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Natural Resource Stewardship and Science

National Park Service Vegetation Inventory Program

Saint Croix National Scenic Riverway, Minnesota/Wisconsin

Natural Resource Report NPS/GLKN/NRR—2012/547



ON THE COVER
A backwater oxbow of the Saint Croix River, between St. Croix Falls and Osceola, Wisconsin.
Photograph by Kevin Hop.

National Park Service Vegetation Inventory Program

Saint Croix National Scenic Riverway, Minnesota/Wisconsin

Natural Resource Report NPS/GLKN/NRR—2012/547

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Contents

Page

Figures vii

Tables ix

Appendices xi

Executive Summary xiii

Acknowledgments xv

Introduction 1

Saint Croix National Scenic Riverway Vegetation Mapping Project 1

The National Park Service Vegetation Inventory Program 2

Natural Resource Inventory and Monitoring Program 2

Vegetation Inventory Program Standards 2

The National Vegetation Classification Standard 3

Content Standard for Digital Geospatial Metadata 4

Saint Croix National Scenic Riverway 4

Project Overview 9

General Process 9

Scoping Meeting 9

Project Boundary Extent 10

Aerial Photography 11

Minimum Mapping Units 13

Classification Organization 13

Vegetation Classification 15

Methods 15

Preliminary Classification 15

Contents (continued)

Page

Data Collection Preparation 15
Field Sampling 16
Data Analyses, Results, and Discussion 18
Vegetation Mapping 29
Methods 29
Preliminary Map Classification 29
Field Reconnaissance 29
Map Classification 30
Photointerpretation 32
Digital Map Automation and Database Development 33
Results 34
Map Classes 34
Map Classification Descriptions 44
Summary Report of the Map Layer 44
Brief Analysis and Discussion 51
Map Layer Presentation 52
Accuracy Assessment 55
Methods 55
Purpose 55
Sampling Design 55
Field Data Collection 56
Data Analyses 57
Results 61

Contents (continued)

Page

Users' Accuracy (Errors of Commission)..... 61

Producers' Accuracy (Errors of Omission)..... 65

References..... 69

Figures

Page

Figure 1. Saint Croix National Scenic Riverway, Minnesota/Wisconsin (courtesy nps.gov). 5

Figure 2. The upper reach of the Namekagon River (south of Namekagon Lake), Wisconsin, shown here as a small, narrow stream. 6

Figure 3. The upper end of Trego Flowage along the Namekagon River, near Trego, Wisconsin. 6

Figure 4. The Saint Croix Flowage held by Gordon Dam, Wisconsin. 7

Figure 5. The Saint Croix River just below Gordon Dam, Wisconsin. 7

Figure 6. The well-developed riverine system of the Saint Croix River several miles below the confluence of the Saint Croix and Namekagon Rivers, Wisconsin. 7

Figure 7. A stretch of the Dalles gorge south of St. Croix Falls, Wisconsin. 7

Figure 8. The developed floodplain corridor of the Saint Croix River further south of the Dalles, Minnesota/Wisconsin. 7

Figure 9. A distant view of Lake Saint Croix, a riverine lake in Minnesota/Wisconsin. 8

Figure 10. Canoeing the Dalles, Minnesota/Wisconsin; near Old Man Cliff. 8

Figure 11. A river boat touring the Dalles, Minnesota/Wisconsin. 8

Figure 12. Project boundary for the Saint Croix National Scenic Riverway (SACN; Minnesota/Wisconsin) vegetation mapping project. 10

Figure 13. Centers of color-infrared aerial photographs (1:12,000-scale) obtained in October 2005 for the Saint Croix National Scenic Riverway (SACN; Minnesota/Wisconsin) vegetation mapping project. 12

Figure 14. Example of a vegetation plot for the Saint Croix National Scenic Riverway (Minnesota/Wisconsin) vegetation mapping project. 17

Figure 15. Locations of 230 vegetation plots for the Saint Croix National Scenic Riverway (SACN; Minnesota/Wisconsin) vegetation mapping project. 19

Figure 16. Locations of 63 quick plots for the Saint Croix National Scenic Riverway (SACN; Minnesota/Wisconsin) vegetation mapping project. 20

Figures (continued)

Page

Figure 17. General vegetation groups as defined by cluster and ordination analyses for the vegetation classification of the Saint Croix National Scenic Riverway (Minnesota/Wisconsin). 21

Figure 18. Field reconnaissance to correlate aerial photo signatures with ground vegetation for the Saint Croix National Scenic Riverway (Minnesota/Wisconsin) vegetation mapping project. 30

Figure 19. Vegetation of the Saint Croix National Scenic Riverway (SACN; Minnesota/Wisconsin) and environs, presented at the natural/semi-natural macrogroup and the cultural class levels of the National Vegetation Classification Standard, Version 2 (FGDC 2008). 53

Figure 20. A field botanist collecting data at an accuracy assessment site for the Saint Croix National Scenic Riverway (Minnesota/Wisconsin) vegetation mapping project. 57

Figure 21. Locations of accuracy assessment sites used to validate the vegetation map layer for the Saint Croix National Scenic Riverway (SACN; Minnesota/Wisconsin) vegetation mapping project 60

Tables

Page

Table 1. Timeline of the vegetation mapping initiative for the Great Lakes Network. 1

Table 2. Hierarchy for natural/semi-natural vegetation (with examples) in the National Vegetation Classification Standard, Version 2 (FGDC 2008). 4

Table 3. Hierarchy for cultural vegetation (with examples) in the National Vegetation Classification Standard, Version 2 (FGDC 2008). 4

Table 4. Aerial photography sets for the Saint Croix National Scenic Riverway (Minnesota/Wisconsin) vegetation mapping project. 11

Table 5. Plot sizes used for vegetation plot sampling for the Saint Croix National Scenic Riverway (Minnesota/Wisconsin) vegetation mapping project. 16

Table 6. Cover classes and vegetation strata used during vegetation plot sampling for the Saint Croix National Scenic Riverway (Minnesota/Wisconsin) vegetation mapping project. 17

Table 7. List of floristic vegetation types of Saint Croix National Scenic Riverway (Minnesota/Wisconsin) that were identified after the collection of vegetation plots in 2007..... 23

Table 8. List of floristic vegetation types of Saint Croix National Scenic Riverway (Minnesota/Wisconsin), with number of field observations..... 24

Table 9. Physiognomic modifiers assigned to polygons during photointerpretation for the Saint Croix National Scenic Riverway (Minnesota/Wisconsin) vegetation mapping project. 32

Table 10. Map classification with crosswalk to the National Vegetation Classification Standard, Version 2 (FGDC 2008), for the Saint Croix National Scenic Riverway (Minnesota/Wisconsin) vegetation mapping project. 35

Table 11. Frequencies and areas of map classes (organized via the National Vegetation Classification Standard, Version 2 [FGDC 2008]) represented in the vegetation map layer for the Saint Croix National Scenic Riverway (Minnesota/Wisconsin) vegetation mapping project. 45

Table 12. Frequencies and areas of map classes (compiled at the macrogroup level in the National Vegetation Classification Standard, Version 2 [FGDC 2008]) represented in the vegetation map layer for the Saint Croix National Scenic Riverway (Minnesota/Wisconsin) vegetation mapping project. 49

Appendices

Page

Appendix A: Plot Sampling Form A-1

Appendix B: Descriptions of Vegetation Types B-1

Appendix C: Field Key to Vegetation Types C-1

Appendix D: List of Plant Species D-1

Appendix E: Descriptions of Map Classes E-1

Appendix F: Accuracy Assessment Form F-1

Appendix G: Accuracy Assessment Contingency Table G-1

Executive Summary

The National Park Service (NPS) Vegetation Inventory Program (VIP) is an effort to classify, describe, and map existing vegetation of national park units for the NPS Natural Resource Inventory and Monitoring (I&M) Program. The NPS VIP is managed by the NPS Biological Resources Management Division and provides baseline vegetation information to the NPS Natural Resource I&M Program. The U.S. Geological Survey (USGS) Vegetation Characterization Program lends a cooperative role in the NPS VIP. The USGS Upper Midwest Environmental Sciences Center, NatureServe, NPS Great Lakes Network, and NPS Saint Croix National Scenic Riverway (SACN) have completed vegetation classification and mapping of the SACN and surroundings.

Photointerpreters, ecologists, and botanists collaborated to identify and describe vegetation types within the National Vegetation Classification Standard (NVCS) and to determine how best to map them by using aerial photographs. The team collected 230 vegetation sampling plots within the SACN project extent. In addition, another 63 quick plots were collected to support the development of the vegetation classification. Furthermore, data from 1,290 accuracy assessment (AA) sites were collected (of which 1,257 were used to test accuracy of the vegetation map layer). These data sets led to the identification of 71 floristic types (of which 69 are at the association level and two are at the alliance level) in the NVCS at SACN. Additional vegetation types are recognized at the group level of the NVCS.

A total of 68 map classes (including map-class phases) were developed to map the vegetation and general land cover of the SACN and environs, including the following: 61 map classes representing natural/semi-natural vegetation types at various levels in the NVCS, four map classes representing cultural vegetation (e.g., developed lands) in the NVCS, and three map classes representing non-vegetation features (e.g., open-water bodies). Features were interpreted by using high-quality stereoscopes over light tables and 1:12,000-scale, color-infrared aerial photographs dated October 2005 (during fall leaf change). Polygon units were mapped to a 0.5 ha minimum mapping unit. An ancillary set of 1:12,000-scale, true-color aerial photographs dated April 2006 and April 2007 (during leaf-off conditions) covering the entire SACN lands were used for additional reference during mapping. The interpreted data were digitally and spatially referenced, making the spatial database layers usable in geographic information systems.

A geodatabase containing various feature-class layers and tables show the locations of vegetation types and general land cover (vegetation map), vegetation plot samples, AA sites, project boundary extent, and aerial photographic centers. The feature-class layer for the SACN vegetation map provides 32,751 polygons of detailed attribute data and covers 68,216.7 ha, with an average polygon size of 2.1 ha. Of the area mapped, 30,891 polygons (94.3%) represent natural/semi-natural types in the NVCS, encompassing 51,523.7 ha (75.5%) of the total map extent.

Summary reports generated from the vegetation map layer indicate that forest types (primarily of the Northern Mesic Hardwood & Conifer Forest Macrogroup) dominate the vegetation landscape (NVCS types), populating 78.9% of polygons and covering 66.2% of area. A thematic AA study was conducted of map classes representing floristic types in the NVCS. Results present an

overall accuracy of 77.2% (kappa index of 76.4%) based on data from 1,257 of the 1,290 AA sites. Most individual map-class themes exceed the NPS VIP standard of 80% with a 90% confidence interval.

The SACN vegetation mapping project delivers many geospatial and vegetation data products in hardcopy and digital formats. These products consist of an in-depth project report discussing methods and results, which include descriptions and a dichotomous key to vegetation types, map classification and map-class descriptions, and a contingency table showing AA results. The suite of products also includes ground photos of vegetation types; a database of vegetation plots and AA sites; field data sheets; aerial photographic prints and images; hardcopy and digital maps; and a geodatabase of vegetation types (map layer), fieldwork locations (vegetation plots and AA sites), aerial photographic indexes, a project boundary, and metadata. All geospatial products are projected in Universal Transverse Mercator, Zone 15, by using the North American Datum of 1983. More NPS VIP information and products of completed park mapping projects are on the Internet at <http://science.nature.nps.gov/im/inventory/veg> and <http://biology.usgs.gov/npsveg>.

Acknowledgments

The success of this complex project was dependent on the collaborative efforts of several individuals from various organizations. The dedicated folks who worked on this project collectively have a wide array of skill and expertise, essential in moving the National Park Service (NPS) Saint Croix National Scenic Riverway (SACN) vegetation mapping project to its completion. We wish to acknowledge those individuals who have been essential in making this project a success.

