calamagrostis canadensis - *Scirpus* spp. - *Dulichium arundinaceum* Herbaceous Vegetation (CEGL006519).

Carex (rostrata, utriculata) - *Carex lacustris* - (*Carex vesicaria*) Herbaceous Vegetation (CEGL002257).

Carex stricta - *Carex* spp. Herbaceous Vegetation (CEGL002258)--Dominance of sedges versus grasses is much higher.

Phalaris arundinacea Eastern Herbaceous Vegetation (CEGL006044).

Phalaris arundinacea Western Herbaceous Vegetation (CEGL001474).

Phleum pratense - (*Calamagrostis canadensis*) Semi-natural Herbaceous Vegetation (CEGL005249).

Related Concepts:

Calamagrostis canadensis herbaceous community (Walbridge and Lang 1982)
Calamagrostis canadensis meadow (Walbridge 1982)
Calamagrostis canadensis wet meadow (Fortney 1975)
Calamagrostis canadensis wet meadow (Byers et al. 2007)
Canada bluejoint-tussock sedge meadow (CAP pers. comm. 1998)
Meadow marsh: bluejoint grass (W13) (Harris et al. 1996)
Palustrine Persistent Emergent Wetland (PEM1) (Cowardin et al. 1979)
SNE low-energy riverbank community (Rawinski 1984)
Shallow Emergent Marsh (Thompson 1996)

SOURCES

Description Authors: S. C. Gawler.

References: Breden et al. 2001, Browning 1859, Byers et al. 2007, CAP pers. comm. 1998, Cowardin et al. 1979, Eastern Ecology Working Group n.d., Fike 1999, Fortney 1975, Francl et al. 2004, Gawler 2002, Harris et al. 1996, Harrison 2004, NAP pers. comm. 1998, Rawinski 1984, Swain and Kearsley 2001, Thompson 1996, Thompson and Sorenson 2000, WNHIP unpubl. data, Walbridge 1982, Walbridge and Lang 1982.



Figure 12. Bluejoint Wet Meadow in Saint-Gaudens National Historic Site (SAGA.17). September 2004. NAD 1983 / UTM easting 4819589, northing 712076.



Figure 13. Bluejoint Wet Meadow in Saint-Gaudens National Historic Site (SAGA.19). September 2004. NAD 1983 / UTM easting 4819567, northing 712119.

COMMON NAME (PARK-SPECIFIC): CATTAIL MARSH
MAP CLASS NAME: EMERGENT MARSH - SHRUB SWAMP SYSTEM

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: C EGL006153

LOCAL INFORMATION

Environmental Description: This community occupies the semipermanently flooded zone adjacent to the open water of the pond and stream, as part of the Blow-Me-Down wetland system. Standing water ranges from 15–50 cm deep above very loose, mucky soils.

Vegetation Description: *Typha latifolia* (broadleaf cattail) is the sole dominant in this community and ranges from 25–50% cover. *Nuphar lutea* ssp. *variegata* (variegated yellow pond-lily) is present along the areas of transition to open water.

Most Abundant Species:

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Herb (field)	Graminoid	<i>Typha latifolia</i> (broadleaf cattail)

Characteristic Species: *Typha latifolia* (broadleaf cattail).

Other Noteworthy Species: Information not available.

Subnational Distribution with Crosswalk Data:

<u>State</u>	<u>SRank</u>	<u>Rel</u>	<u>Conf</u>	<u>SName</u>	<u>Reference</u>
NH	S4?	=	1	Cattail Marsh	Sperduto and Nichols 2004

Local Range: Because of the small size of the occurrences, this is one of three wetland communities that comprise a single, emergent marsh unit on the community map. This community occupies approximately 20% of the polygon.

Classification Comments: At Saint-Gaudens National Historic Site, this community occurs in the semipermanently flooded zone adjacent to the open water of the pond and stream, as part of the Blow-Me-Down Pond wetland system.

Other Comments: Information not available.

Local Description Authors: P. Bowman.

Plots: SAGA.16. AA point: SAGA.AA23.

Saint-Gaudens National Historic Site Inventory Notes: Information not available.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Herbaceous Vegetation (V)
Physiognomic Subclass	Perennial graminoid vegetation (V.A.)
Physiognomic Group	Temperate or subpolar grassland (V.A.5.)
Physiognomic Subgroup	Natural/Semi-natural temperate or subpolar grassland (V.A.5.N.)
Formation	Semipermanently flooded temperate or subpolar grassland (V.A.5.N.1.)
Alliance	<i>Typha (angustifolia, latifolia)</i> - (<i>Schoenoplectus</i> spp.) Semipermanently Flooded Herbaceous Alliance (A.1436)
Alliance (English name)	(Narrowleaf Cattail, Broadleaf Cattail) - (Clubrush species) Semipermanently Flooded Herbaceous Alliance

Association	<i>Typha (angustifolia, latifolia)</i> - (<i>Schoenoplectus</i> 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).

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* (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* (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:

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Herb (field)	Graminoid	<i>Typha angustifolia</i> (narrowleaf cattail)
		<i>Typha latifolia</i> (broadleaf cattail)
		<i>Typha x glauca</i> (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:

<u>Species</u>	<u>GRank</u>	<u>Type</u>	<u>Note</u>
<i>Lythrum salicaria</i> (purple loosestrife)	-	plant	invasive exotic
<i>Phragmites australis</i> (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, Saratoga, 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.



Figure 14. Cattail Marsh in Saint-Gaudens National Historic Site (SAGA.16). September 2004. NAD 1983 / UTM easting 4819650, northing 711982.

COMMON NAME (PARK-SPECIFIC): COBBLE - SAND RIVER CHANNEL

SYNONYMS

USNVC English Name: Twisted Sedge - Indian-hemp - Flatsedge species Herbaceous Vegetation

USNVC Scientific Name: *Carex torta* - *Apocynum cannabinum* - *Cyperus* spp. Herbaceous Vegetation

USNVC Identifier: C EGL006536

LOCAL INFORMATION

Environmental Description: This community is restricted to a small gravel bar in Blow-Me-Down Brook. Its open character is maintained by flooding and ice-scour, and the lack of soil development leads to sparse vegetative cover.

Vegetation Description: The vegetation is a sparse mix of tree seedlings, shrubs, and herbs on a substrate of fine gravel and sand. *Platanus occidentalis* (American sycamore) seedlings are the most abundant woody vegetation and comprise a shrub layer that ranges from 10–25% cover. Herbs present in the community include *Solidago canadensis* (Canada goldenrod), *Eupatorium perfoliatum* (common boneset), *Dichanthelium clandestinum* (deertongue), *Agrostis stolonifera* (creeping bentgrass), *Muhlenbergia mexicana* (Mexican muhly), and *Euthamia graminifolia* (flat-top goldentop), among others, with overall herbaceous cover around 20%.

Most Abundant Species:

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Tall shrub/sapling	Broad-leaved deciduous tree	<i>Platanus occidentalis</i> (American sycamore)
Herb (field)	Forb	<i>Solidago canadensis</i> (Canada goldenrod)
Herb (field)	Graminoid	<i>Dichanthelium clandestinum</i> (deertongue)

Characteristic Species: *Platanus occidentalis* (American sycamore), *Solidago canadensis* (Canada goldenrod).

Other Noteworthy Species: Information not available.

Subnational Distribution with Crosswalk Data:

<u>State</u>	<u>SRank</u>	<u>Rel</u>	<u>Conf</u>	<u>SName</u>	<u>Reference</u>
NH	SNR*	F	.	Boulder - Cobble River Channel	Sperduto and Nichols 2004
NH	SNR*	F	.	Cobble - Sand River Channel	Sperduto and Nichols 2004
NH	SNR*	F	.	Herbaceous Sandy River Channel	Sperduto and Nichols 2004
NH	SNR*	F	.	Twisted Sedge Low Riverbank	Sperduto 2000a

Local Range: Although the sole occurrence of this community is very small, it is distinct and discrete enough to be easily mapped within Blow-Me-Down Brook in the northwest corner of the park.

Classification Comments: Information not available.

Other Comments: Information not available.

Local Description Authors: P. Bowman.

Plots: SAGA.15.

Saint-Gaudens National Historic Site Inventory Notes: Information not available.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Herbaceous Vegetation (V)
Physiognomic Subclass	Perennial graminoid vegetation (V.A.)
Physiognomic Group	Temperate or subpolar grassland (V.A.5.)
Physiognomic Subgroup	Natural/Semi-natural temperate or subpolar grassland (V.A.5.N.)
Formation	Temporarily flooded temperate or subpolar grassland (V.A.5.N.j.)
Alliance	<i>Carex torta</i> Temporarily Flooded Herbaceous Alliance (A.1340)
Alliance (English name)	Twisted Sedge Temporarily Flooded Herbaceous Alliance
Association	<i>Carex torta</i> - <i>Apocynum cannabinum</i> - <i>Cyperus</i> spp. Herbaceous Vegetation
Association (English name)	Twisted Sedge - Indian-hemp - Flatsedge species Herbaceous Vegetation
Ecological System(s):	Central Appalachian Stream and Riparian (CES202.609). Central Appalachian River Floodplain (CES202.608).