We respectfully thank the NPS Vegetation Inventory Program (VIP) and the U.S. Geological Survey (USGS) Vegetation Characterization Program (VCP) staff for entrusting this project to us, including Karl Brown (NPS VIP Coordinator) for funding the SACN vegetation mapping project, Mike Mulligan (USGS VCP Coordinator) for providing additional funding support for the vegetation mapping effort, and Tammy Cook (NPS VIP) for giving us guidance when we needed it.

We also thank Bill Route and Ulf Gafvert of the NPS Great Lakes Network for supporting and coordinating a cluster approach to classify and map the remaining six national park units within the network. Further thanks are given to Ulf for managing the acquisition of fall, color-infrared aerial photography for the project, and furthermore, for providing an additional set of spring, leaf-off, true-color aerial photographs, which greatly assisted us in our mapping.

Thanks are also in order to the NPS SACN staff—particularly Robin Maercklein—for hosting this project, with its series of meetings, training sessions, and field efforts. The staff provided the project with valuable local knowledge of the landscape of SACN and insight into local management and research needs.

We also acknowledge and thank our field teams who spent many hours collecting the data that formed the basis of so much of this project. We also acknowledge and thank our field teams who spent many hours collecting the data that formed the basis of so much of this project. We thank Norm Aaseng of the Minnesota Department of Natural Resources and Eric Epstein of the Wisconsin Department of Natural Resources for help with classification questions. Our field crews, who did so much for advancing this project were as follows: for plot collection, Barb Delaney, Samantha Engh, Ann Singsaas, Gina Quiram, Matt Smith, and Nicole Soper-Gorden; and for accuracy assessment (AA) collections Jake Davidson, Stephanie Erlandson, Chris Groebner, Ken Hiser, Greg Kolari, Heidi Langrehr, Janet Marr, and Ruth Nissen.

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This project required the cooperation and assistance of many individuals. Their diligence in working on this multifarious project is highly regarded and appreciated because their labors went toward so many aspects of this project—from developing the vegetation classification to creating the spatial geodatabase.

Introduction

Saint Croix National Scenic Riverway Vegetation Mapping Project

The Saint Croix National Scenic Riverway (SACN) vegetation mapping project is an initiative of the National Park Service (NPS) Vegetation Inventory Program (VIP), with cooperative support from the U.S. Geological Survey (USGS) Vegetation Characterization Program (VCP) to classify and map plant communities of SACN. The goals of the project are to adequately describe and map plant communities of SACN and its immediate surroundings and to provide the NPS Natural Resource Inventory and Monitoring (I&M) Program, resource managers, and biological researchers with useful baseline vegetation information.

The SACN vegetation mapping project is also part of a cluster approach to classify and map plant communities for six of the remaining park units within the Great Lakes Network (GLKN) of the I&M Program. A cluster approach provided an avenue for advancing consistency of the vegetation classification throughout the network as well as the mapping thereof. With Voyageurs National Park and Isle Royale National Park already completed (mid-1990s), six GLKN park units needing vegetation inventory remained, including the Apostle Islands National Lakeshore, Grand Portage National Monument, Indiana Dunes National Lakeshore, Pictured Rocks National Lakeshore, Saint Croix National Scenic Riverway, and Sleeping Bear Dunes National Lakeshore. The Mississippi National River and Recreation Area (MISS) is also within the GLKN; however, the MISS was not included in this six-cluster effort. With this cluster of six park units, an approach was taken to classify and map the vegetation of these park units in a somewhat staggered timeline (Table 1), providing some opportunity to share results and experiences from park units of the same regional locale.

Table 1. Timeline of the vegetation mapping initiative for the Great Lakes Network.

[AA, Accuracy Assessment; Clsf, Classification; Mtg, Meeting; Veg, Vegetation]

National Park	2004	2005	2006	2007	2008	2009	2010	2011
Indiana Dunes National Lakeshore	Air Photos	Scope Mtg Veg Plots	Veg Clsf Mapping	Mapping Field AA	AA Analysis Wrap-up	Product Updates		
Apostle Islands National Lakeshore	Air Photos	Scope Mtg Veg Plots	Veg Plots	Veg Clsf Mapping	Mapping Field AA	AA Analysis Wrap-up	Wrap-up	
Pictured Rocks National Lakeshore		Air Photos	Scope Mtg Veg Plots	Veg Clsf Mapping	Mapping Field AA	AA Analysis Wrap-up	Wrap-up	
Grand Portage National Monument			Air Photos	Scope Mtg Veg Plots	Mapping	Field AA AA Analysis	Wrap-up	
Sleeping Bear Dunes National Lakeshore				Scope Mtg Veg Plots Air Photos	Veg Clsf Mapping	Mapping Field AA	AA Analysis	Wrap-up
Saint Croix National Scenic Riverway		Air Photos	Scope Mtg Veg Plots	Veg Plots Veg Clsf Mapping	Veg Clsf Mapping	Mapping Field AA	Field AA AA Analysis	AA Analysis Wrap-up

We officially inaugurated the SACN vegetation mapping project in spring of 2006, with a scoping meeting wherein partners discussed project objectives, goals, and methods. Major collaborators at this meeting included staff from the NPS VIP, NPS GLKN, the NPS SACN, NatureServe and its constituents, and the USGS Upper Midwest Environmental Sciences Center. Common to all NPS VIP projects, the three major components of the SACN vegetation mapping

project are as follows: (1) vegetation classification, (2) vegetation mapping, and (3) map accuracy assessment. In this report, we discuss each of these fundamental components in detail.

The National Park Service Vegetation Inventory Program

The NPS VIP is an effort to classify, describe, and map existing vegetation of national park units. Managed by the NPS Biological Resources Management Division, the NPS VIP provides baseline vegetation information for the NPS Natural Resource I&M Program. The USGS VCP lends a cooperative role in the NPS VIP. Vegetation layers and associated information support a wide variety of resource assessment, park management, and planning needs. They also provide structure for framing and answering critical scientific questions about vegetation communities and their relation to environmental processes across the landscape.

Program scientists developed procedures for classification, mapping, and accuracy assessment (The Nature Conservancy [TNC] and Environmental Systems Research Institute 1994a, 1994b, TNC et al. 1994, NatureServe 2004). Ecology and mapping teams worked together to share knowledge and data and to resolve issues regarding classification and mapping procedures. The NPS VIP products meet Federal Geographic Data Committee (FGDC) standards for vegetation classification and metadata and meet national standards for spatial accuracy and data transfer. Mapping standards include a minimum mapping unit (MMU) of 0.5 ha and classification accuracy meeting or exceeding 80% (with a 90% confidence level) for map classes representing plant communities. All geospatial products are projected in Universal Transverse Mercator (UTM) and use the North American Datum of 1983 (NAD83).

The NPS VIP provides an array of data products. Mapping products include aerial photographs, spatial databases of vegetation (including metadata), a map classification description or key, hard-copy maps of vegetation, and an accuracy assessment of the vegetation map. Vegetation products include a vegetation classification, a dichotomous field key to the vegetation classes, formal descriptions and ground photos of the vegetation types, and field data in database format. More NPS VIP information and products of completed park mapping projects are on the Internet at <http://science.nature.nps.gov/im/inventory/veg> and <http://biology.usgs.gov/npsveg>.

Natural Resource Inventory and Monitoring Program

The NPS Natural Resource I&M Program is a long-term effort to acquire information needed to help maintain ecosystem integrity for all NPS units with significant natural resources. One of the long-term goals of the I&M Program is to produce baseline inventories of basic biological and geophysical natural resources. The NPS VIP provides detailed vegetation maps based on aerial photographs and meets specified thematic accuracy standards (80%) set by the I&M Program. More information on the I&M Program is available on the Internet at <http://science.nature.nps.gov/im/index.cfm>.

Vegetation Inventory Program Standards

The NPS VIP uses nationally defined standards, some of which are maintained by the FGDC. These include the following:

- National Vegetation Classification Standard (FGDC 2008),
- Content Standard for Digital Geospatial Metadata (FGDC 1998a),
- Spatial Data Transfer Standard (FGDC 1998b),

- United States National Map Accuracy Standards (U.S. Geological Survey 1999), and
- Integrated Taxonomic Information System (U.S. Department of Agriculture).

Descriptions and links to websites for these standards can be accessed at <http://biology.usgs.gov/npsveg/standards.html>.

The National Vegetation Classification Standard

In 1997, the FGDC adopted the Vegetation Classification Standard: FGDC-STD-005-1997 (FGDC 1997). Since then, the FGDC Vegetation Subcommittee has derived a major revision, which is the National Vegetation Classification Standard (NVCS), Version 2: FGDC-STD-005-2008 (Version 2) (FGDC 2008). This revision was an effort to foster a cohesive view between Federal agencies in their approach to classifying vegetation, thus reducing duplicative efforts among multiple agencies. Version 2 replaced the original and addressed several issues known with the first version and included a substantial reorganization of the classification hierarchical structure. The purpose of the classification standard is to promote consistent classification of vegetation resources across regions. The use of a national standard aids effective resource stewardship by augmenting compatibility and widespread use of the information throughout the NPS and other Federal and State agencies.

The NVCS classifies existing vegetation within a hierarchical structure. In brief, the classification is separated into two overriding categories, including natural vegetation (including semi-natural) and cultural vegetation. From there, each category is further divided into three main sections, including the following: (1) Upper (where physiognomy plays a predominant role), (2) Middle (where both floristics and physiognomy play a significant role), and (3) Lower (where floristics plays a predominant role). Within each section, additional levels are subset. Separate hierarchies are developed for cultural and natural vegetation types. Tables 2 and 3 show the hierarchical structures for both natural and cultural vegetation types. Definitions of these various levels are detailed within Section 2 of the NVCS (FGDC 2008); however, with the emphasis given by the NPS VIP to natural/semi-natural vegetation types of the floristic levels (alliance and association) and the group level of the NVCS, we provide the following brief definitions:

- An association-level type is the finest level of the NVCS and is "defined on the basis of a characteristic range of species composition, diagnostic species occurrence, habitat conditions and physiognomy." (Jennings et al. 2006, as quoted in FGDC 2008:14). "Associations reflect topo-edaphic climate, substrates, hydrology, and disturbance regimes" (FGDC 2008:14).
- An alliance-level type is hierarchically one level above the association and is "defined by a characteristic range of species composition, habitat conditions, physiognomy, and diagnostic species, typically at least one of which is found in the uppermost or dominant stratum of the vegetation." (Jennings et al. 2006, as quoted in FGDC 2008:14). "Alliances reflect regional to subregional climate, substrates, hydrology, moisture/nutrient factors, and disturbance regimes" (FGDC 2008:14).
- A group-level type is hierarchically one level above the alliance (two levels above association) yet is also the lowest level of the middle section of the NVCS hierarchy. The group level is defined in Table 2.4 of the NVCS as "combinations of relatively narrow sets of diagnostic plant species (including dominants and co-dominants), broadly similar

composition, and diagnostic growth forms that reflect biogeographic differences in composition and sub-continental to regional differences in mesoclimate, geology, substrates, hydrology, and disturbance regimes" (FGDC 2008:17).

Table 2. Hierarchy for natural/semi-natural vegetation (with examples) in the National Vegetation Classification Standard, Version 2 (FGDC 2008).

Level	Example
Upper: Physiognomy plays a predominant role.	
Formation Class	Forest & Woodland Class (1.)
Formation Subclass	Temperate Forest (1.C.)
Formation	Temperate Flooded & Swamp Forest (1.C.3.)
Middle: Both floristics and physiognomy play a significant role.	
Division	Northeastern & Central North American Flooded & Swamp Forest (1.C.3.a./D011.)
Macrogroup	Northern & Central Swamp Forest (MG030.)
Group	Northern & Central Alkaline Conifer & Hardwood Swamp (G046.)
Lower: Floristics plays a predominant role.	
Alliance	*Fraxinus nigra* - *Acer rubrum* Saturated Forest (A.347)
Association	*Fraxinus nigra* - Mixed Hardwoods - Conifers / *Cornus sericea* / *Carex* spp. Forest (CEGL002105)

Table 3. Hierarchy for cultural vegetation (with examples) in the National Vegetation Classification Standard, Version 2 (FGDC 2008).

Level	Example
Upper: Physiognomy plays a predominant role.	
Cultural Class	Agricultural Vegetation
Cultural Subclass	Herbaceous Agricultural Vegetation
Cultural Formation	Pasture / Hay
Cultural Subformation	Permanent Pasture & Hayland
Middle: Both floristics and physiognomy play a significant role.	
Cultural Group *[optional]*	Temperate and Tropical Permanent Pasture & Hayland
Cultural Subgroup	Grass
Lower: Floristics plays a predominant role.	
Cultural Type	Co-dominance of tall fescue & perennial ryegrass
Cultural Subtype *[optional]*	

Content Standard for Digital Geospatial Metadata

Metadata are data that describe the content, quality, condition, and other characteristics of other data. As a standard product, the NPS VIP employs FGDC-compliant metadata files for each spatial data set it produces. In 1998, the FGDC approved the Content Standard for Digital Geospatial Metadata, FGDC-STD-001-1998 (FGDC 1998a). This metadata standard uses a common set of terminology and definitions to document digital geospatial data.

Saint Croix National Scenic Riverway

The SACN (Figure 1) is located in western Wisconsin and along the eastern edge of Minnesota. It encompasses over 400 km of river, consisting mostly of the Saint Croix and the Namekagon Rivers.

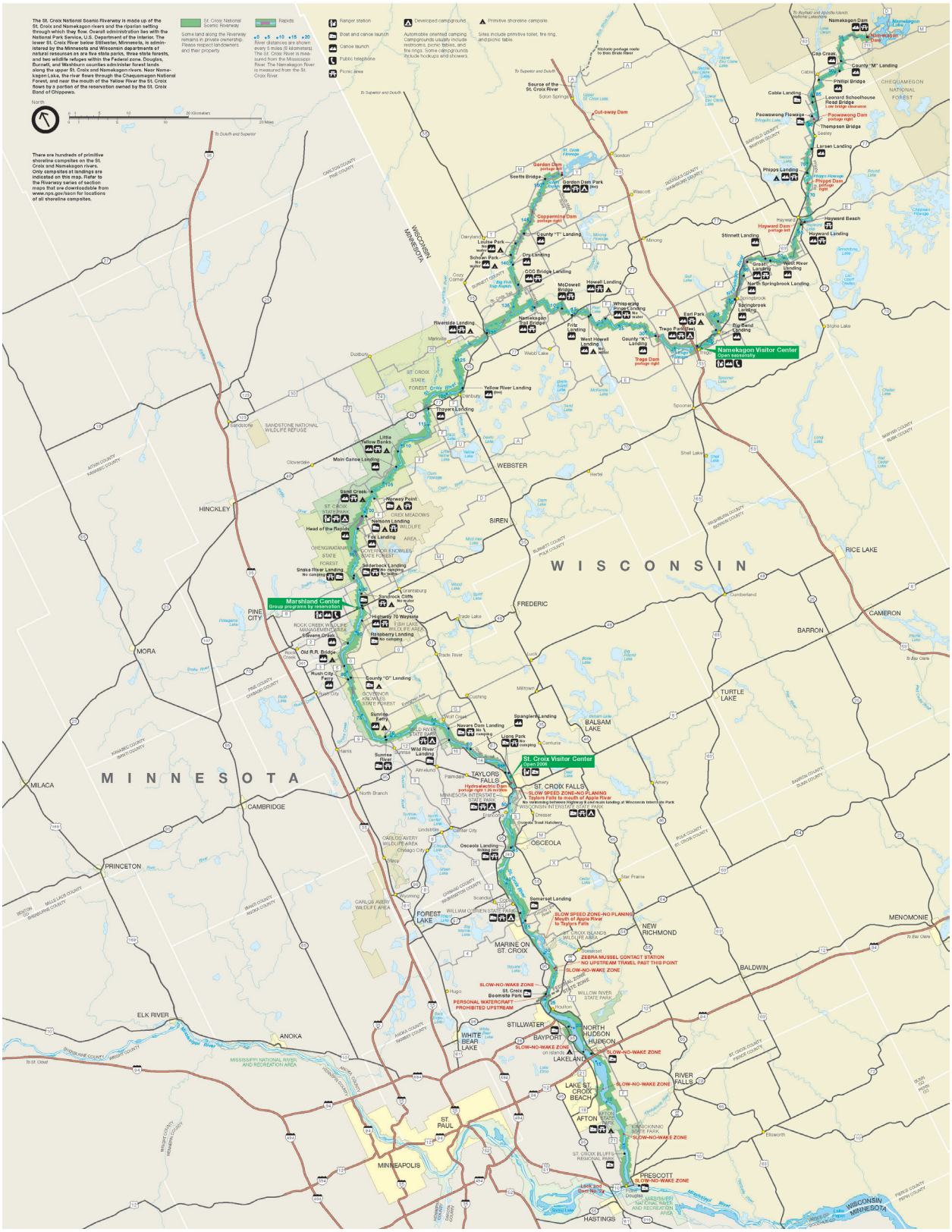


Figure 1. Saint Croix National Scenic Riverway, Minnesota/Wisconsin (courtesy nps.gov).

The administrative boundary of SACN comprises an area of almost 40,000 ha. The administrative boundary includes lands owned by the NPS, State and local governments, and lands in private ownership. Some of the lands outside of NPS ownership are under scenic easement for preserving the scenic aspect of river corridors. The upper portions of the Saint Croix and the Namekagon Rivers were established under the National Wild and Scenic Rivers Act (NWSRA) in 1968. The lower portion of the Saint Croix River was added via the NWSRA in 1972. The NWSRA came into effect to help protect clean and free-flowing rivers such as the Saint Croix and Namekagon Rivers.

The Ojibwe and the Dakota Indians made their home in the lands of the SACN area. During European fur-trading days, American Indians began trading with the French and English. Beaver were exploited, and then with the onset of European settlement, the forests of the region were heavily exploited to build cities and towns. In the late eighteen hundreds and early nineteen hundreds, the rivers were used to transport logs from harvesting the expansive forests of the area, often causing log jams.

The Namekagon River, all of which is in Wisconsin, begins as a small, narrow stream at the Namekagon Dam (Figure 2) and flows for almost 160 km, growing into a well-established, mid-sized river system before entering the upper portion of the Saint Croix River. Several dams along the Namekagon River form flowage lakes (Figure 3), including Pacwawong Flowage, Phipps Flowage, Hayward Lake, and Trego Flowage.



Figure 2. The upper reach of the Namekagon River (south of Namekagon Lake), Wisconsin, shown here as a small, narrow stream.



Figure 3. The upper end of Trego Flowage along the Namekagon River, near Trego, Wisconsin.

Although the Saint Croix River actually begins at a small spring well before entering the SACN lands, the upper reach of the Saint Croix River within the SACN begins at Gordon Dam, which holds the Saint Croix Flowage (Figure 4). Below the Gordon Dam, the river continues as a moderate fast-flowing river fed by the impounded waters above the dam (Figure 5). The Saint Croix River flows southward to St. Croix Falls, Wisconsin, where it enters the Indianhead Flowage (impounded by the 18-km tall hydroelectric dam at St. Croix Falls). The Saint Croix River below Gordon Dam flows exclusively in Wisconsin for the first 40 km and then becomes the border between Minnesota and Wisconsin for the remainder of the river. The major tributary entering the Saint Croix River is the Namekagon River, which joins after the first 32 km of the Saint Croix River. The Saint Croix River becomes a well-developed riverine system between the Indianhead Flowage and the confluence of the Saint Croix and Namekagon Rivers (Figure 6).



Figure 4. The Saint Croix Flowage held by Gordon Dam, Wisconsin.



Figure 5. The Saint Croix River just below Gordon Dam, Wisconsin.



Figure 6. The well-developed riverine system of the Saint Croix River several miles below the confluence of the Saint Croix and Namekagon Rivers, Wisconsin.

The lower portion of the Saint Croix River begins directly below the hydroelectric dam at St. Croix Falls, Wisconsin, flowing fast and rigorous for just the first couple miles through a steep, bedrock gorge. This area is known as the Dalles (Figure 7). The river slows and turns calmer as it leaves the Dalles southward and widens into a well-developed floodplain corridor (Figure 8).



Figure 7. A stretch of the Dalles gorge south of St. Croix Falls, Wisconsin.



Figure 8. The developed floodplain corridor of the Saint Croix River further south of the Dalles, Minnesota/Wisconsin.

The southern half of the lower portion of the Saint Croix River is actually a riverine lake and is known as Lake Saint Croix (Figure 9). It runs from just north of Stillwater, Minnesota, where the waters significantly widen and deepen, to Prescott, Wisconsin, where the Saint Croix River empties into the Mississippi River. Differences in flow rates between these two rivers have historically resulted in a hydraulic dam and have formed a natural bar at the confluence of the Saint Croix and Mississippi Rivers.



Figure 9. A distant view of Lake Saint Croix, a riverine lake in Minnesota/Wisconsin.

The SACN offers a wide variety of destinations and activities, including visitor centers, scenic drives, hiking trails, wildlife watching, camping, swimming, fishing, canoeing, kayaking, sail boating, motor boating, and tour boating (Figures 10 and 11).



Figure 10. Canoeing the Dalles, Minnesota/Wisconsin; near Old Man Cliff.



Figure 11. A river boat touring the Dalles, Minnesota/Wisconsin.

Project Overview

General Process

The three main components of the Saint Croix National Scenic Riverway (SACN) vegetation mapping project are as follows: (1) vegetation classification, (2) vegetation mapping, and (3) map accuracy assessment (AA). Our objectives were to identify and map existing vegetation types of SACN and its immediate environs.

Color-infrared (CIR) aerial photographs of the study area were collected during the fall season of 2005, providing aerial photos for fieldwork and mapping. True-color (TC) aerial photographs were also collected during the spring seasons of 2006 and 2007. The scoping meeting for the SACN vegetation mapping project was held May 8–9, 2006, at the headquarters of SACN, in Saint Croix Falls, Wisconsin. At this meeting, primary partners met to discuss and plan the vegetation mapping project.

During the summer seasons of 2006 and 2007, botanists collected vegetation samples for plant community characterization. We entered the sampling data into the National Park Service (NPS) PLOTS Database (NatureServe 2005) and performed analyses, which provided detailed ecological information to affirm plant communities at the SACN and document them with local descriptors. The vegetation classification was later modified with additional field reconnaissance data of SACN, vegetation samples from other park units within the Great Lakes Network (GLKN), and data from AA sites.

Before mapping, we performed field reconnaissance throughout the late summer of 2007 and summer of 2008 to correlate vegetation types to their appearances on the aerial photographs. This process ultimately resulted in the development of a map classification. An understanding of vegetation types is essential for mapping them. As vegetation concepts became known from either field or lab, we applied them to our photointerpretative mapping.

We completed a draft version of the vegetation map—a spatial database layer—for AA. During the summers of 2009 and 2010, field crews collected data of stratified and randomly selected sites for evaluating the accuracy of the vegetation map layer. Results were tabulated into a contingency matrix.

Ultimately, we developed a geodatabase containing four feature classes, including the following: vegetation and land cover polygons (showing locations of vegetation types and general land cover features, such as non-vegetated open water), vegetation points (containing vegetation sampling plots and AA sites), 1:12,000-scale CIR aerial photographic centers, and project boundary extent. Included in the geodatabase are several tables providing a suite of supporting information, from classification crosswalks to detailed sampling data. All geospatial products are projected in the Universal Transverse Mercator (UTM), Zone 15, by using the North American Datum of 1983 (NAD83).