GLOBAL DESCRIPTION

Concept Summary: This herbaceous vegetation occurs on large coarse substrates deposited along medium- to high-energy river channels and, less frequently, exposed lakeshores with heavy wave action. Seasonal flooding and ice-scour maintain the open nature of these communities; generally, they develop in areas of the active channel that are exposed at low water or in drought years. Vegetation can be sparse to dense depending on degree of flooding and length of exposure. Characteristic perennial species that tolerate inundation and flood scouring include *Carex torta* (twisted sedge) and low *Salix* (willow) spp. Associated species tend to vary widely from site to site, can be diverse, and may be sparse; they include *Apocynum cannabinum* (Indianhemp), *Verbena hastata* (swamp verbena), *Symphotrichum puniceum* (purplestem aster), *Doellingeria umbellata* (parasol whitetop), *Solidago rugosa* (wrinkleleaf goldenrod), *Solidago canadensis* (Canada goldenrod), *Solidago gigantea* (giant goldenrod), *Calamagrostis canadensis* (bluejoint), *Phalaris arundinacea* (reed canarygrass), *Scirpus expansus* (woodland bulrush), *Scirpus cyperinus* (woolgrass), *Thelypteris palustris* (eastern marsh fern), *Scutellaria lateriflora* (blue skullcap), *Agrostis stolonifera* (creeping bentgrass), *Dichanthelium clandestinum* (deertongue), *Eupatorium maculatum* (spotted joeypyeweed), *Eupatorium perfoliatum* (common boneset), *Elymus riparius* (riverbank wildrye), *Cyperus strigosus* (strawcolored flatsedge), and other *Cyperus* (flatsedge) spp., *Eleocharis* (spikerush) spp., *Lobelia cardinalis* (cardinalflower), *Onoclea sensibilis* (sensitive fern), *Viola* (violet) spp., *Clematis virginiana* (devil's darning needles), *Polygonum amphibium* (water knotweed), *Polygonum hydropiper* (marshpepper knotweed), *Polygonum pensylvanicum* (Pennsylvania smartweed), *Polygonum sagittatum* (arrowleaf tearthumb), *Polygonum persicaria* (spotted ladysthumb), *Polygonum punctatum* (dotted smartweed), *Polygonum lapathifolium* (curlytop knotweed), *Schizachyrium scoparium* (little bluestem), *Andropogon gerardii* (big bluestem), and occasionally *Sanguisorba canadensis* (Canadian burnet). Battered and stunted shrubs and trees can occur, including *Salix sericea* (silky willow), *Salix eriocephala* (Missouri River willow), *Cornus amomum* (silky dogwood), *Betula nigra* (river birch), *Populus deltoides* (eastern cottonwood), and *Platanus occidentalis* (American sycamore). Nonvascular plants can be sparse, but where present can include *Bryum* (bryum moss) spp. Invasive, exotic species can be problematic in these areas, especially *Tussilago farfara* (coltsfoot), *Lythrum salicaria* (purple loosestrife), *Polygonum cuspidatum* (Japanese knotweed), *Polygonum persicaria* (spotted ladysthumb), and in the southern portion of the range *Microstegium vimineum* (Nepalese browntop).

Environmental Description: This community occurs on cobble, gravel, and sand bars or banks of streams and rivers with medium to high gradients. Seasonal flooding and ice-scour maintain the open nature of these communities.

Vegetation Description: Vegetation can be sparse to dense depending on degree of flooding and length of exposure. Characteristic perennial species that tolerate inundation and flood scouring include *Carex torta* (twisted sedge) and low *Salix* (willow) spp. Associated species tend to vary widely from site to site, can be diverse, and may be sparse; they include *Apocynum cannabinum* (Indianhemp), *Verbena hastata* (swamp verbena), *Symphyotrichum puniceum* (purplestem aster), *Doellingeria umbellata* (parasol whitetop), *Solidago rugosa* (wrinkleleaf goldenrod), *Solidago canadensis* (Canada goldenrod), *Solidago gigantea* (giant goldenrod), *Calamagrostis canadensis* (bluejoint), *Phalaris arundinacea* (reed canarygrass), *Scirpus expansus* (woodland bulrush), *Scirpus cyperinus* (woolgrass), *Thelypteris palustris* (eastern marsh fern), *Scutellaria lateriflora* (blue skullcap), *Agrostis stolonifera* (creeping bentgrass), *Dichanthelium clandestinum* (deertongue), *Eupatorium maculatum* (spotted joepeyeweed), *Eupatorium perfoliatum* (common boneset), *Elymus riparius* (riverbank wildrye), *Cyperus strigosus* (strawcolored flatsedge), and other *Cyperus* (flatsedge) spp., *Eleocharis* (spikerush) spp., *Lobelia cardinalis* (cardinalflower), *Onoclea sensibilis* (sensitive fern), *Viola* (violet) spp., *Clematis virginiana* (devil's darning needles), *Polygonum amphibium* (water knotweed), *Polygonum hydropiper* (marshpepper knotweed), *Polygonum pennsylvanicum* (Pennsylvania smartweed), *Polygonum sagittatum* (arrowleaf tearthumb), *Polygonum persicaria* (spotted ladysthumb), *Polygonum punctatum* (dotted smartweed), *Polygonum lapathifolium* (curlytop knotweed), *Schizachyrium scoparium* (little bluestem), *Andropogon gerardii* (big bluestem), and occasionally *Sanguisorba canadensis* (Canadian burnet). Battered and stunted shrubs and trees can occur, including *Salix sericea* (silky willow), *Salix eriocephala* (Missouri River willow), *Cornus amomum* (silky dogwood), *Betula nigra* (river birch), *Populus deltoides* (eastern cottonwood), and *Platanus occidentalis* (American sycamore). Nonvascular plants can be sparse, but where present can include *Bryum* (bryum moss) spp. Invasive, exotic species can be problematic in these areas, especially *Tussilago farfara* (coltsfoot), *Lythrum salicaria* (purple loosestrife), *Polygonum cuspidatum* (Japanese knotweed), *Polygonum persicaria* (spotted ladysthumb), and in the southern portion of the range *Microstegium vimineum* (Nepalese browntop).

Most Abundant Species:

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Herb (field)	Graminoid	<i>Carex torta</i> (twisted sedge)

Characteristic Species: *Apocynum cannabinum* (Indianhemp), *Carex torta* (twisted sedge).

Other Noteworthy Species:

<u>Species</u>	<u>GRank</u>	<u>Type</u>	<u>Note</u>
<i>Lythrum salicaria</i> (purple loosestrife)	-	plant	invasive exotic
<i>Microstegium vimineum</i> (Nepalese browntop)	-	plant	invasive exotic
<i>Polygonum cuspidatum</i> (Japanese knotweed)	-	plant	invasive exotic
<i>Polygonum persicaria</i> (spotted ladysthumb)	-	plant	invasive exotic
<i>Tussilago farfara</i> (coltsfoot)	-	plant	invasive exotic

USFWS Wetland System: Palustrine.

DISTRIBUTION

Range: This association is found from New England south through New York and Pennsylvania.

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

Federal Lands: NPS (Saint-Gaudens).

CONSERVATION STATUS

Rank: G4G5 (2-Feb-2005).

Reasons: This community is common in tributaries in the upper portions of watersheds. The rank within Pennsylvania is S3; considering its whole range, its rank should probably be changed to G5.

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 2 - Moderate.

Comments: This type was originally developed for the Northern Appalachians but later extended south to Pennsylvania. This is a very heterogeneous type, but analysis of the Pennsylvania data failed to reveal any consistent variants. Ongoing work (as of 2005) in the National Capital Region (Virginia, Maryland, West Virginia) is generating some plot data that may help determine if a different temporarily flooded herbaceous river-scour association is needed for that region. If so, the transition area from this more northern type to the more southern type will need to be defined, and that may alter the range of this type.

Similar Associations:

Carex torta Herbaceous Vegetation (CEGL004103).

Related Concepts:

River Cobble Shore Community (Thompson 1996)

Riverine Scour Vegetation (Perles et al. 2004)

Riverside Sand/Gravel Community (Thompson 1996)

SOURCES

Description Authors: S. L. Neid, mod. S. C. Gawler.

References: Bowman 2000, Eastern Ecology Working Group n.d., Edinger et al. 2002, Metzler and Barrett 2001, Nichols et al. 2001, Perles et al. 2004, Sperduto and Nichols 2004, Swain and Kearsley 2000, Thompson 1996, Thompson and Sorenson 2000.



Figure 15. Cobble - Sand River Channel in Saint-Gaudens National Historic Site (SAGA.15). September 2004. NAD 1983 / UTM easting 4819979, northing 711837.

COMMON NAME (PARK-SPECIFIC): ENRICHED HARDWOOD FOREST SEEP

SYNONYMS

USNVC English Name: Sensitive Fern - (Northern Maidenhair) - Orange Jewelweed - Plantainleaf Sedge Herbaceous Vegetation

USNVC Scientific Name: *Onoclea sensibilis* - (*Adiantum pedatum*) - *Impatiens capensis* - *Carex plantaginea* Herbaceous Vegetation [Provisional]

USNVC Identifier: C EGL006409

LOCAL INFORMATION

Environmental Description: This community is present as small (typically less than 500 m²) inclusions within the surrounding upland forest. The surrounding forest type can be somewhat enriched (Semi-rich Northern Hardwood Forest) or not (Hemlock - Beech - Oak - Pine Forest). Small areas of seepage are frequent at Saint-Gaudens National Historic Site at the bases of steep eroding slopes, although most of them are too minor to harbor a full suite of seepage plant species. These seeps are variable in their levels of nutrient enrichment, but the larger examples show signs of strong enrichment, as indicated by the vegetation. In fact, many of the plant species that have been ascribed to rich mesic forest communities in previous reports are actually found in these enriched seeps. The soils in these seeps are typically mucky, with a constant discharge of groundwater maintaining them in an essentially saturated condition.

Vegetation Description: The larger examples of this community type may contain canopy and understory trees, particularly *Fraxinus americana* (white ash), *Carya cordiformis* (bitternut hickory), and *Acer saccharum* (sugar maple), as well as *Betula alleghaniensis* (yellow birch) and *Quercus rubra* (northern red oak). Cover in both the canopy and understory strata ranges from 50–60%. The shrub layer is sparse (1–5%), but species such as *Cornus amomum* (silky dogwood) and *Lonicera canadensis* (American fly honeysuckle) may be present. The herbaceous layer is typically lush (60–80%) and contains many rich-site indicators, such as *Adiantum pedatum* (northern maidenhair), *Carex platyphylla* (broadleaf sedge), *Carex plantaginea* (plantainleaf sedge), and *Desmodium glutinosum* (pointedleaf ticktrefoil). Other herbs present include *Carex scabrata* (eastern rough sedge), *Carex debilis* (white edge sedge), *Deparia acrostichoides* (silver false spleenwort), *Matteuccia struthiopteris* (ostrich fern), *Onoclea sensibilis* (sensitive fern), *Polystichum acrostichoides* (Christmas fern), *Amphicarpaea bracteata* (American hogpeanut), and *Actaea* spp. (baneberry).