Scoping Meeting

We officially launched the mapping project with a scoping meeting held May 8–9, 2006, at the headquarters of SACN in Saint Croix Falls, Wisconsin. Various cooperators joined together to discuss the objectives and methods of the SACN vegetation mapping project, receive

assignments, and view the landscape and vegetation of SACN. Individuals from the NPS Vegetation Inventory Program (VIP), NPS SACN, NPS GLKN, U.S. Geological Survey Upper Midwest Environmental Science Center, and NatureServe along with their constituents from offices of the Minnesota and Wisconsin departments of natural resources, met to achieve the following objectives:

- Inform SACN staff of the classification and mapping project,
- Learn about management and science issues and concerns at the SACN,
- Learn about existing data,
- Explore possible cooperation with neighbors and partners,
- Develop an action plan for vegetation classification and mapping, and
- Discuss the project boundary extent.

Project Boundary Extent

The project boundary extent for the SACN vegetation mapping project includes the entire administrative boundary for SACN, plus an approximate 300 m environs (Figure 12). The total map extent is 68,217 ha, including all SACN administrative lands and extended environs. We produced a feature-class layer showing the extent of the project boundary and incorporated it into the geodatabase for the SACN vegetation mapping project.

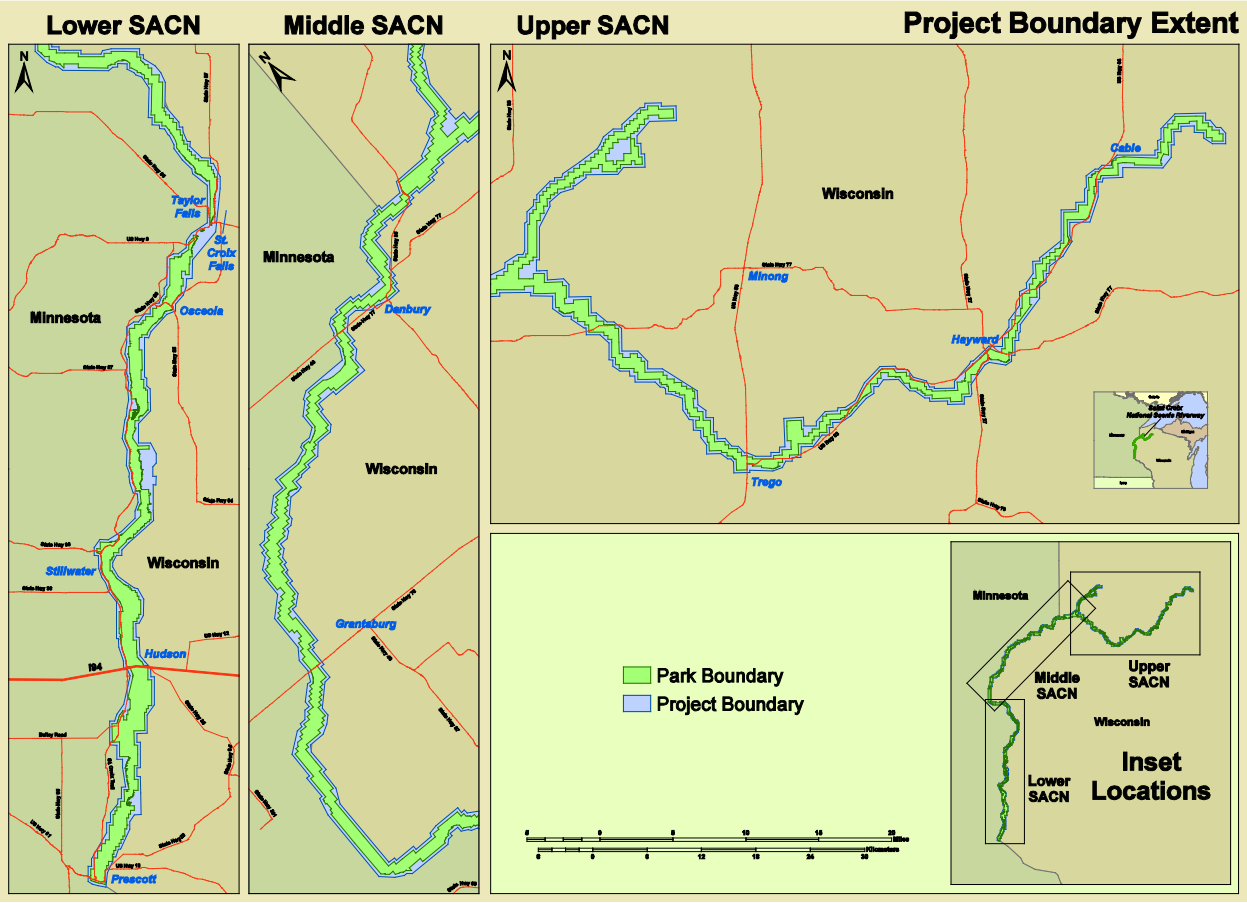


Figure 12. Project boundary for the Saint Croix National Scenic Riverway (SACN; Minnesota/Wisconsin) vegetation mapping project.

Aerial Photography

Aerial photographs provide the baseline imagery data for mapping vegetation types and other feature units. Vertical photographs (photographs taken with the aerial camera pointed straight down at the ground) collected with proper overlapping within each flight line permit an interpreter to study the photographs three-dimensionally with a stereoscope (Avery 1978). Because ecologic settings are taken into account in mapping vegetation types, the ability to view aerial photographs in this way is fundamental.

A variety of film emulsions were available, and Avery (1978) concludes that no single film emulsion serves all purposes. Our aim with collecting aerial photography for the SACN vegetation mapping project was to capture peak leaf-color change, aiding mapping in viewing distinctions between various deciduous forest types.

A set of 1:12,000-scale CIR aerial photographs was collected on October 10, 2007 (funded by the NPS VIP, and the photo mission was supervised by GLKN staff). This set of photography was the primary imagery used in photointerpretative mapping. In addition to the CIR photos, sets of 1:12,000-scale TC aerial photographs were collected on April 14, 2006, and April 18, 2007, providing deciduous leaf-off viewing. This photo mission was funded and supervised by GLKN staff. Having the TC photos gave interpreters a definite advantage in determining evergreen tree and shrub components within forest communities that are otherwise obscured by deciduous tree canopy on the fall-season CIR photos, thus giving credence to Avery's (1978) statement regarding lack of a single all-purpose film emulsion. Table 4 gives details of the aerial photography acquired for the SACN vegetation mapping project.

Table 4. Aerial photography sets for the Saint Croix National Scenic Riverway (Minnesota/Wisconsin) vegetation mapping project.

[CIR, color-infrared; TC, true-color]

Photography date	Film type	Scale	Products	Company
October 10, 2005	CIR Transparency (Positive)	1:12,000	Contact Print Diapositive Orthophotograph	Nova Blue (Aerial Services, Inc., subcontractor)
April 14, 2006 & April 18, 2007	TC Transparency (Positive)	1:12,000	Contact Print Orthophotograph	JF New (Williams Aerial and Mapping, subcontractor)

To assure stereo viewing and full aerial coverage, aerial photo missions were planned with a 60% forward-lap and 30% side-lap. Contact prints of both CIR and TC sets were produced for fieldwork use by mappers and vegetation crews. Diapositives of the CIR set were produced for photointerpretative mapping.

We produced a feature-class layer locating the centers of the CIR aerial photographs (1:12,000-scale) obtained in October 2005 (Figure 13). This feature class is incorporated into the geodatabase for the SACN vegetation mapping project. In addition, a digital orthophotographic mosaic of both the CIR and TC aerial photographs was produced by the aerial photo contractor.

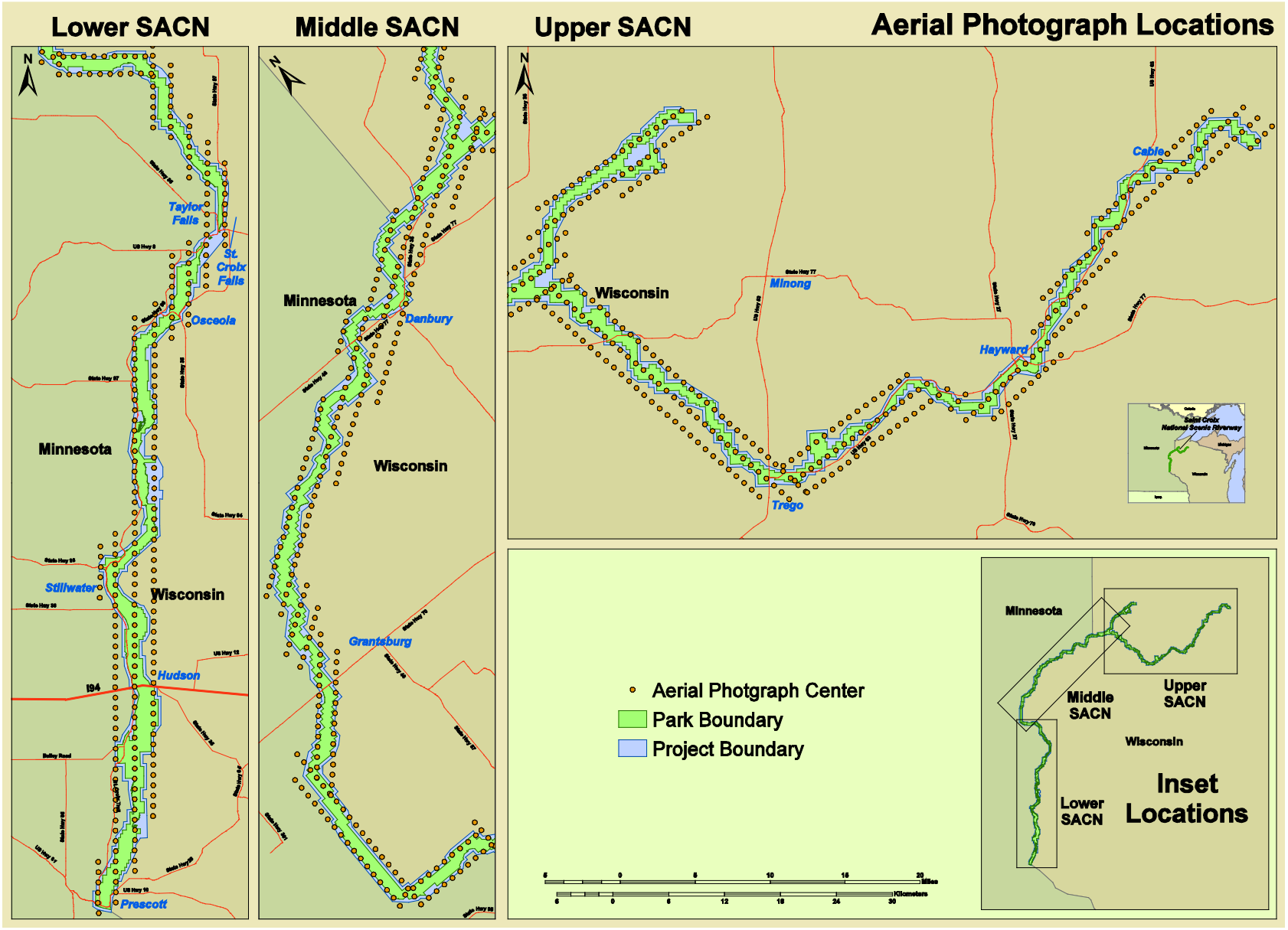


Figure 13. Centers of color-infrared aerial photographs (1:12,000-scale) obtained in October 2005 for the Saint Croix National Scenic Riverway (SACN; Minnesota/Wisconsin) vegetation mapping project.

Minimum Mapping Units

We applied the NPS VIP standard minimum mapping unit (MMU) of 0.5 ha for mapping. For vegetation types unique to their immediate surroundings (e.g., emergent wetland within an upland forest setting), we allowed for mapping below the MMU down to 0.25 ha. In addition, we applied a secondary MMU of 2.0 ha for physiognomic feature changes within a particular map class (e.g., open versus closed canopy). We used MMU templates to help us determine minimum polygon size on the photographs during mapping. Because of angle distortions inherent to nonrectified aerial photos, along with slight scale changes from high ridges to valley bottoms, we applied our MMU standards liberally.