Most Abundant Species:

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Tree canopy	Broad-leaved deciduous tree	<i>Acer saccharum</i> (sugar maple) <i>Fraxinus americana</i> (white ash)
Herb (field)	Graminoid	<i>Carex scabrata</i> (eastern rough sedge)
Herb (field)	Fern or fern ally	<i>Adiantum pedatum</i> (northern maidenhair) <i>Polystichum acrostichoides</i> (Christmas fern)

Characteristic Species: *Carex plantaginea* (plantainleaf sedge), *Carya cordiformis* (bitternut hickory), *Fraxinus americana* (white ash).

Other Noteworthy Species: Information not available.

Subnational Distribution with Crosswalk Data:

<u>State</u>	<u>SRank</u>	<u>Rel</u>	<u>Conf</u>	<u>SName</u>	<u>Reference</u>
NH	SNR*	F	.	Circumneutral Hardwood Forest Seep	Sperduto and Nichols 2004

Local Range: Forest seeps at Saint-Gaudens National Historic Site are too small to be delineated as polygons on the map. However, two of the larger circumneutral seeps are represented as points, one in the Semi-rich Northern Hardwood Forest cove in the southeastern portion of the park, and one in the southern portion of the large Hemlock - Beech - Oak - Pine Forest polygon in the central portion of the park.

Classification Comments: These seeps are distinct enough from surrounding forest types to merit their own designation as an herbaceous vegetation type. Many occurrences are small enough that the overstory is simply trees associated with the surrounding forest, but the herbaceous flora and hydrology are different.

Other Comments: The enriched soils in these seeps provide favorable conditions for a number of invasive plant species, and *Berberis thunbergii* (Japanese barberry) was found in the largest example. Efforts should be made to control these invasives while they are still present at low levels.

Local Description Authors: P. Bowman.

Plots: SAGA.10 (the largest example of this type).

Saint-Gaudens National Historic Site Inventory Notes: Information not available.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Herbaceous Vegetation (V)
Physiognomic Subclass	Perennial forb vegetation (V.B.)
Physiognomic Group	Temperate or subpolar perennial forb vegetation (V.B.2.)
Physiognomic Subgroup	Natural/Semi-natural temperate or subpolar perennial forb vegetation (V.B.2.N.)
Formation	Saturated temperate perennial forb vegetation (V.B.2.N.f.)
Alliance	<i>Symplocarpus foetidus</i> - <i>Caltha palustris</i> Saturated Herbaceous Alliance (A.1694)
Alliance (English name)	Skunk-cabbage - Yellow Marsh-marigold Saturated Herbaceous Alliance
Association	<i>Onoclea sensibilis</i> - (<i>Adiantum pedatum</i>) - <i>Impatiens capensis</i> - <i>Carex plantaginea</i> Herbaceous Vegetation [Provisional]
Association (English name)	Sensitive Fern - (Northern Maidenhair) - Orange Jewelweed - Plantainleaf Sedge Herbaceous Vegetation
Ecological System(s):	Laurentian-Acadian Northern Hardwoods Forest (CES201.564).

GLOBAL DESCRIPTION

Concept Summary: These small seepage wetlands occur as pockets or narrow linear patches within northern hardwood forests where seepage waters create saturated and mineral-rich conditions. Streamheads and lower slopes are typical settings, and the ground surface is usually gently sloping. Though generally shaded by the overhanging forest canopy, this association is defined by the herbaceous vegetation which is distinctly different from the herb and shrub layers in the surrounding forest. Shrub cover is generally low, and herb cover is lush (typically in the range of 60–85%). Bryophytes may be present but are often patchy. Herb composition is variable depending on the nutrient status of the soil and seepage water. Ferns, such as *Onoclea sensibilis* (sensitive fern), *Athyrium filix-femina* (common ladyfern), and *Matteuccia struthiopteris* (ostrich fern), may be prominent. *Impatiens capensis* (jewelweed) and *Arisaema triphyllum* (Jack in the pulpit) are typical forb species. On the more enriched sites, *Adiantum pedatum* (northern maidenhair), *Hydrophyllum virginianum* (Shawnee salad), *Impatiens pallida* (pale touch-me-not), *Milium effusum* (American milletgrass), *Carex platyphylla* (broadleaf sedge), and/or *Carex plantaginea* (plantainleaf sedge) may be present. Other species commonly recorded from this

vegetation are *Carex scabrata* (eastern rough sedge), *Carex debilis* (white edge sedge), *Polystichum acrostichoides* (Christmas fern), *Glyceria striata* (fowl mannagrass), *Solidago caesia* (wreath goldenrod), and *Ageratina altissima* (white snakeroot).

Environmental Description: These small seepage wetlands occur as pockets or narrow linear patches within northern hardwood forests where seepage waters create saturated and mineral-rich conditions. Streamheads and lower slopes are typical settings, and the ground surface is usually gently sloping.

Vegetation Description: Though generally shaded by the overhanging forest canopy, this association is defined by the herbaceous vegetation which is distinctly different from the herb and shrub layers in the surrounding forest. Shrub cover is generally low, and herb cover is lush (typically in the range of 60–85%). Bryophytes may be present but are often patchy. Herb composition is variable depending on the nutrient status of the soil and seepage water. Ferns, such as *Onoclea sensibilis* (sensitive fern), *Athyrium filix-femina* (common ladyfern), and *Matteuccia struthiopteris* (ostrich fern), may be prominent. *Impatiens capensis* (jewelweed) and *Arisaema triphyllum* (Jack in the pulpit) are typical forb species. On the more enriched sites, *Adiantum pedatum* (northern maidenhair), *Hydrophyllum virginianum* (Shawnee salad), *Impatiens pallida* (pale touch-me-not), *Milium effusum* (American milletgrass), *Carex platyphylla* (broadleaf sedge), and/or *Carex plantaginea* (plantainleaf sedge) may be present. Other species commonly recorded from this vegetation are *Carex scabrata* (eastern rough sedge), *Carex debilis* (white edge sedge), *Polystichum acrostichoides* (Christmas fern), *Glyceria striata* (fowl mannagrass), *Solidago caesia* (wreath goldenrod), and *Ageratina altissima* (white snakeroot).

Most Abundant Species:

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Herb (field)	Forb	<i>Arisaema triphyllum</i> (Jack in the pulpit) <i>Impatiens capensis</i> (jewelweed)
Herb (field)	Fern or fern ally	<i>Athyrium filix-femina</i> (common ladyfern) <i>Matteuccia struthiopteris</i> (ostrich fern) <i>Onoclea sensibilis</i> (sensitive fern)

Characteristic Species: *Adiantum pedatum* (northern maidenhair), *Arisaema triphyllum* (Jack in the pulpit), *Carex plantaginea* (plantainleaf sedge), *Carex platyphylla* (broadleaf sedge), *Impatiens capensis* (jewelweed).

Other Noteworthy Species: Information not available.

USFWS Wetland System: Palustrine.

DISTRIBUTION

Range: This association ranges across northern New England and New York and is expected to occur in adjacent Canada; its extent southward is unknown.

States/Provinces: ME, NB?, NH, NY?, QC?, VT.

Federal Lands: NPS (Marsh-Billings-Rockefeller, Saint-Gaudens).

CONSERVATION STATUS

Rank: G4? (6-Dec-2005).

Reasons: Rank has not been evaluated.

CLASSIFICATION INFORMATION

Status: Provisional.

Confidence: 2 - Moderate.

Comments: This type is supported by plot data from parks in Vermont and New Hampshire. Similar vegetation has been observed elsewhere in the region but not generally documented as distinct. Attention to these forested seeps could provide data to refine their classification and distribution.

Similar Associations:

Symplocarpus foetidus - *Impatiens capensis* Herbaceous Vegetation (CEGL006567).

Related Concepts: Information not available.

SOURCES

Description Authors: S. C. Gawler.

References: Eastern Ecology Working Group n.d., Sperduto and Nichols 2004.



Figure 16. Enriched Hardwood Forest Seep in Saint-Gaudens National Historic Site (SAGA.10). August 2004. NAD 1983 / UTM easting 4819639, northing 712226.

COMMON NAME (PARK-SPECIFIC): HEMLOCK - BEECH - OAK - PINE FOREST

SYNONYMS

USNVC English Name: Eastern Hemlock - American Beech - Northern Red Oak Forest

USNVC Scientific Name: *Tsuga canadensis* - *Fagus grandifolia* - *Quercus rubra* Forest

USNVC Identifier: CEGLO06088

LOCAL INFORMATION

Environmental Description: This variable type is the most common forest community at Saint-Gaudens National Historic Site. Sperduto and Nichols (2004) describe two variants of this type: the typic variant and the compact till/low river terrace variant, both of which are present at Saint-Gaudens National Historic Site, although they are not delineated separately on the vegetation maps. The typic variant is generally found on the drier mid to upper portions of gentle to moderately steep slopes. The compact till/low river terrace variant is restricted to the series of level terraces above Blow-Me-Down Pond. These terraces are generally more mesic than the typic variant sites and occasionally contain low swales or vernal pools.

Vegetation Description: Typic variant: *Tsuga canadensis* (eastern hemlock), *Fagus grandifolia* (American beech), *Quercus rubra* (northern red oak), and *Pinus strobus* (eastern white pine) are the primary canopy trees, with varying degrees of dominance depending on the age of the canopy trees, disturbance history, and edaphic factors (primarily soil moisture). Other frequent mid to early successional tree species that may be present in the canopy or understory include *Betula papyrifera* (paper birch), *Acer rubrum* (red maple), *Prunus serotina* (black cherry), *Acer pensylvanicum* (striped maple), and *Populus tremuloides* (quaking aspen). Overall canopy cover ranges from 50–75%. The cover in the subcanopy varies from 50–70% and typically has a large component of *Fagus grandifolia* (American beech) or *Tsuga canadensis* (eastern hemlock). The shrub layer is generally sparse (5–10%; maximum 20%) and consists primarily of tree saplings, although *Viburnum acerifolium* (mapleleaf viburnum) may be present. The herbaceous layers are typically rather sparse (5–20%), but frequent species include *Aralia nudicaulis* (wild sarsaparilla), *Maianthemum canadense* (Canada mayflower), *Maianthemum racemosum* (feathery false lily of the valley), *Polystichum acrostichoides* (Christmas fern), *Dennstaedtia punctilobula* (eastern hayscented fern), *Uvularia sessilifolia* (sessileleaf bellwort), *Mitchella repens* (partridgeberry), *Trientalis borealis* (starflower), and *Monotropa uniflora* (Indianpipe).