Classification Organization

For this project report and the final products related to the SACN vegetation mapping project (e.g., the geodatabase), we organized the vegetation classification with the National Vegetation Classification Standard (NVCS), Version 2 (FGDC 2008). In the NVCS, separate categories are provided for natural and cultural vegetation. Typically, areas having 1% or more of their surface area covered by live vegetation are classified within the NVCS. The NVCS excludes non-vegetated natural lands (e.g., sand beaches) and waters (e.g., lakes, rivers). For these, we employed the classification provided by the 2001 National Land Cover Database (Homer et al. 2004).

Throughout this report, the term "vegetation type" is used to reference vegetation classification units in general, at any level of the hierarchy within the NVCS. For example, the Northern Hardwood - Hemlock - White Pine Forest Group and the *Alnus incana* Swamp Shrubland Association are both treated as vegetation types. Furthermore, the term "floristic level" (or similar use) is used to describe collectively the two natural/semi-natural lower levels (association and alliance) of the NVCS.

Vegetation Classification

Methods

Preliminary Classification

The first step in classifying the vegetation of the Saint Croix National Scenic Riverway (SACN) was to prepare a preliminary classification report prior to the May 2006 scoping meeting. This report for the SACN area was generated by reviewing all association and alliance types in the National Vegetation Classification Standard (NVCS) attributed to the forested regions of Minnesota or Wisconsin. This listing of vegetation types covered a much broader area than the SACN project area, including many vegetation types that were very unlikely to occur there. This initial list of associations and alliances was reviewed by NatureServe and SACN staff to remove vegetation types thought unlikely to occur at the SACN. The resulting preliminary classification report included 113 associations as potentially occurring at the SACN. The list of vegetation types from this report served as a rough guide to the number and kind of vegetation types the field crew might encounter during vegetation plot sampling and helped us to estimate how much data the field crews would need to collect to adequately survey the project area.

Data Collection Preparation

The protocols for the National Park Service (NPS) Vegetation Inventory Program (VIP) allow for the collection of approximately three plots per estimated vegetation type (from the preliminary classification report), on average. The preliminary classification listed 113 possible associations in the project area; however, several of those were similar to each other, and we expected that only one or two of those would actually be present in the project area. For example, we knew there would be dry or dry-mesic prairies, typically containing little bluestem (*Schizachyrium scoparium*) in the project area, but there were five associations listed in the preliminary classification that fit this. We did not know which of those would best fit the data we would gather from the project area, but we suspected that the data would best fit one, two, or, at most, three of those five. So, although we had five dry-mesic prairie types in the preliminary classification, we estimated that we would need only six plots to adequately characterize those prairies. We did similar analyses for all associations in the preliminary classification and estimated there would be approximately 52 unique vegetation associations at the SACN. Thus, our initial plan was to sample at least 210 plots.

Some vegetation types in the preliminary classification (e.g., conifer and conifer-hardwood swamps) were less well described or were expected to have variable composition from stand to stand, so we targeted them for 3–5 plots. Other types (e.g., water-lily marshes and some other herbaceous marshes) were well described and/or compositionally simpler; therefore, we targeted those for 1–3 plots. In addition to the data collected for this project, we searched for other field data that could supplement the plots we would collect. The Minnesota Department of Natural Resources (DNR) has many plots from across the State and generously allowed us to use their data. We did not want to include data that represented vegetation communities not likely to be found in the project area, so we only used plots from the three Minnesota counties that bordered the Saint Croix River, including Chisago, Pine, and Washington. For the analyses, we used the 341 plots from those counties, along with the 230 sampled for this project. Nearly all of the Minnesota DNR plots were outside of the project area.

All but six plots sampled for this project were within the project boundary for the SACN project. Plots sampled outside of the project boundary were on nearby public lands (e.g., State park lands), ranging 1–266 m from the project boundary. In attempting an inventory of vegetation communities at the SACN, we faced the problem of finding every vegetation type at the SACN without knowing where they all were or even exactly what they all were. The available time for fieldwork prohibited extensive reconnaissance. Instead, we used available GIS layers, the preliminary vegetation classification, consultation with knowledgeable staff at SACN, and the experience of the field crew to guide our sampling effort. Our field crew in the first year was led by an ecologist with extensive knowledge of the southern half of the project area. Her knowledge, combined with the relatively limited amount of public land available for sampling, allowed us to sample nearly all of the vegetation that was ultimately identified in the southern section of the park. In the second year, our field crew focused on the northern half of the park, but they had to rely more heavily on the advice of staff at SACN in making an attempt to visit all the major habitats (for example, herbaceous marshes, shrub swamps, fens, deciduous uplands) to find as many vegetation communities as possible.

Field Sampling

The field sampling methodology was adapted from program standards (NatureServe 2004). Details are provided therein with a general summary here.

Plots were placed to represent the character of an entire stand of vegetation as well as possible. Plots were usually located at least 15 m from the boundary of another vegetation type to reduce the variability associated with the transition from one vegetation type to another. This was not always possible in the case of small or linear vegetation stands. It was sometimes difficult to determine what constituted the boundary of a unique vegetation type because two adjacent stands may be floristically very similar but are separated in the NVCS based on physiognomic criteria (e.g., amount of shrub or tree canopy cover).

Plots were square or rectangular and were either 100 or 400 m^2, depending on the dominant physiognomy (Table 5). Boundaries of plots were marked with flagging or measuring tapes.

Table 5. Plot sizes used for vegetation plot sampling for the Saint Croix National Scenic Riverway (Minnesota/Wisconsin) vegetation mapping project.

Dominant Physiognomy	Plot size	Plot area
Forest: trees have their crowns overlapping, usually forming 60-100% cover.	20 x 20 m or 40 x 10 m	400 m^2
Woodland: open stands of trees with crowns usually not touching. Canopy tree cover 25-60%, OR exceeds shrub, dwarf-shrub, herb, and nonvascular cover.	20 x 20 m or 40 x 10 m	400 m^2
Shrubland: shrubs greater than 0.5 m tall are dominant, usually forming more than 25% cover OR exceeding tree, dwarf-shrub, herb, and nonvascular cover.	10 x 10 m or 20 x 5 m	100 m^2
Dwarf-shrubland (e.g., heath): Shrubs less than 0.5 m tall are dominant, usually forming more than 25% cover OR exceeds tree, shrub, herb, and nonvascular cover.	10 x 10 m or 20 x 5 m	100 m^2
Herbaceous (e.g., grassland, meadow, marsh): Herbs dominant, usually forming more than 25% cover OR exceeds tree, shrub, dwarf-shrub, and nonvascular cover.	10 x 10 m or 20 x 5 m	100 m^2
Nonvascular (e.g., cliff): nonvascular cover dominant, usually forming more than 25% cover.	10 x 10 m or 20 x 5 m	100 m^2
Sparse vegetation (e.g., blowout, beach): less than 10% total vegetation cover.	10 x 10 m or 20 x 5 m	100 m^2

Within each plot, the vegetation was visually separated into strata. The canopy cover and average height of each stratum was estimated. Within each stratum, all taxa within the plot area were identified, and the foliar cover of each taxon was estimated by using cover classes. (See Table 6 for cover classes and strata.) The diameter at breast height (DBH) of trees greater than 10 cm around was recorded as well.

Table 6. Cover classes and vegetation strata used during vegetation plot sampling for the Saint Croix National Scenic Riverway (Minnesota/Wisconsin) vegetation mapping project.

Cover scales		Vegetation strata
T	0–1%	T1 Emergent Canopy:
P	>1–5%	T2 Main Canopy
1	>5–15%	T3 Subcanopy
2	>15–25%	S1 Tall Shrubs
3	>25–35%	S2 Short Shrubs
4	>35–45%	S3 Dwarf-shrubs
5	>45–55%	H Herbaceous (field layer, including tree seedlings)
6	>55–65%	A1 Floating-leaved aquatics
7	>65–75%	A2 Submerged-leaved aquatics
8	>75–85%	
9	>85–95%	
10	>95%	

Environmental information, such as slope, aspect, soil texture, and evidence of disturbance, were recorded. Locational information, including spatial coordinates, was obtained by using a global positioning system (GPS), and written directions to the plot were provided. Digital photographs were taken of the plot to provide additional information and assist in classifying the plot. Finally, the field crew gave the plot a provisional classification name. Figure 14 shows an example of a vegetation plot. For an example of a plot form, see Appendix A: Plot Sampling Form.



Figure 14. Example of a vegetation plot for the Saint Croix National Scenic Riverway (Minnesota/Wisconsin) vegetation mapping project.

In addition to data collected at standard plots, in 2006 we had the field crew collect less detailed data from a number of other plots. These were informally called "quick plots" to distinguish them from the standard, more detailed plots; for the quick plots, we used the same methods of data collection except for the completeness of the floristic sampling. At the quick plots, the crews recorded the cover of the most dominant 1–5 species in each vegetation stratum rather than a full species list. These plots were much faster to sample (roughly 20–30 minutes per plot rather than 1–2 hours), enabling our crew to sample more plots in a given amount of time. We intended to use these data to glean more information on the geographic range of vegetation communities and to help discover vegetation types missed during the first year of plot sampling. If there were quick plots for which the vegetation recorded did not fit with the vegetation community represented in the standard plots sampled in 2006, we would instruct our field crews, when they returned for standard-plot sampling in 2007, to look for vegetation similar to that sampled at the quick plot.

Data Analyses, Results, and Discussion

Field teams collected plot data from June through mid-September, 2006 (134 plots), and again from June through mid-August, 2007 (96 plots). Thus, we sampled 230 plots specifically for the SACN project (Figure 15). In 2006, our field crew also sampled 59 quick plots, for which the data were qualitatively used in the classification process and to help fully describe vegetation communities, but these quick-plot data were not used in the quantitative analyses described below. Four accuracy assessment (AA) sites were transferred to quick plots to preserve site data that had been overlooked during the AA analysis. Figure 16 shows the locations of all 63 quick plots that were collected during the SACN project.

All field data were entered into the NPS PLOTS Database Version 2.0, a Microsoft Access database designed for the NPS VIP (NatureServe 2005). The Minnesota DNR plots were imported into the same database, and taxonomic names were standardized by using the U.S. Department of Agriculture's Integrated Taxonomic Information System, which is the standard taxonomy used by the NPS VIP. This resulted in a database of 571 vegetation plots available for analyses.

To analyze vegetation patterns and classify types, we partitioned the plot data by using Non-metric multi-dimensional scaling (NMS) ordination and Flexible Beta clustering techniques with PC-ORD 5.0 software (McCune and Mefford 1999). Potential groupings of plots were also compared by using indicator species.

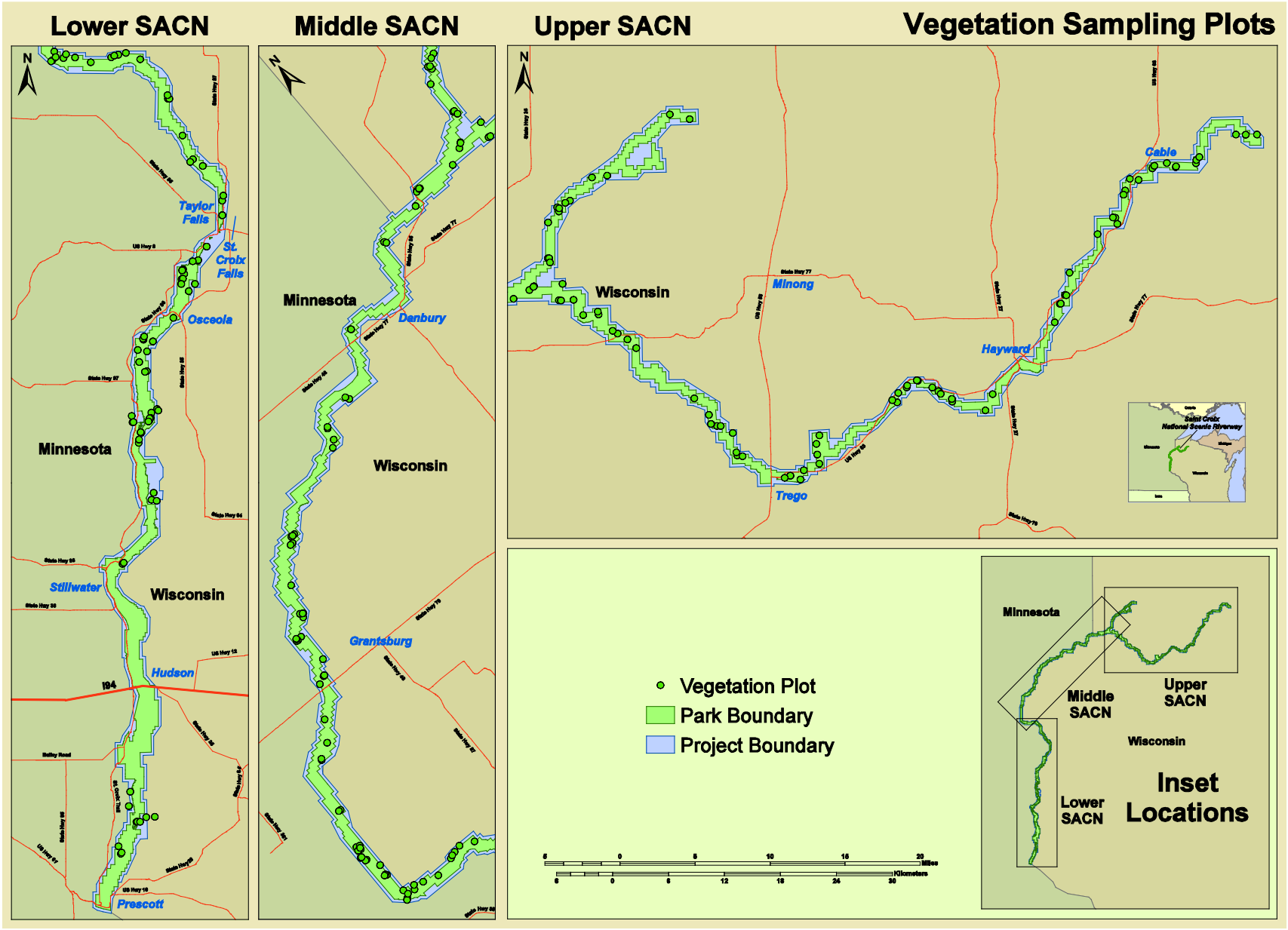


Figure 15. Locations of 230 vegetation plots for the Saint Croix National Scenic Riverway (SACN; Minnesota/Wisconsin) vegetation mapping project.

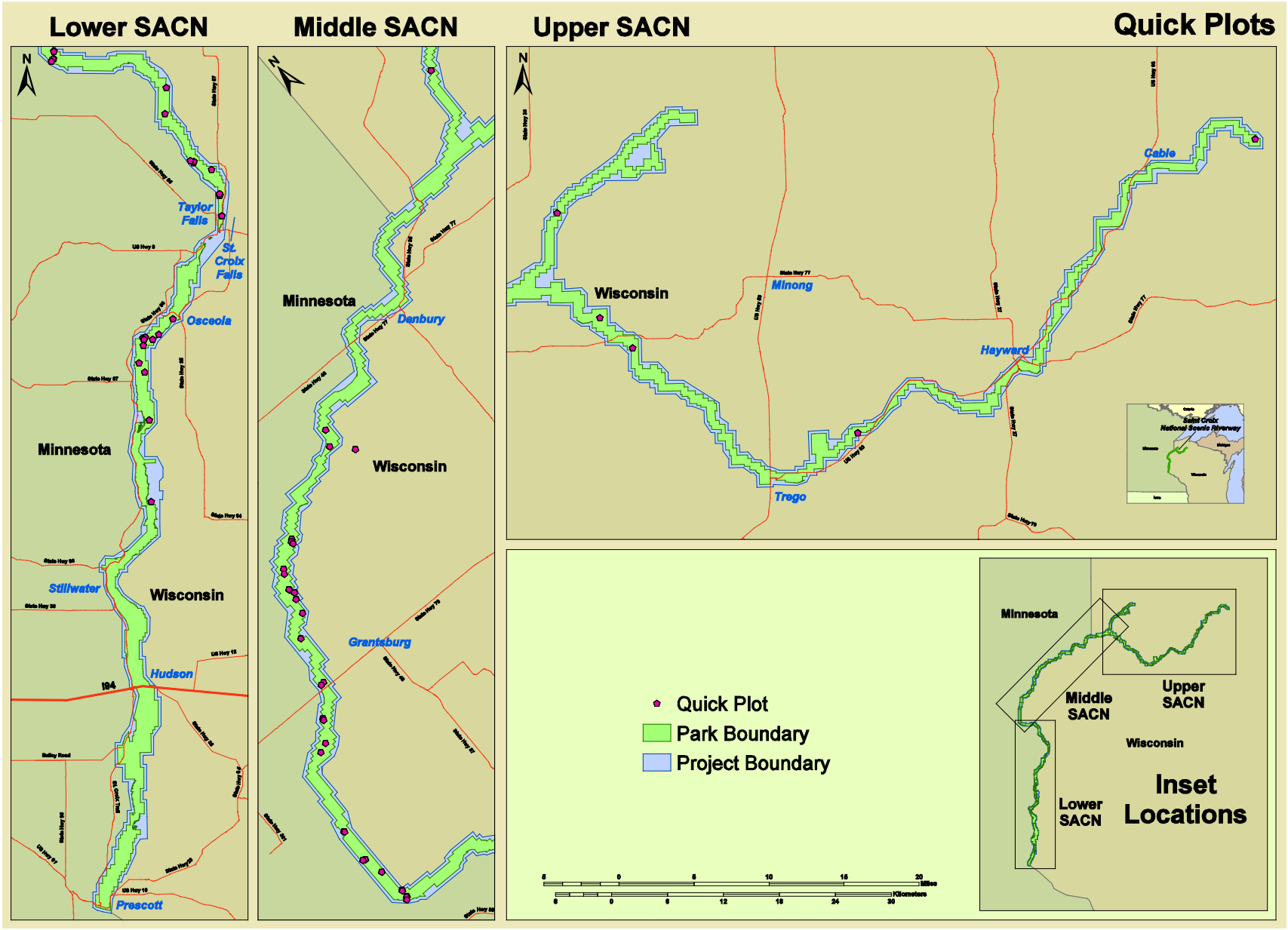


Figure 16. Locations of 63 quick plots for the Saint Croix National Scenic Riverway (SACN; Minnesota/Wisconsin) vegetation mapping project.

Our quantitative analyses proceeded iteratively, starting with the entire data set, deriving a few to several groups, and then repeating the process on each new group until we ended up with sets of plots that matched the scale of an association in the NVCS. At the SACN, the initial split was between upland plots and wetland plots. Each of these groups was subsequently divided into forests and woodlands versus shrublands and herbaceous vegetation (Figure 17). After that, we began separating groups of plots at the association scale. Each association could be represented by one to several plots. Dominant canopy species were of primary importance in dividing the forest types, and the understory species were used to parse those types into associations. In order to better inform the results of the ordination and cluster analyses, the constancy and frequency of all the overstory and understory species associated with all the plots in each grouping were calculated. These calculations helped to further characterize and differentiate vegetation types and were particularly useful for some of the variable forest types. Shrublands and herbaceous plots were distinguished by using NMS and Flexible Beta clustering, and then further differentiated by dominant species.

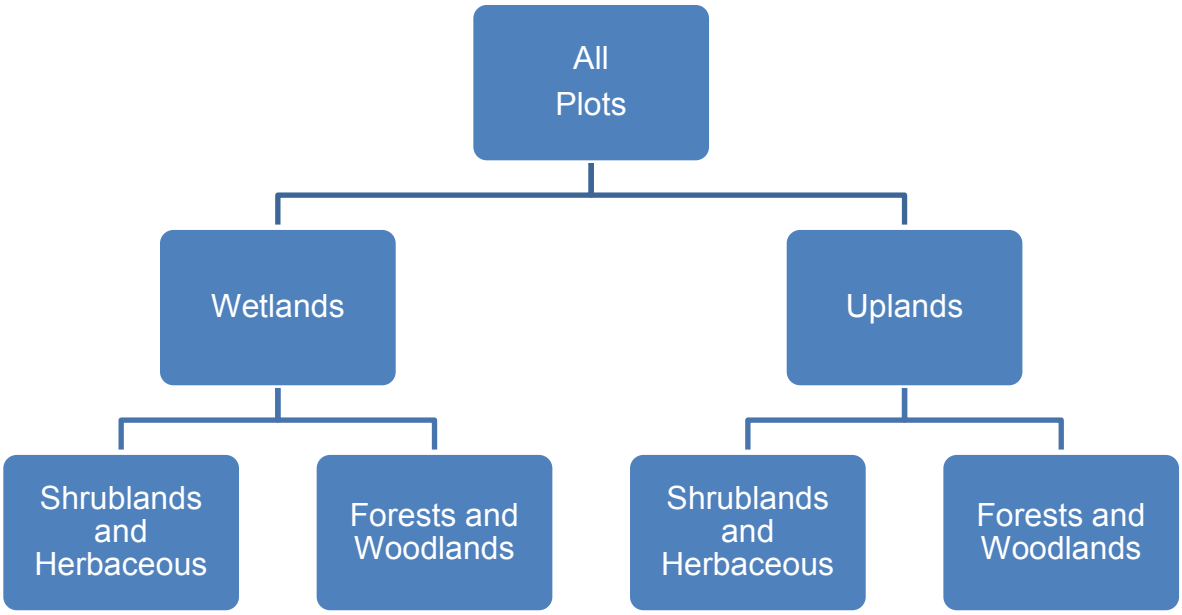


Figure 17. General vegetation groups as defined by cluster and ordination analyses for the vegetation classification of the Saint Croix National Scenic Riverway (Minnesota/Wisconsin).

By using the results of both NMS and Flexible Beta clustering analyses, classification rules were generated to assign plots to NVCS associations or alliances. For forest communities, those stands that had 25–75% cover from hardwoods in the canopy were considered a mixed forest and classified by the dominant conifer in the canopy. Those stands that had <25% canopy cover from hardwoods were classified by the dominant conifer; those with <25% canopy cover from conifer species were classified by the mixture of hardwoods found in the canopy. These rules were also applied during the mapping of the NVCS types.

Through the analyses of our plots, we identified 63 units that represented plant communities. Sixty-one were at the association level of the NVCS; one represented old fields and was placed at the group level of the NVCS; and one represented plots from forested seeps. The plots that represented old fields were not classified to the lower, floristic levels of the NVCS because of

the variability in floristic and physiognomic composition, and the data for these plots are not reported with the results for the floristic units. The seeps were too variable to classify easily and too small to map for this project, so we left them out of further analyses. After mapping and AA were completed, we found that three associations represented by four Minnesota DNR plots had not been found in the project area; therefore, these plots and communities were removed from the project results. After removal of the old fields, seeps, and communities not found in the project area, we had 58 vegetation communities represented by 547 plots.

Each vegetation community was sampled at an average of nine plots. Individual communities were sampled at between one and 66 plots. This general trend was skewed by the inclusion of the Minnesota DNR plots. We had between zero and 14 plots per community among the plots collected solely for this project (hereafter called "NPS plots"). Though the crews made a special effort to find uncommon vegetation communities, rare and/or less variable communities still tended to have been sampled in the fewest plots, while the most common and/or most variable types were sampled in the most. For example, one-quarter of all plots was classified in three widespread and somewhat variable associations. Their variability is summarized as follows:

Northern Maple - Basswood Forest (66 plots, 14 NPS plots): a very common mesic deciduous forest with moderate-to-dense tree canopy and a sparse-to-moderate subcanopy, but when combined they nearly always provide >80% tree cover. Tree strata are not typically floristically variable, with the dominant species nearly always being sugar maple (*Acer saccharum*), American basswood (*Tilia americana*), and northern red oak (*Quercus rubra*), with hophornbeam (*Ostrya americana*) and red maple (*Acer rubrum*) common. Young sugar maple is common, indicating a self-sustaining forest. The Northern Maple - Basswood Forest is similar to the Northern Red Oak - Sugar Maple Forest but contains less northern red oak.