Compact till/low river terrace variant: In this variant, *Tsuga canadensis* (eastern hemlock) is present but does not occur at codominant levels, while *Acer rubrum* (red maple) becomes more prominent. Canopy cover is similar to the typic variant, although the understory is slightly less dense (30–40%). The shrub layer ranges from 10–30% cover, with saplings of *Fagus grandifolia* (American beech) being the most abundant species. There is also a much higher herbaceous cover in this variant (20–50%), as well as a greater diversity of species. In addition to many of the understory plants described for the typic variant, pteridophytes are often abundant and include *Lycopodium obscurum* (rare clubmoss), *Lycopodium annotinum* (stiff clubmoss), *Osmunda claytoniana* (interrupted fern), and *Lycopodium digitatum* (fan clubmoss). *Hamamelis virginiana* (American witchhazel) and *Corylus cornuta* (beaked hazelnut) are present in low abundances, and *Medeola virginiana* (Indian cucumber) is also present in the herb layer.

Most Abundant Species:

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Tree canopy	Broad-leaved deciduous tree	<i>Acer rubrum</i> (red maple) <i>Fagus grandifolia</i> (American beech) <i>Quercus rubra</i> (northern red oak)
Tree subcanopy	Needle-leaved tree	<i>Tsuga canadensis</i> (eastern hemlock)
Tall shrub/sapling	Broad-leaved deciduous tree	<i>Fagus grandifolia</i> (American beech)
Herb (field)	Forb	<i>Maianthemum canadense</i> (Canada mayflower)
Herb (field)	Fern or fern ally	<i>Dennstaedtia punctilobula</i> (eastern hayscented fern) <i>Dryopteris marginalis</i> (marginal woodfern) <i>Lycopodium annotinum</i> (stiff clubmoss) <i>Polystichum acrostichoides</i> (Christmas fern)

Characteristic Species: *Fagus grandifolia* (American beech), *Quercus rubra* (northern red oak).

Other Noteworthy Species: Information not available.

Subnational Distribution with Crosswalk Data:

<u>State</u>	<u>SRank</u>	<u>Rel</u>	<u>Conf</u>	<u>SName</u>	<u>Reference</u>
NH	SNR	=	1	Hemlock - Beech - Oak - Pine Forest	Sperduto 2000a

Local Range: Because the typic variant and the compact till/low river terrace variant differ in the abundance of conifers in the canopy, the signature of the type on the aerial photo varies from areas of near-exclusive hardwood dominance to areas of approximately even hardwood-conifer mixtures. The largest forest polygon at Saint-Gaudens National Historic Site, located in the northwest corner of the park, consists of both variants of the type. The remaining polygons tagged to this type are comprised exclusively of the typic variant.

Classification Comments: The dominance of eastern hemlock in this type distinguishes it from monotypic eastern white pine stands which most likely represent early successional versions of Hemlock - Beech - Oak - Pine Forest.

Other Comments: Many of the mesic terraces that have been delineated as Hemlock - Beech - Oak - Pine Forest were designated Rich Mesic Forest in previous surveys.

Local Description Authors: P. Bowman.

Plots: SAGA.02, SAGA.03, SAGA.09, SAGA.23, and SAGA.24: typic variant.

SAGA.07 and SAGA.08: compact till/low river terrace variant. AA points: SAGA.AA02, SAGA.AA06, SAGA.AA13, SAGA.AA14, SAGA.AA16, SAGA.AA20, and SAGA.AA25.

Saint-Gaudens National Historic Site Inventory Notes: Information not available.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Forest (I)
Physiognomic Subclass	Mixed evergreen-deciduous forest (I.C.)
Physiognomic Group	Mixed needle-leaved evergreen - cold-deciduous forest (I.C.3.)
Physiognomic Subgroup	Natural/Semi-natural mixed needle-leaved evergreen - cold-deciduous forest (I.C.3.N.)
Formation	Mixed needle-leaved evergreen - cold-deciduous forest (I.C.3.N.a.)
Alliance	<i>Tsuga canadensis</i> - <i>Betula alleghaniensis</i> Forest Alliance (A.412)
Alliance (English name)	Eastern Hemlock - Yellow Birch Forest Alliance
Association	<i>Tsuga canadensis</i> - <i>Fagus grandifolia</i> - <i>Quercus rubra</i> 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 (CES201.563).

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* (Indianpipe), 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* (Indianpipe), and occasionally *Lycopodium dendroideum* (tree

groundpine), *Coptis trifolia* (threeleaf goldthread), and *Dennstaedtia punctilobula* (eastern hayscented fern).

Most Abundant Species:

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Tree (canopy & subcanopy)	Needle-leaved tree	<i>Tsuga canadensis</i> (eastern hemlock)
Tree canopy	Broad-leaved deciduous tree	<i>Fagus grandifolia</i> (American beech) <i>Quercus rubra</i> (northern red oak)
Tree subcanopy	Broad-leaved deciduous tree	<i>Acer rubrum</i> (red maple) <i>Betula lenta</i> (sweet birch)
Tall shrub/sapling	Broad-leaved deciduous shrub	<i>Acer pensylvanicum</i> (striped maple) <i>Hamamelis virginiana</i> (American witch-hazel) <i>Viburnum acerifolium</i> (mapleleaf viburnum)
Tall shrub/sapling	Broad-leaved evergreen shrub	<i>Kalmia latifolia</i> (mountain laurel)
Herb (field)	Forb	<i>Aralia nudicaulis</i> (wild sarsaparilla) <i>Trientalis borealis</i> (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, Saratoga, 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 & 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)

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

Central New England mesic conifer forest on acidic bedrock / till (Rawinski 1984)

Eastern Hemlock: 23 (Eyre 1980)

Hemlock Forest (Thompson 1996)

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 17. Hemlock - Beech - Oak - Pine Forest in Saint-Gaudens National Historic Site (SAGA.03). August 2004. NAD 1983 / UTM easting 4819964, northing 712552.



Figure 18. Hemlock - Beech - Oak - Pine Forest (compact till/low river terrace variant) in Saint-Gaudens National Historic Site (SAGA.07). August 2004. NAD 1983 / UTM easting 4819746, northing 712114.



Figure 19. Hemlock - Beech - Oak - Pine Forest in Saint-Gaudens National Historic Site (SAGA.23). September 2004. NAD 1983 / UTM easting 4819829, northing 712189.

COMMON NAME (PARK-SPECIFIC): HEMLOCK - WHITE PINE FOREST

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: CEGLO06328

LOCAL INFORMATION

Environmental Description: This community generally occupies steep to very steep slopes, although it also occurs on more level areas above these slopes. At Saint-Gaudens National Historic Site, these dry slopes are the result of erosion into the deep glacio-fluvial and glacial lakebed sediments that comprise the site.

Vegetation Description: This is a coniferous forest type characterized by the dominance of *Tsuga canadensis* (eastern hemlock), which ranges from 60–70% cover in the canopy. *Pinus strobus* (eastern white pine) typically occurs in the community as a "super-canopy" (35 m or greater in height) above the hemlock and comprises 10–25% cover. In addition to the hemlock and eastern white pine, *Betula lenta* (sweet birch) is usually present in the canopy but in lower abundance (5–10% cover). This community has little to no shrub cover and understory herbs are sparse (<5%), but, in places, include *Polystichum acrostichoides* (Christmas fern), *Dryopteris marginalis* (marginal woodfern), *Maianthemum canadense* (Canada mayflower), *Dennstaedtia punctilobula* (eastern hayscented fern), *Trientalis borealis* (starflower), and *Mitchella repens* (partridgeberry).

Most Abundant Species:

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Tree canopy	Needle-leaved tree	<i>Pinus strobus</i> (eastern white pine) <i>Tsuga canadensis</i> (eastern hemlock)
Tree canopy	Broad-leaved deciduous tree	<i>Betula lenta</i> (sweet birch)
Herb (field)	Forb	<i>Maianthemum canadense</i> (Canada mayflower)
Herb (field)	Fern or fern ally	<i>Dryopteris marginalis</i> (marginal woodfern), <i>Polystichum acrostichoides</i> (Christmas fern)

Characteristic Species: *Pinus strobus* (eastern white pine), *Tsuga canadensis* (eastern hemlock).

Other Noteworthy Species: Information not available.

Subnational Distribution with Crosswalk Data:

<u>State</u>	<u>SRank</u>	<u>Rel</u>	<u>Conf</u>	<u>SName</u>	<u>Reference</u>
NH	SNR	=	1	Hemlock - White Pine Forest	Sperduto and Nichols 2004

Local Range: Patches of forest that are heavily dominated by conifers typically correspond to this community, with the exception of the even-aged eastern white pine stand along the eastern boundary of the park (see White Pine Successional Forest). The largest patch of this type at Saint-Gaudens National Historic Site is centered on the steep ravines in the middle of the park. Smaller patches are found on the steep slopes above Blow-Me-Up Brook and on steep, west-facing slopes at the southern end of the park.

Classification Comments: Information not available.

Other Comments: The dominance of eastern hemlock in this type distinguishes it from monotypic eastern white pine stands which most likely represent early successional versions of Hemlock - Beech - Oak - Pine Forest.

Local Description Authors: P. Bowman.

Plots: SAGA.11, SAGA.12, SAGA.13, and SAGA.25. AA points: SAGA.AA10, SAGA.AA22, SAGA.AA08.

Saint-Gaudens National Historic Site Inventory Notes: Information not available.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Forest (I)
Physiognomic Subclass	Evergreen forest (I.A.)
Physiognomic Group	Temperate or subpolar needle-leaved evergreen forest (I.A.8.)
Physiognomic Subgroup	Natural/Semi-natural temperate or subpolar needle-leaved evergreen forest (I.A.8.N.)
Formation	Rounded-crowned temperate or subpolar needle-leaved evergreen forest (I.A.8.N.b.)
Alliance	<i>Pinus strobus</i> - <i>Tsuga canadensis</i> Forest Alliance (A.127)
Alliance (English name)	Eastern White Pine - Eastern Hemlock Forest Alliance
Association	<i>Pinus strobus</i> - <i>Tsuga canadensis</i> 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).