Northern Red Oak - Sugar Maple Forest (41 plots, 10 NPS plots): a common mesic deciduous forest with a moderate-to-dense tree canopy, nearly always dominated by a combination of northern red oak (*Quercus rubra*) and sugar and/or red maple (*Acer saccharum* and/or *A. rubrum*); paper birch (*Betula papyrifera*) is often present in low amounts. The Northern Red Oak - Sugar Maple Forest is similar to the Northern Maple - Basswood Forest but with a higher proportion of northern red oak, and sites are somewhat more likely to have been disturbed.

Aspen - Birch - Red Maple Forest (35 plots, 9 NPS plots): a common and somewhat floristically and physiognomically variable forest, with the tree canopy dominated by one or more of the following species: quaking aspen (*Populus tremuloides*), red maple (*Acer rubrum*), and bigtooth aspen (*Populus grandidentata*). Paper birch (*Betula papyrifera*) is often present up to being co-dominant but is never strongly dominant by itself. The canopy can be moderately open to dense and the trees can be short to tall. This type of forest results from some kind of disturbance, so the floristic and physiognomic variability tends to reflect the time since disturbance and the nature of disturbance, as well as site factors that might favor one species over another.

During our summer 2008 field reconnaissance for the mapping effort, we discovered other vegetation types that had not been characterized by the plot data. An additional 13 floristic

vegetation types (11 associations and two alliances) were defined from informal field data and aerial photo study, and the addition of these types was eventually supported with data from field AA data collected in 2009 and 2010 (Table 7). Most of these communities were well described from a regional perspective, so assigning them to vegetation associations was straightforward, even without data from full vegetation plots. There were some unusual vegetation assemblages found that did not fit existing associations well. Two of these were characterized by jack pine or jack pine-aspen dominance and fit into existing alliances (the next finest unit in the NVCS hierarchy), but we did not have enough detailed data to feel confident in creating new associations. Two others did not fit existing associations, but we felt we had enough data to create associations. These two—Bur Oak - Mixed Oak Woodland and White Pine - Oak Driftless Bluff Forest— represented fairly common but localized vegetation in the southern and central part of the mapping area. Further comparison to data from a wider area may result in a modification of these associations or even combination with other associations.

Table 7. List of floristic vegetation types of Saint Croix National Scenic Riverway (Minnesota/Wisconsin) that were identified after the collection of vegetation plots in 2007.

[NVCS, National Vegetation Classification Standard, Version 2 (FGDC, 2008); A., Alliance; CEGL, Community Element Global]

Association Name*	NVCS Code
Pinus banksiana Forest Alliance	A.116
Pinus banksiana - *Populus tremuloides* Forest Alliance	A.390
Populus deltoides - *Salix nigra* Forest	CEGL002018
Riverine Sand Flats - Bars Sparse Vegetation	CEGL002049
Populus tremuloides / *Corylus americana* Forest	CEGL002063
Typha spp. Midwest Herbaceous Vegetation	CEGL002233
Pinus strobus - (*Pinus resinosa*) Driftless Bluff Forest	CEGL002378
Pinus strobus / *Acer spicatum* - *Corylus cornuta* Forest	CEGL002445
Populus tremuloides - *Betula papyrifera* / (*Abies balsamea*, *Picea glauca*) Forest	CEGL002466
Thuja occidentalis - (*Picea mariana*, *Abies balsamea*) / *Alnus incana* Forest	CEGL002456
Chamaedaphne calyculata - *Myrica gale* / *Carex lasiocarpa* Dwarf-shrubland	CEGL005228
Pinus strobus - *Quercus* (*alba*, *velutina*, *rubra*) Driftless Bluff Forest	CEGL005561
Quercus macrocarpa - *Quercus* (*alba*, *ellipsoidalis*, *velutina*) Woodland	CEGL005560

*Unless otherwise specified.

Table 7 shows that eight of the 13 vegetation communities found after plot-data collection was complete were classified as upland forests. Upland forests are the predominant vegetation class at the SACN and with the extensive historical and ongoing anthropogenic disturbance in the project area, there were many stands that were altered more or less from a natural condition. These can be difficult to classify because we have to decide whether they should be classified as a disturbed version of an existing natural vegetation community or whether they are altered to an extent such that they should be classified into a new type. Making that decision with confidence sometimes requires more data than we are able to collect. Five of the eight upland forests found after plot collection were disturbance related.

The Dalles area of the SACN features a habitat that is different from that in most of the project area, which is reflected in the number of less-common vegetation types found only in that area. We developed two new associations for that area based on plot data from this project, and we considered developing another rare bedrock-prairie association but did not feel we had enough data to justify it. These communities, distinguishable based on “Driftless” being in their names,

are currently linked to communities that tend to occur further south on sedimentary bedrock in the Driftless Area of Minnesota and Wisconsin. The basalt bedrock of the Dalles area may be significantly different enough that separate associations should be created just for this area, but we currently lack the data to make that decision.

In all, a total of 71 natural/semi-natural floristic vegetation types (69 associations and two alliances) from the NVCS were identified for the SACN. Table 8 lists the vegetation types and includes the number of times each type was sampled at a vegetation plot, quick plot, or an AA site. (Note that some plots, quick plots, and AA sites were classified at the group level of the NVCS and do not appear in Table 8.) It is also worth noting that there were approximately three times more AA sites and quick plots sampled than there were vegetation plots (1,353 versus 547) or about six times as many AA sites and quick plots than NPS plots sampled within the project area. Thus, most of the field observations were from AA sites and quick plots. Data from AA sites and quick plots provide important information on distribution and dominant species but do not have the detail of a full vegetation plot.

For other types above the floristic vegetation level of the NVCS (e.g., group), we relied on general observations via studies from the field and of aerial photos to determine placement in the NVCS. These types characterize anthropogenic or natural disturbance regimes (e.g., ruderal herbaceous fields or dynamic beaver meadows).

Table 8. List of floristic vegetation types of Saint Croix National Scenic Riverway (Minnesota/Wisconsin), with number of field observations.

[NVCS, National Vegetation Classification Standard, Version 2 (FGDC, 2008); CEGL, Community Element Global; A., Alliance]

Group	Association Name*	NVCS Code	Observations
Forest and Woodland Class			
North-Central Beech - Maple - Basswood Forest			
	North-Central Maple - Basswood Forest	CEGL002062	4
Chinkapin Oak - Ash - Red-cedar Alkaline Forest			
	Chinquapin Oak Bluff Woodland	CEGL002144	15
Northeastern & North-Central Oak - Hickory Forest			
	Midwestern White Oak - Red Oak Forest	CEGL002068	78
	Eastern White Pine - Oak Driftless Bluff Forest	CEGL005561	9
	Bur Oak - Mixed Oak Woodland	CEGL005560	19
Great Lakes Pine - Oak Forest & Woodland			
	Jack Pine - Northern Pin Oak Forest	CEGL002478	38
	Red Pine - Aspen - Birch Forest	CEGL002520	38
	Red Pine / Blueberry Dry Forest	CEGL002443	34
	White Pine - Red Oak Forest	CEGL002480	65
	White Pine - Aspen - Birch Forest	CEGL002479	27
	White Pine / Mountain Maple Mesic Forest	CEGL002445	48
	Northern Pin Oak - (Bur Oak) Forest	CEGL002077	28
Great Lakes Pine Barrens			
	Jack Pine - Red Pine Barrens	CEGL005124	11
	Jack Pine - Red Pine / Scrub Oak Woodland	CEGL002484	26
Eastern Great Plains Tallgrass Aspen Parkland			
	Aspen / American Hazel Forest	CEGL002063	15

Group	Association Name*	NVCS Code	Observations
Great Plains Oak Woodland			
	North-central Dry-Mesic Oak Woodland	CEGL002142	49
Northern Hardwood - Hemlock - White Pine Forest			
	Maple - Yellow Birch Northern Hardwoods Forest	CEGL002457	13
	Northern Maple - Basswood Forest	CEGL002458	85
	Paper Birch / Sugar Maple - Mixed Hardwoods Forest	CEGL002464	1
	White Pine - (Red Pine) Driftless Bluff Forest	CEGL002378	4
	Aspen - Birch - Red Maple Forest	CEGL002467	66
	Aspen - Birch / Sugar Maple - Mixed Hardwoods Forest	CEGL002468	9
	Northern Red Oak - Sugar Maple Forest	CEGL002461	54
Eastern Cottonwood - Black Willow Flooded & Swamp			
	Midwestern Cottonwood - Black Willow Forest	CEGL002018	5
Silver Maple - Green Ash - Sycamore Floodplain			
	Silver Maple - Elm Forest	CEGL002586	59
	Ash - Elm - Mixed Lowland Hardwood Forest	CEGL002081	69
	Northern Ash - Elm Floodplain Forest	CEGL002089	26
Northern & Central Conifer & Hardwood Alkaline Swamp			
	Red Maple - Ash - Birch Swamp Forest	CEGL002071	35
	Black Ash - Mixed Hardwood Swamp	CEGL002105	69
	White-cedar - Black Ash Swamp	CEGL005165	35
Northern & Central Shrub Swamp			
	Gray Alder Swamp	CEGL002381	72
Jack Pine - Black Spruce Forest			
	Jack Pine Forest Alliance	A.116	24
	Jack Pine - Quaking Aspen Forest Alliance	A.390	21
White Spruce - Balsam Fir Forest			
	Spruce - Fir - Aspen Forest	CEGL002475	44
	Spruce - Fir / Mountain Maple Forest	CEGL002446	14
	Aspen - Birch / Boreal Conifer Forest	CEGL002466	13
Eastern Black Spruce - Tamarack Acidic Swamp & Bog Forest			
	Black Spruce - Tamarack / Labrador-tea Poor Swamp	CEGL005271	31
Eastern Tamarack - Conifer Alkaline Swamp			
	Northern Tamarack Rich Swamp	CEGL002471	65
	White-cedar - (Mixed Conifer) / Alder Swamp	CEGL002456	20
Shrubland & Grassland Class			
Central Great Plains Tallgrass Prairie			
	Midwest Dry-Mesic Prairie	CEGL002214	11
Sand & Gravel Tallgrass Prairie			
	Little Bluestem Bedrock Bluff Prairie	CEGL002245	10
	Midwest Dry Sand Prairie	CEGL002318	15
	Midwest Dry-Mesic Sand Prairie	CEGL002210	4
Northern & Central Ruderal Meadow & Shrubland			
	Hazelnut - Serviceberry Ruderal Shrubland	CEGL005562	24
Eastern North American River Shoreline			
	Riverine Igneous - Metamorphic Cobble - Gravel Shore	CEGL002304	1
	Riverine Sand Flats	CEGL002049	1
North-Central Appalachian, Interior & Prairie Fen			
	Skunk-cabbage Seepage Meadow	CEGL002385	4

Group	Association Name*	NVCS Code	Observations
Eastern North American Boreal Acidic Bog & Poor Fen			
	Bog Birch - Leatherleaf Rich Fen	CEGL002494	20
	Northern Sedge Poor Fen	CEGL002265	15
	Leatherleaf Poor Fen	CEGL005277	25
	Tamarack Scrub Poor Fen	CEGL005226	6
Eastern North American Boreal Alkaline Fen			
	Woolly-fruit Sedge Shore Fen	CEGL005229	5
	Leatherleaf - Sweetgale Shore Fen	CEGL005228	13
Northern & Central Riverscour Wetland			
	Sandbar Willow Shrubland	CEGL008562	4
Northern & Central Ruderal Wet Meadow & Marsh			
	Reed Canarygrass Eastern Marsh	CEGL006044	44
	Eastern Reed Marsh	CEGL004141	4
Eastern North American Freshwater Marsh			
	Bulrush - Cattail - Bur-reed Shallow Marsh	CEGL002026	35
	Midwest Cattail Deep Marsh	CEGL002233	5
	Wild Rice Marsh	CEGL002382	13
Eastern North American Wet Meadow			
	Bluejoint Wet Meadow	CEGL005174	19
	Northern Sedge Wet Meadow	CEGL002257	66
	Upright Sedge Wet Meadow	CEGL002258	17
	Dogwood - Mixed Willow Shrub Meadow	CEGL002187	60
	Central Cordgrass Wet Prairie	CEGL002224	2
Great Plains Freshwater Marsh			
	Arrowhead - Rice Cutgrass Marsh	CEGL005240	24
Aquatic Wetland Vegetation Class			
Eastern North American Freshwater Aquatic Vegetation			
	Water-lily Aquatic Wetland	CEGL002386	27
	Midwest Pondweed Submerged Aquatic Wetland	CEGL002282	28
Rock Vegetation Class			
Eastern North American Temperate Cliff			
	Northern (Laurentian) Igneous - Metamorphic Dry Cliff	CEGL002300	3
	Midwest Moist Limestone - Dolostone Cliff	CEGL002292	3
	Midwest Dry Sandstone Cliff	CEGL002045	3
	Midwest Moist Sandstone Cliff	CEGL002287	1

*Unless otherwise specified.