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* (Indianpipe), *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), *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* (Indianpipe), *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), *Polytrichum* (polytrichum moss), and *Dicranum* (dicranum moss) species.

Most Abundant Species:

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Tree canopy	Needle-leaved tree	<i>Pinus strobus</i> (eastern white pine) <i>Tsuga canadensis</i> (eastern hemlock)
Tall shrub/sapling	Broad-leaved deciduous shrub	<i>Hamamelis virginiana</i> (American witch-hazel)
Herb (field)	Fern or fern ally	<i>Polystichum acrostichoides</i> (Christmas fern) <i>Thelypteris noveboracensis</i> (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, Saratoga); 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)

Eastern Hemlock: 23 (Eyre 1980)

Hemlock Forest (Thompson 1996)

White Pine - Hemlock: 22 (Eyre 1980)

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 1937a, 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 20. Hemlock - White Pine Forest in Saint-Gaudens National Historic Site (SAGA.11). August 2004. NAD 1983 / UTM easting 4819666, northing 712418.



Figure 21. Hemlock - White Pine Forest in Saint-Gaudens National Historic Site (SAGA.13). August 2004. NAD 1983 / UTM easting 4819559, northing 712321.

COMMON NAME (PARK-SPECIFIC): MEDIUM-DEPTH EMERGENT MARSH
MAP CLASS NAME: EMERGENT MARSH - SHRUB SWAMP SYSTEM

SYNONYMS

USNVC English Name: Bluejoint - Bulrush species - Threeway Sedge Herbaceous Vegetation
USNVC Scientific Name: *Calamagrostis canadensis* - *Scirpus* spp. - *Dulichium arundinaceum* Herbaceous Vegetation
USNVC Identifier: C EGL006519

LOCAL INFORMATION

Environmental Description: This is an emergent marsh that occurs in low, wet areas that are separated from the stream channel by higher streamside deposits.

Vegetation Description: Co-dominance in this community is shared by three species: *Leersia virginica* (whitegrass), *Dulichium arundinaceum* (threeway sedge), and *Typha latifolia* (broadleaf cattail). Other species, such as *Scirpus cyperinus* (woolgrass), *Lysimachia terrestris* (earth loosestrife), *Carex lupulina* (hop sedge), and the exotic *Lythrum salicaria* (purple loosestrife), are occasional in low abundance. Overall vegetative cover ranges from 80–90%.

Most Abundant Species:

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Herb (field)	Graminoid	<i>Dulichium arundinaceum</i> (threeway sedge)
		<i>Leersia virginica</i> (whitegrass)
		<i>Typha latifolia</i> (broadleaf cattail)

Characteristic Species: *Dulichium arundinaceum* (threeway sedge), *Leersia virginica* (whitegrass), *Typha latifolia* (broadleaf cattail).

Other Noteworthy Species: Information not available.

Subnational Distribution with Crosswalk Data:

<u>State</u>	<u>SRank</u>	<u>Rel</u>	<u>Conf</u>	<u>SName</u>	<u>Reference</u>
NH	SNR	=	1	Mixed Tall Graminoid - Scrub - Shrub Marsh	Sperduto and Nichols 2004

Local Range: Because of the small size of the occurrences, this is one of three wetland communities that comprise a single, emergent marsh unit on the community map. This community occupies approximately 20% of the polygon.

Classification Comments: At Saint-Gaudens National Historic Site, this community occurs in lower, wetter areas adjacent to Bluejoint Wet Meadow but above the semipermanently flooded Cattail Marsh, as part of the Blow-Me-Down Pond wetland system.

Other Comments: The invasive forb *Lythrum salicaria* (purple loosestrife) is present in this community, although at lower abundances than in Bluejoint Wet Meadow.

Local Description Authors: P. Bowman.

Plots: SAGA.18.

Saint-Gaudens National Historic Site Inventory Notes: Information not available.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Herbaceous Vegetation (V)
Physiognomic Subclass	Perennial graminoid vegetation (V.A.)
Physiognomic Group	Temperate or subpolar grassland (V.A.5.)
Physiognomic Subgroup	Natural/Semi-natural temperate or subpolar grassland (V.A.5.N.)
Formation	Seasonally flooded temperate or subpolar grassland (V.A.5.N.k.)
Alliance	<i>Calamagrostis canadensis</i> Seasonally Flooded Herbaceous Alliance (A.1400)
Alliance (English name)	Bluejoint Seasonally Flooded Herbaceous Alliance
Association	<i>Calamagrostis canadensis</i> - <i>Scirpus</i> spp. - <i>Dulichium arundinaceum</i> Herbaceous Vegetation
Association (English name)	Bluejoint - Bulrush species - Threeway Sedge Herbaceous Vegetation
Ecological System(s):	Laurentian-Acadian Floodplain Forest (CES201.587). Laurentian-Acadian Wet Meadow - Shrub Swamp (CES201.582).

GLOBAL DESCRIPTION

Concept Summary: These are seasonally flooded, mixed-composition wetland meadows of the northeastern United States. They occur on flats, floodplains of small streams, beaver meadows, and lakeshores. The substrate is muck or well-decomposed peat overlying mineral soil, usually slightly acidic (pH 5.0–6.0). After spring flooding, many sites will dry to exposed soil during the summer; others remain well saturated. The vegetation is dominated by robust graminoids or graminoids mixed with shrubs. Shrub cover can range up to 50%, but graminoid cover typically exceeds woody cover, and in some cases, shrubs are absent. The herbaceous layer is well-developed, often over 40% cover and up to nearly 100% cover. Bryophyte cover is usually little to none but may occasionally be extensive. The herbaceous layer is often dominated by some combination of *Calamagrostis canadensis* (bluejoint), *Scirpus* (bulrush) spp. (including *Scirpus cyperinus* [woolgrass], *Scirpus expansus* [woodland bulrush], and *Scirpus atrovirens* [green bulrush]), and *Dulichium arundinaceum* (threeway sedge). Other locally common species may include *Acorus calamus* (calamus), *Agrostis gigantea* (redtop), *Carex lacustris* (hairy sedge), *Carex lupulina* (hop sedge), *Carex lupuliformis* (false hop sedge), *Carex lurida* (shallow sedge), *Carex stricta* (upright sedge), *Carex utriculata* (Northwest Territory sedge), *Glyceria canadensis* (rattlesnake mannagrass), *Glyceria grandis* (American mannagrass), *Iris versicolor* (harlequin blueflag), *Hypericum ellipticum* (pale St. Johnswort), *Juncus canadensis* (Canadian rush), *Leersia oryzoides* (rice cutgrass), *Leersia virginica* (whitegrass), *Lysimachia terrestris* (earth loosestrife), *Onoclea sensibilis* (sensitive fern), *Osmunda regalis* (royal fern), *Phalaris arundinacea* (reed canarygrass), *Poa palustris* (fowl bluegrass), and *Triadenum fraseri* (Fraser's marsh St. Johnswort). *Typha latifolia* (broadleaf cattail) may occasionally be present, but these wetlands are usually slightly higher (relative to the water table) than typical cattail marshes. *Lythrum salicaria* (purple loosestrife) may be locally invasive. Shrub species typically include *Spiraea alba* (white meadowsweet) and *Salix* (willow) spp. Other shrub constituents vary from site to site and may include *Alnus incana* (gray alder), *Alnus serrulata* (hazel alder), *Cephalanthus occidentalis* (common buttonbush), *Cornus sericea* (red-osier dogwood), *Ilex verticillata* (common winterberry), *Myrica gale* (sweetgale), *Salix pedicellaris* (bog willow), *Spiraea tomentosa* (steeplebush), *Vaccinium corymbosum* (highbush blueberry), or *Viburnum dentatum* (southern arrow-wood). This association is related to other regional wet meadow types but differs in not being almost monotypically dominated by *Carex stricta* (upright sedge), *Calamagrostis canadensis* (bluejoint), or *Phalaris arundinacea* (reed canarygrass).

Environmental Description: These are seasonally flooded, mixed-composition wetland meadows of the northeastern United States. They occur on flats, floodplains of small streams, beaver meadows, and lakeshores. The substrate is muck or well-decomposed peat overlying mineral soil, usually slightly acidic (pH 5.0–6.0). After spring flooding, many sites will dry to exposed soil during the summer.

Vegetation Description: The vegetation is dominated by robust graminoids or graminoids mixed with shrubs. Shrub cover can range up to 50%, but graminoid cover typically exceeds woody cover, and in some cases, shrubs are absent. The herbaceous layer is well-developed, often over 40% cover and up to nearly 100% cover. Bryophyte cover is usually little to none but may occasionally be extensive. The herbaceous layer is often dominated by some combination of *Calamagrostis canadensis* (bluejoint), *Scirpus* (bulrush) spp. (including *Scirpus cyperinus* [woolgrass], *Scirpus expansus* [woodland bulrush], and *Scirpus atrovirens* [green bulrush]), and *Dulichium arundinaceum* (threeway sedge). Other locally common species may include *Acorus calamus* (calamus), *Agrostis gigantea* (redtop), *Carex lacustris* (hairy sedge), *Carex lupulina* (hop sedge), *Carex lupuliformis* (false hop sedge), *Carex lurida* (shallow sedge), *Carex stricta* (upright sedge), *Carex utriculata* (Northwest Territory sedge), *Glyceria canadensis* (rattlesnake mannagrass), *Glyceria grandis* (American mannagrass), *Iris versicolor* (harlequin blueflag), *Hypericum ellipticum* (pale St. Johnswort), *Juncus canadensis* (Canadian rush), *Leersia oryzoides* (rice cutgrass), *Leersia virginica* (whitegrass), *Lysimachia terrestris* (earth loosestrife), *Onoclea sensibilis* (sensitive fern), *Osmunda regalis* (royal fern), *Phalaris arundinacea* (reed canarygrass), *Poa palustris* (fowl bluegrass), and *Triadenum fraseri* (Fraser's marsh St. Johnswort). *Typha latifolia* (broadleaf cattail) may occasionally be present, but these wetlands are usually slightly higher (relative to the water table) than typical cattail marsh. *Lythrum salicaria* (purple loosestrife) may be locally invasive. Shrub species typically include *Spiraea alba* (white meadowsweet) and *Salix* (willow) spp. Other shrub constituents vary from site to site, and may include *Alnus incana* (gray alder), *Alnus serrulata* (hazel alder), *Cephalanthus occidentalis* (common buttonbush), *Cornus sericea* (red-osier dogwood), *Ilex verticillata* (common winterberry), *Myrica gale* (sweetgale), *Salix pedicellaris* (bog willow), *Spiraea tomentosa* (steepleshrub), *Vaccinium corymbosum* (highbush blueberry), or *Viburnum dentatum* (southern arrow-wood).

Most Abundant Species:

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Herb (field)	Graminoid	<i>Calamagrostis canadensis</i> (bluejoint)
		<i>Dulichium arundinaceum</i> (threeway sedge)
		<i>Scirpus atrovirens</i> (green bulrush)
		<i>Scirpus cyperinus</i> (woolgrass)
		<i>Scirpus expansus</i> (woodland bulrush)

Characteristic Species: *Calamagrostis canadensis* (bluejoint), *Dulichium arundinaceum* (threeway sedge), *Scirpus atrovirens* (green bulrush), *Scirpus cyperinus* (woolgrass), *Scirpus expansus* (woodland bulrush).

Other Noteworthy Species:

<u>Species</u>	<u>GRank</u>	<u>Type</u>	<u>Note</u>
<i>Agrostis gigantea</i> (redtop)	-	plant	exotic
<i>Lythrum salicaria</i> (purple loosestrife)	-	plant	invasive exotic
<i>Scirpus ancistrochaetus</i> (barbedbristle bulrush)	G3	plant	Federally listed endangered

USFWS Wetland System: Palustrine.

DISTRIBUTION

Range: Information not available.

States/Provinces: DE, MA, ME, NH, NY, PA, VT.

Federal Lands: NPS (Acadia, Eisenhower, Gettysburg, Saint-Gaudens, Saratoga); USFWS (Aroostook?, Assabet River?, Great Meadows?, Moosehorn, Nulhegan Basin, Oxbow).

CONSERVATION STATUS

Rank: GNR (6-Jul-1999).

Reasons: Information not available.

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 2 - Moderate.

Comments: Information not available.

Similar Associations:

Calamagrostis canadensis - *Phalaris arundinacea* Herbaceous Vegetation (CEGL005174).

Carex stricta - *Carex vesicaria* Herbaceous Vegetation (CEGL006412).

Scirpus cyperinus Seasonally Flooded Herbaceous Vegetation (CEGL006349).

Related Concepts: Information not available.

SOURCES

Description Authors: S. C. Gawler.

References: Calhoun et al. 1994, Eastern Ecology Working Group n.d., Gawler 2002, NRCS 2004, Northern Appalachian Ecology Working Group 2000, Sperduto 2000b, Sperduto and Nichols 2004, Thompson and Sorenson 2000.



Figure 22. Medium-depth Emergent Marsh in Saint-Gaudens National Historic Site (SAGA.18). September 2004. NAD 1983 / UTM easting 4819594, northing 712127.

COMMON NAME (PARK-SPECIFIC): SEMI-RICH NORTHERN HARDWOOD FOREST

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: C EGL006211

LOCAL INFORMATION

Environmental Description: This community is intermediate between the compact till/low river terrace variant of Hemlock - Beech - Oak - Pine Forest and enriched hardwood forest seeps in terms of nutrient availability and diversity of rich-site species. The Saint-Gaudens occurrences of this community type fall within the terrace flat variant, as described by Sperduto and Nichols (2004), and are found primarily on low terraces adjacent to Blow-Me-Up Brook. They occur as small (mostly <1 ac) inclusions within the surrounding Hemlock - Beech - Oak - Pine Forest.

Vegetation Description: Although *Acer saccharum* (sugar maple) is the nominal species for this type, it is actually codominant with several other species at Saint-Gaudens National Historic Site, including *Tilia americana* (American basswood), *Fraxinus americana* (white ash), and *Betula alleghaniensis* (yellow birch), with canopy cover ranging between 50–75%. Other trees present in the canopy include *Betula lenta* (sweet birch), *Tsuga canadensis* (eastern hemlock), *Acer rubrum* (red maple), *Fraxinus nigra* (black ash), *Ulmus americana* (American elm), and, at the lower end of Blow-Me-Up Brook near the confluence with Blow-Me-Down Brook, *Platanus occidentalis* (American sycamore). The subcanopy ranges between 30–60% cover and can include any of the described canopy species. The shrub layer is sparse (5–10% cover) but may include *Acer pensylvanicum* (striped maple) and *Viburnum acerifolium* (mapleleaf viburnum). The herb layer ranges from 30–50% cover and is dominated by a variety of pteridophytes, including *Matteuccia struthiopteris* (ostrich fern), *Onoclea sensibilis* (sensitive fern), *Polystichum acrostichoides* (Christmas fern), *Phegopteris connectilis* (long beechfern), *Gymnocarpium dryopteris* (western oakfern), *Dryopteris intermedia* (intermediate woodfern), *Osmunda claytoniana* (interrupted fern), *Athyrium filix-femina* (common ladyfern), and *Equisetum scirpoides* (dwarf scouringrush). Other frequent herbs include *Arisaema triphyllum* (Jack in the pulpit), *Cardamine diphylla* (crinkleroot), *Trillium erectum* (red trillium), *Amphicarpaea bracteata* (American hogpeanut), and *Prenanthes alba* (white rattlesnakeroot).

Most Abundant Species:

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Tree canopy	Broad-leaved deciduous tree	<i>Acer saccharum</i> (sugar maple) <i>Fraxinus americana</i> (white ash) <i>Tilia americana</i> (American basswood)
Herb (field)	Forb	<i>Arisaema triphyllum</i> (Jack in the pulpit)
Herb (field)	Fern or fern ally	<i>Matteuccia struthiopteris</i> (ostrich fern) <i>Polystichum acrostichoides</i> (Christmas fern)

Characteristic Species: *Acer saccharum* (sugar maple), *Arisaema triphyllum* (Jack in the pulpit), *Tilia americana* (American basswood).

Other Noteworthy Species: Information not available.

Subnational Distribution with Crosswalk Data:

<u>State</u>	<u>SRank</u>	<u>Rel</u>	<u>Conf</u>	<u>SName</u>	<u>Reference</u>
NH	SNR	=	1	Semi-rich Mesic Sugar Maple Forest	Sperduto and Nichols 2004

Local Range: The primary mappable occurrence of this community occurs along Blow-Me-Up Brook. There is also a small occurrence in a mesic cove at the southern end of the park. Because these polygons are either very narrow or quite small, it is difficult to distinguish this type on the aerial photograph from the surrounding Hemlock - Beech - Oak - Pine Forest on the uplands. The mapped polygons are actually complexes of small patches of Semi-rich Northern Hardwood Forest with larger patches of Hemlock - Beech - Oak - Pine Forest.

Classification Comments: Much of the area of this community was once classified as Rich Mesic Forest (CEGL005008), but this community lacks a number of herbaceous species diagnostic of rich mesic areas.

Other Comments: The exotic herbs *Epipactis helleborine* (broadleaf helleborine) and *Mycelis muralis* (wall-lettuce) are both frequent in this community. Although not currently considered invasive, their presence and cover should be monitored to identify any change in their abundances. Additionally, in at least one area, brush and other garden wastes were discarded in the ravine and are accumulating on the slopes above this community.

Local Description Authors: P. Bowman.

Plots: SAGA.01, SAGA.04, SAGA.05, SAGA.06, and SAGA.14.

Saint-Gaudens National Historic Site Inventory Notes: Information not available.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Forest (I)
Physiognomic Subclass	Deciduous forest (I.B.)
Physiognomic Group	Cold-deciduous forest (I.B.2.)
Physiognomic Subgroup	Natural/Semi-natural cold-deciduous forest (I.B.2.N.)
Formation	Lowland or submontane cold-deciduous forest (I.B.2.N.a.)
Alliance	<i>Acer saccharum</i> - <i>Fraxinus americana</i> - <i>Tilia americana</i> Forest Alliance (A.217)
Alliance (English name)	Sugar Maple - White Ash - American Basswood Forest Alliance
Association	<i>Acer saccharum</i> - (<i>Fraxinus americana</i>) / <i>Arisaema triphyllum</i> Forest
Association (English name)	Sugar Maple - (White Ash) / Jack-in-the-Pulpit Forest
Ecological System(s):	Laurentian-Acadian Northern Hardwoods Forest (CES201.564).

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 245–610 m (800–2000 ft) on slightly enriched soils, often silt loams derived from pelite or other subacidic bedrock. Ridgetops 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* (alternateleaf 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 245–610 m (800–2000 ft) 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* (alternateleaf 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:

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Tree canopy	Broad-leaved deciduous tree	<i>Acer saccharum</i> (sugar maple) <i>Fraxinus americana</i> (white ash)
Tree subcanopy	Broad-leaved deciduous tree	<i>Acer saccharum</i> (sugar maple)
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	<i>Acer pensylvanicum</i> (striped maple) <i>Cornus alternifolia</i> (alternateleaf dogwood) <i>Ostrya virginiana</i> (hophornbeam) <i>Sambucus racemosa</i> (red elderberry)
Herb (field)	Forb	<i>Arisaema triphyllum</i> (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, Saratoga, 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)

Semi-rich northern hardwood forest (NAP pers. comm. 1998)

Sugar Maple: 27 (Eyre 1980)

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 23. Semi-rich Northern Hardwood Forest in Saint-Gaudens National Historic Site (SAGA.01). August 2004. NAD 1983 / UTM easting 4818739, northing 712158.



Figure 24. Semi-rich Northern Hardwood Forest in Saint-Gaudens National Historic Site (SAGA.04). August 2004. NAD 1983 / UTM easting 4819898, northing 712759.



Figure 25. Semi-rich Northern Hardwood Forest in Saint-Gaudens National Historic Site (SAGA.05). August 2004. NAD 1983 / UTM easting 4819925, northing 712295.

COMMON NAME (PARK-SPECIFIC): SUCCESSIONAL OLD FIELD

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: C EGL006107

LOCAL INFORMATION

Environmental Description: Open pasture west of the Saint-Gaudens house, maintained by annual mowing.

Vegetation Description: Vegetation was not formally surveyed. Common grasses include *Phleum pratense* (timothy) and *Agrostis* (bentgrass) spp., with typical old-field forbs including *Solidago* (goldenrod) spp. and *Hieracium* (hawkweed) spp.

Most Abundant Species: Information not available.

Characteristic Species: *Phleum pratense* (timothy) and *Agrostis* (bentgrass) spp.

Other Noteworthy Species: Information not available.

Subnational Distribution with Crosswalk Data:

<u>State</u>	<u>SRank</u>	<u>Rel</u>	<u>Conf</u>	<u>SName</u>	<u>Reference</u>
NH	SNA	.	.	[not crosswalked]	.

Local Range: One 10-ac open field west of Saint-Gaudens house and one 4.4 ac field to east of the house.

Classification Comments: Information not available.

Other Comments: Vegetation not formally surveyed.

Local Description Authors: S. C. Gawler.

Plots: None. AA point: SAGA.AA29.

Saint-Gaudens National Historic Site Inventory Notes: Photo on cover.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Herbaceous Vegetation (V)
Physiognomic Subclass	Perennial graminoid vegetation (V.A.)
Physiognomic Group	Temperate or subpolar grassland (V.A.5.)
Physiognomic Subgroup	Natural/Semi-natural temperate or subpolar grassland (V.A.5.N.)
Formation	Medium-tall sod temperate or subpolar grassland (V.A.5.N.c.)
Alliance	<i>Dactylis glomerata</i> - <i>Rumex acetosella</i> Herbaceous Alliance (A.1190)
Alliance (English name)	Orchard Grass - Common Sheep Sorrel Herbaceous Alliance
Association	<i>Dactylis glomerata</i> - <i>Phleum pratense</i> - <i>Festuca</i> spp. - <i>Solidago</i> 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).

GLOBAL DESCRIPTION

Concept Summary: This broadly defined vegetation type includes pastures and post-agricultural fields and is largely composed of nonnative cool-season grasses and herbs (generally of European origin) in the early stages of succession. The fields are typically mowed at least

annually. Physiognomically, these grasslands are generally comprised of mid-height (1–3 feet tall) grasses and forbs, with occasional scattered shrubs. Species composition varies from site to site, depending on land-use history and perhaps soil type, but in general this vegetation is quite wide-ranging in northeastern and midwestern states and at higher elevations (610–1220 m [2000–4000 ft]) 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:

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Herb (field)	Forb	<i>Rumex acetosella</i> (common sheep sorrel)
Herb (field)	Graminoid	<i>Dactylis glomerata</i> (orchardgrass)
		<i>Festuca rubra</i> (red fescue)
		<i>Phleum pratense</i> (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* (winkleleaf goldenrod).

Other Noteworthy Species:

<u>Species</u>	<u>GRank</u>	<u>Type</u>	<u>Note</u>
<i>Anthoxanthum odoratum</i> (sweet vernalgrass)	-	plant	exotic
<i>Bromus tectorum</i> (cheatgrass)	-	plant	exotic
<i>Dactylis glomerata</i> (orchardgrass)	-	plant	exotic
<i>Daucus carota</i> (Queen Anne's lace)	-	plant	exotic
<i>Elymus repens</i> (quackgrass)	-	plant	exotic
<i>Lolium perenne</i> (perennial ryegrass)	-	plant	exotic
<i>Phleum pratense</i> (timothy)	-	plant	exotic
<i>Poa compressa</i> (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, Saratoga, 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 nonnative grasses and herbs (generally of European origin).

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 3 - Weak.

Comments: *Schizachyrium scoparium* - (*Andropogon virginicus*) - *Solidago* spp. Herbaceous Vegetation (CEGL006333) is similar to this type but is dominated by warm-season grasses.

Similar Associations:

Lolium (*arundinaceum*, *pratense*) Herbaceous Vegetation (CEGL004048).

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, Newbold et al. 1988, Perles et al. 2006a, Perles et al. 2006b, Perles et al. 2006c, Perles et al. 2007, Sneddon et al. 1995, TDNH unpubl. Data.



Figure 26. Successional Old Field in Saint-Gaudens National Historic Site (SAGA.AA29). September 2006. NAD 1983 / UTM easting 4819769, northing 712590.

COMMON NAME (PARK-SPECIFIC): WHITE PINE SUCCESSIONAL FOREST

SYNONYMS

USNVC English Name: Eastern White Pine Successional Forest
USNVC Scientific Name: *Pinus strobus* Successional Forest
USNVC Identifier: CEGLO07944

LOCAL INFORMATION

Environmental Description: This successional forest type is found on gentle to moderate slopes along the southeast edge of the park.

Vegetation Description: This association occurs where *Pinus strobus* (eastern white pine) forms an almost monotypic canopy, mixed with minor amounts of *Quercus rubra* (northern red oak) and *Tsuga canadensis* (eastern hemlock). No information is available on herb cover.

Most Abundant Species:

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Tree canopy	Needle-leaved tree	<i>Pinus strobus</i> (eastern white pine)

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

Other Noteworthy Species: Information not available.

Subnational Distribution with Crosswalk Data:

<u>State</u>	<u>SRank</u>	<u>Rel</u>	<u>Conf</u>	<u>SName</u>	<u>Reference</u>
NH	SNA	.	.	[not crosswalked]	.

Local Range: This type is restricted to a single polygon on the southeast edge of the park.

Classification Comments: The single polygon mapped as this type appears as if it is trending towards Hemlock - Beech - Oak - Pine Forest as succession proceeds.

Other Comments: This type was not originally recognized as a distinct type at the park and was not sampled. No photograph available.

Local Description Authors: S. C. Gawler.

Plots: None. AA point: SAGA.AA18.

Saint-Gaudens National Historic Site Inventory Notes: Information not available.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Forest (I)
Physiognomic Subclass	Evergreen forest (I.A.)
Physiognomic Group	Temperate or subpolar needle-leaved evergreen forest (I.A.8.)
Physiognomic Subgroup	Natural/Semi-natural temperate or subpolar needle-leaved evergreen forest (I.A.8.N.)
Formation	Rounded-crowned temperate or subpolar needle-leaved evergreen forest (I.A.8.N.b.)
Alliance	<i>Pinus strobus</i> Forest Alliance (A.128)
Alliance (English name)	Eastern White Pine Forest Alliance
Association	<i>Pinus strobus</i> Successional Forest
Association (English name)	Eastern White Pine Successional Forest
Ecological System(s):	Information not available.

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:

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Tree canopy	Needle-leaved tree	<i>Pinus strobus</i> (eastern white pine)

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

Other Noteworthy Species:

<u>Species</u>	<u>GRank</u>	<u>Type</u>	<u>Note</u>
<i>Achillea millefolium</i> (common yarrow)	-	plant	exotic
<i>Agrostis gigantea</i> (redtop)	-	plant	exotic
<i>Anthoxanthum odoratum</i> (sweet vernalgrass)	-	plant	exotic
<i>Berberis thunbergii</i> (Japanese barberry)	-	plant	exotic
<i>Daucus carota</i> (Queen Anne's lace)	-	plant	exotic
<i>Elaeagnus umbellata</i> (autumn olive)	-	plant	exotic
<i>Elymus repens</i> (quackgrass)	-	plant	exotic
<i>Lonicera morrowii</i> (Morrow's honeysuckle)	-	plant	exotic
<i>Rosa multiflora</i> (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, Saratoga); 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.

No photograph available.

Appendix G. Index of representative photographs of vegetation classification sampling plots and accuracy assessment points at Saint-Gaudens National Historic Site.

	Page
Alder - Dogwood Alluvial Thicket	
Figure 9. SAGA.21	66
Figure 10.SAGA.22	67
Aquatic Bed	
Figure 11. SAGA.20	72
Bluejoint Wet Meadow	
Figure 12. SAGA.17	76
Figure 13. SAGA.19	77
Cattail Marsh	
Figure 14. SAGA.16	82
Cobble - Sand River Channel	
Figure 15. SAGA.15	87
Enriched Hardwood Forest Seep	
Figure 16. SAGA.10	92
Hemlock - Beech - Oak - Pine Forest	
Figure 17. SAGA.03	97
Figure 18. SAGA.07	98
Figure 19. SAGA.23	98
Hemlock - White Pine Forest	
Figure 20. SAGA.11	102
Figure 21. SAGA.13	103
Medium-depth Emergent Marsh	
Figure 22. SAGA.18	108
Semi-rich Northern Hardwood Forest	
Figure 23. SAGA.01	113
Figure 24. SAGA.04	113
Figure 25. SAGA.05	114
Successional Old Field	
Figure 26. SAGA.AA29	118
White Pine Successional Forest	No photograph available

Index of Photographs by Plot Number

SAGA.01 Semi-rich Northern Hardwood Forest.....113
SAGA.03 Hemlock - Beech - Oak - Pine Forest97
SAGA.04 Semi-rich Northern Hardwood Forest.....113
SAGA.05 Semi-rich Northern Hardwood Forest.....114
SAGA.07 Hemlock - Beech - Oak - Pine Forest98
SAGA.10 Enriched Hardwood Forest Seep.....92
SAGA.11 Hemlock - White Pine Forest.....102
SAGA.13 Hemlock - White Pine Forest.....103
SAGA.15 Cobble - Sand River Channel.....87
SAGA.16 Cattail Marsh.....82
SAGA.17 Bluejoint Wet Meadow76
SAGA.18 Medium-depth Emergent Marsh108
SAGA.19 Bluejoint Wet Meadow77
SAGA.20 Aquatic Bed.....72
SAGA.21 Alder - Dogwood Alluvial Thicket66
SAGA.22 Alder - Dogwood Alluvial Thicket67
SAGA.23 Hemlock - Beech - Oak - Pine Forest98

Index of Photographs by Accuracy Assessment Number

SAGA.AA29 Successional Old Field.....118

Appendix H. Bibliography for global vegetation descriptions from the U.S. National Vegetation Classification System.

- Ambrose, J. 1990a. Georgia's natural communities--A preliminary list. Unpublished document. Georgia Natural Heritage Inventory. 5 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.
- Bowman, P. 2000. Draft classification for Delaware. Unpublished draft. Delaware Natural Heritage Program.
- Breden, T. F. 1989. A preliminary natural community classification for New Jersey. Pages 157–191 in: E. F. Karlin, editor. New Jersey's rare and endangered plants and animals. Institute for Environmental Studies, Ramapo College, Mahwah, NJ. 280 pp.
- Breden, T. F., Y. R. Alger, K. S. Walz, and A. G. Windisch. 2001. Classification of vegetation communities of New Jersey: Second iteration. Association for Biodiversity Information and New Jersey Natural Heritage Program, Office of Natural Lands Management, Division of Parks and Forestry, New Jersey Department of Environmental Protection, Trenton.
- Brown, 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.
- Browning, M. 1859. Forty-four years of the life of a hunter; being reminiscences of Meshach Browning, a Maryland hunter, roughly written down by himself. Ill. E. Stabler. J. B. Lippincott Company, Philadelphia. Reprinted in 2003 by Appalachian Background, Oakland. 400 pp.
- 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.
- CAP [Central Appalachian Forest Working Group]. 1998. Central Appalachian Working group discussions. The Nature Conservancy, Boston, MA.
- Calhoun, A. J. K., J. E. Cormier, R. B. Owen, Jr., A. F. O'Connell, Jr., C. T. Roman, and R. W. Tiner, Jr. 1994. The wetlands of Acadia National Park and vicinity. Maine Agricultural and Forest Experiment Station Miscellaneous Publication 721. 108 pp.
- 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. 1996. Natural communities of Delaware. Unpublished review draft. Delaware Natural Heritage Program, Division of Fish and Wildlife, Delaware Division of Natural Resources and Environmental Control, Smyrna, DE. 52 pp.
- Clark, J. S. 1986. Vegetation and land-use history of the William Floyd Estate, Fire Island National Seashore, Long Island, New York. USDI, National Park Service, North Atlantic Region, Office of Scientific Studies. 126 pp.
- Comer, P. J., D. A. Albert, H. A. Wells, B. L. Hart, J. B. Raab, D. L. Price, D. M. Kashian, R. A. Corner, and D. W. Schuen. 1995a. Michigan's Native Landscape, as Interpreted from the General Land Office Surveys 1816–1856. Michigan Natural Features Inventory, Lansing, MI. 78 pp. plus digital map.
- Comer, P. J., D. A. Albert, and M. Austin (cartography). 1998. Vegetation of Michigan circa 1800: An interpretation of the General Land Office Surveys 1816–1856. Michigan Natural Features Inventory, Lansing, MI. 2-map set, scale: 1:500,000.
- Comer, P. J., and D. A. Albert. 1997. Natural community crosswalk. Unpublished draft of February 20, 1997. Michigan Natural Features Inventory, Lansing, MI.
- Comer, P., D. Faber-Langendoen, R. Evans, S. Gawler, C. Josse, G. Kittel, S. Menard, M. Pyne, M. Reid, K. Schulz, K. Snow, and J. Teague. 2003. Ecological systems of the United States: A working classification of U.S. terrestrial systems. NatureServe, Arlington, 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.
- Dowhan, J. J., and R. Rozsa. 1989. Flora of Fire Island, Suffolk County, 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. 166 pp.
- Elliman, T. 2003. Boston Harbor Islands plant communities. Report submitted to Massachusetts Natural Heritage & Endangered Species Program, Massachusetts Division of Fisheries & Wildlife, Westborough.
- Enser, R. 1999. Natural communities of Rhode Island. Unpublished draft, December 1999. 22 pp.
- Eyre, F. H., editor. 1980. Forest cover types of the United States and Canada. Society of American Foresters, Washington, DC. 148 pp.
- FNAI [Florida Natural Areas Inventory]. 1990. Guide to the natural communities of Florida. Florida Natural Areas Inventory and Florida Department of Natural Resources, Tallahassee. 111 pp.
- 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., 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, 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. 114 pp. plus appendices.
- Fortney, R. H. 1975. The vegetation of Canaan Valley, West Virginia: A taxonomic and ecological study. Ph.D. dissertation, University of West Virginia, Morgantown.
- Foti, T., M. Blaney, X. Li, and K. G. Smith. 1994. A classification system for the natural vegetation of Arkansas. Proceedings of the Arkansas Academy of Science 48:50–53.
- Francl, K. E., W. M. Ford, and S. B. Castleberry. 2004. Characterization of high elevation central Appalachian wetlands. Research Paper NE-725. USDA Forest Service, Northeastern Research Station, Newtown Square, PA. 26. pp.
- 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]
- Gordon, R. B. 1937a. The botanical survey of the Allegheny State Park. New York State Museum Handbook 17:23–88. State University of New York, Albany.
- 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.
- 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., compiler. 2004. Classification of vegetation communities of Maryland: First iteration. A subset of the International Classification of Ecological Communities: Terrestrial Vegetation of the United States, NatureServe. Maryland Natural Heritage Program, Maryland Department of Natural Resources, Annapolis. 243 pp.
- Hoagland, B. 2000. The vegetation of Oklahoma: A classification for landscape mapping and conservation planning. The Southwestern Naturalist 45(4):385–420.

- 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.
- INAI [Iowa Natural Areas Inventory]. No date. Vegetation classification of Iowa. Iowa Natural Areas Inventory, Iowa Department of Natural Resources, Des Moines.
- Keever, C. 1979. Mechanisms of plant succession on old fields of Lancaster County, Pennsylvania. *Bulletin of the Torrey Botanical Club* 106(4):299–308.
- MENHP [Maine Natural Heritage Program]. 1991. Natural landscapes of Maine: A classification of ecosystems and natural communities. Unpublished document. Office of Comprehensive Planning, Maine Natural Heritage Program, Augusta. 77 pp.
- Metzler, K. J., and J. P. Barrett. 2001. Vegetation classification for Connecticut. Draft 5/21/2001. Connecticut Department of Environmental Protection, Natural Resources Center, Natural Diversity Database, Hartford.
- Metzler, K. J., and J. P. Barrett. 2004. Vegetation classification for Connecticut. Draft. State Geological and Natural History Survey of Connecticut, Department of Environmental Protection, Hartford, CT.
- Midwestern Ecology Working Group of NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Terrestrial Vegetation. NatureServe, Minneapolis, MN.
- NAP [Northern Appalachian-Boreal Forest Working Group]. 1998. Northern Appalachian-Boreal Working group discussions. The Nature Conservancy, Boston, MA.
- NRCS [Natural Resources Conservation Service]. 2004. Soil survey of Saratoga County, New York. USDA Natural Resources Conservation Service. 590 pp.
- NatureServe Ecology - Southeastern United States. No date. Unpublished data. NatureServe, Durham, NC.
- Nelson, P. W. 1985. The terrestrial natural communities of Missouri. Missouri Natural Areas Committee, Jefferson City. 197 pp. Revised edition, 1987.
- Newbold, A., J. Evert, and J. Holt. 1988. Rare plant and general flora survey of the White Clay Creek Park, Newcastle County, Delaware. 40 pp.
- Nichols, 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.
- Peet, R. K., T. R. Wentworth, M. P. Schafale, and A.S. Weakley. 2002. Unpublished data of the North Carolina Vegetation Survey. University of North Carolina, Chapel Hill.
- Penfound, W. T. 1953. Plant communities of Oklahoma lakes. *Ecology* 34:561–583.
- 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, 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: Volume 2 of 2 -Appendix G. Technical Report NPS/NER/NRTR- -2007/076. 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 Historic Park. Technical Report NPS/NER/NRTR--2006/058. National Park Service, Philadelphia, PA.

- Perles, S., G. Podniesinski, and J. Wagner. 2004. Classification, assessment and protection of non-forested floodplain wetlands of the Susquehanna drainage. Report to the U.S. Environmental Protection Agency and Pennsylvania Department of Conservation and Natural Resources. Pennsylvania Natural Heritage Program, Harrisburg. 128 pp.
- Rawinski, T. 1984. Natural community description abstract - southern New England calcareous seepage swamp. Unpublished report. The Nature Conservancy, Boston, MA. 6 pp.
- 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.
- Schafale, M. P., and A. S. Weakley. 1990. Classification of the natural communities of North Carolina. Third approximation. North Carolina Department of Environment, Health, and Natural Resources, Division of Parks and Recreation, Natural Heritage Program, Raleigh. 325 pp.
- 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. 369 pp.
- Schotz, Al. Personal communication. Community Ecologist. Alabama Natural Heritage Program. Huntingdon College, Massey Hall, 1500 East Fairview Avenue, Montgomery, AL 36106-2148.
- 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.
- Southeastern Ecology Working Group of NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Terrestrial Vegetation. NatureServe, Durham, NC.
- 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., and W. F. Nichols. 2004. Natural communities of New Hampshire: A guide and classification. New Hampshire Natural Heritage Inventory, DRED Division of Forests and Lands, Concord. 242 pp.
- 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. 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. 39 pp.
- 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.
- 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. 146 pp.

- 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.
- 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. USDI National Park Service. Philadelphia, PA.
- WNHIP [Wisconsin Natural Heritage Inventory Program]. No date. Vegetation classification of Wisconsin and published data. Wisconsin Natural Heritage Program, Wisconsin Department of Natural Resources, Madison.
- 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.
- 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.
- Zanoni, T. A., P. G. Risser, and I. H. Butler. 1979. Natural areas for Oklahoma. Oklahoma Natural Heritage Program, Norman. 72 pp.

The Department of the Interior protects and manages the nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors its special responsibilities to American Indians, Alaska Natives, and affiliated Island Communities.

NPS 428/114389, May 2012

National Park Service
U.S. Department of the Interior



Natural Resource Stewardship and Science
1201 Oakridge Drive, Suite 150
Fort Collins, CO 80525

www.nature.nps.gov

EXPERIENCE YOUR AMERICA™