All floristic types within the NVCS that we identified (mostly at the association level, with two alliances) at the SACN are described in Appendix B: Descriptions of Vegetation Types. These descriptions show the position of each type within the NVCS hierarchy, followed by information about environmental characteristics, vegetation, important species, classification issues, relationship to other classification systems, and distribution. Most fields in the description have a section with information on the range-wide characteristics (prefaced by "Global") and one on the characteristics of the type at the SACN (prefaced by "Saint Croix National Scenic Riverway"). The global, or range-wide, information applies to the vegetation community across its entire range. This information has been gathered from scientific literature and other field data and is stored in NatureServe's central database. For the descriptive text fields, global information can be thought of as an average or modal expression of a relatively undisturbed stand of the

community throughout its range. The local fields (listed as Saint Croix National Scenic Riverway) are derived from information used in the classification phases of this project. For the SACN, this information mostly consisted of plot data from Minnesota DNR and the plots sampled for this project; however, some information from AA field data and less formal field observations is also included. Vegetation types that did not have plot data; that is, those types that were found after the plot sampling was finished, do have descriptions but are drawn only from global information. We did not include local information that was not supported by rigorous plot data. A key to vegetation types is provided in Appendix C: Field Key to Vegetation Types, which can be used in concert with the vegetation descriptions. A listing of plant species identified from the vegetation plot samples and AA sites are provided in Appendix D: List of Plant Species.

Vegetation Mapping

Methods

Mapping vegetation of the Saint Croix National Scenic Riverway (SACN) and environs involved five primary steps, including the following: (1) preliminary map classification (2) field reconnaissance, (3) map classification, (4) photointerpretation, and (5) digital map automation and database development. Although these steps occurred sequentially, they overlap to some degree.

Preliminary Map Classification

Prior to field reconnaissance, it is advantageous for photointerpreters to become familiar with any known vegetation types to be mapped. Having a map classification in hand with initial mapping conventions, as preliminary as it might be, promotes continuity from the classifier to the mapper at the onset of the vegetation mapping process. Additionally, this preliminary step puts in the hands of the photointerpreters the foundations of a working map classification, one that will undoubtedly go through many updates and revisions throughout the vegetation mapping process.

By late summer of 2007, the vegetation classification for the lower portions of the SACN had been developed via preliminary analyses of the vegetation sampling data collected the prior year. Thus, we met as classifiers and mappers in Redwing, Minnesota, during September 2007 to discuss the vegetation classification and how vegetation types might best be represented in a workable map classification. Pertinent details about the vegetation types that might aid in making interpretive decisions were assembled into mapping conventions.

Field Reconnaissance

In preparation to map vegetation types, we spent several days in the field investigating ground conditions and comparing them to the set of color-infrared (CIR) aerial photographs (the set of photos acquired for photointerpretative mapping). This process is necessary, as Hershey and Befort (1995) explain, because CIR photography is not consistent enough between photo sets to allow a species to be depicted precisely. Film batch, printing process, sun angle, light intensity, shadow, and exposure can all affect the appearance. Hence, in spite of our experience as photointerpreters, we engaged in ground verification of the aerial photographs. Ultimately, field reconnaissance helped us correlate photo signatures of the vegetation (appearances of vegetation on the aerial photographs) with vegetation on the ground (Figure 18).

Field reconnaissance also allowed photointerpreters to become more familiar with the local ecology of vegetation types, which is always important when applying ecologic concepts to photointerpretative mapping. Where photointerpreters discovered limitations to interpreting vegetation types by using aerial photographs, environmental models were tested to determine if vegetation types could be consistently separated by environmental elements.

We performed our field reconnaissance during late summer 2007 and throughout the summer of 2008. Much of this effort was accomplished as a team of mappers and ecologists to ensure correct assessment of vegetation types and, subsequently, to promote correct classification during photointerpretative mapping. We became familiar with the vegetation and local ecology as we discussed the structural, floristic, and habitat characteristics of the vegetation encountered

in the field and compared the vegetation types to their appearance on the photos. Through this process, we built an understanding of how to map the vegetation types and established a working map classification with mapping protocols.



Figure 18. Field reconnaissance to correlate aerial photo signatures with ground vegetation for the Saint Croix National Scenic Riverway (Minnesota/Wisconsin) vegetation mapping project.

The photo contact prints were taken into the field, with notes recorded onto photo jackets. Field notes might consist of the map-class assignment, if known. Other notes, to promote proper perspective of species composition (e.g., heterogeneous versus monotypic forest stand), might include comments regarding significant species. In essence, we would build a photo signature and environmental model on which to base our decisions during photointerpretative mapping. In addition, estimated tree heights were occasionally recorded to give a perspective for applying the physiognomic height modifier during mapping.

Map Classification

The map classification and protocols are based on existing classification systems. A map class represents a definable feature (e.g., a vegetation type) that can be distinguished on an aerial photograph and/or by use of an environmental model. We linked map classes representing natural/semi-natural vegetation types to the floristic levels (association or alliance) in the National Vegetation Classification Standard (NVCS), Version 2 (FGDC 2008), as identified by NatureServe. Some vegetation types could not be assigned to an association- or alliance-level type because of disturbance (e.g., human or beaver activities). For those map classes, we assigned the appropriate group-level type further up the hierarchy in the NVCS. Cultural vegetation (e.g., roads, residence, parks) were linked to the upper echelon of the NVCS and then

further described with special modifiers by using the classification from the National Land Cover Database (NLCD) 2001 (Homer et al. 2004).[1] For non-vegetation features (e.g., open water bodies), we derived map classes corresponding closely with the classification from NLCD 2001.

For those map classes directly representing association types in the NVCS, we assigned the map-class name with the synonym name established in the classification database of NatureServe[2] (e.g., Midwestern White Oak - Red Oak Forest). For those map classes representing more than one association type in the NVCS, we derived a comparable name for the map class (e.g., map-class name of "Sugar Maple - American Basswood Forest" for the collective associations of the North-Central Maple - Basswood Forest and Northern Maple - Basswood Forest Associations). For alliance types, we used a direct translation to the scientific name within the database of NatureServe. For map classes with phases, we used the synonym names, followed by, and in parenthesis, the phase name we derived, such as "Ash - Elm - Mixed Lowland Hardwood Forest (bur oak phase)." We developed map-class phases when a variation of the plant community was recognizable on the aerial photographs and had importance for either management or ecologic interests. For map classes representing types above the floristic level in the NVCS and for non-vegetation features, we derived generic names to describe the feature.

We continually updated the map classification throughout the mapping effort. Each field endeavor revealed new information, prompting us to modify map classes and their definitions. We also made revisions as the vegetation classification developed to completeness. Furthermore, as aerial photos were interpreted, new issues arose, which forced us to redefine, expand, or polish map-class definitions. Throughout the project, we adjusted the map classification as needed to best reflect the vegetation classification we knew at the time.

We derived a map-class code for each map class merely for ease of assigning information to map polygons and as a short-hand language amongst team members. For each polygon, a map-attribute code is assigned, which is a code constructed of the following two sections: (1) a single map-class code and (2) a set of physiognomic modifier codes. A hyphen separates the two code systems (e.g., [map-class code]-[set of physiognomic modifier codes]).

A map-class code is made up of three alpha characters and represents an independent map class; each begins with the first alpha representing the major physiognomic characteristic, as follows:

- F = Forest,
- W = Woodland,
- S = Shrubland,
- H = Herbaceous Vegetation,
- V = Sparse Vegetation,
- C = Cultural Developed, and
- N = Non-NVCS.

[1] The NLCD 2001 is a land cover database produced by the Multi-Resolution Land Characterization 2001 Consortium.
[2] An exception was made for the Eastern Red-cedar - (Hardwood) Bluff Woodland (WRC) map class, which represents the Chinquapin Oak Bluff Woodland association (CEGL002144). In this particular case, chinquapin oak is not a component of CEGL002144 sites within the SACN lands; however, eastern red-cedar is a significant component. Although a common name to an association may not always reflect local scenarios, it seemed in this case that having the map-class named simply "chinquapin oak" would be somewhat misguiding.

The subsequent two alpha characters for each map class loosely represent the map-class name (e.g., AS for alder swamp, WM for wet meadow, DV for developed).

The physiognomic modifier codes are strings of alpha and numeric characters and, when applicable, follow the map-class codes. These physiognomic modifiers provide additional information describing the physiognomic characteristics of the vegetation within each mapped polygon. Table 9 lists the physiognomic modifiers we used for mapping the SACN.

An example of a map-attribute code is "FBL-2B3." This code describes given map polygons as the bur-oak phase (FBL) of the map class "Ash - Elm - Mixed Lowland Hardwood Forest," which represents the *Fraxinus pennsylvanica* - *Celtis occidentalis* - *Tilia americana* - (*Quercus macrocarpa*) Forest Association (CEGL002081) in the NVCS. This code also indicates that the vegetation has a coverage density of 25–60%, a coverage pattern that is clumped/bunched, and an average tree height of 5–15 m throughout the mapped polygon. Presenting this series of map classification and physiognomic information can enhance the interpretation of the map layer for managers and researchers, particularly when introducing other geospatial data sets.

Table 9. Physiognomic modifiers assigned to polygons during photointerpretation for the Saint Croix National Scenic Riverway (Minnesota/Wisconsin) vegetation mapping project.

Category	Modifier	Meaning
Coverage density (Applied to all vegetation map classes)	1	Closed Canopy/Continuous (60–100% cover)
	2	Open Canopy/Discontinuous (25–60% cover)
	3	Dispersed-Sparse Canopy (10–25% cover)
Coverage pattern (Applied to all vegetation map classes)	A	Evenly Dispersed
	B	Clumped/Bunched
	C	Gradational/Transitional
	D	Regularly Alternating
Height (Applied to woody terrestrial vegetation map classes only)	1	>30 m
	2	15–30 m
	3	5–15 m
	4	0.5–5 m
	5	<0.5 m

Photointerpretation

Preparation of the aerial photographs for interpretation generally followed procedures of Owens and Hop (1995). We placed clear acetate overlays on each aerial photograph diapositive used for mapping. Using the diapositive photos for mapping provided us with the highest resolution possible. The diapositive photos are also dimensionally stable and virtually not affected by temperature and humidity changes. The paper contact prints are less desirable because they are grainier, and the paper base can expand and contract slightly with changes in temperature and humidity.

We registered mapping overlays to the CIR aerial photos (1:12,000-scale) from October 2005 by using the fiducials (standard reference points) and identification information of the photo. We viewed the CIR aerial photos for interpretation by using Richards MIM light tables and Bausch & Lomb Zoom 240 stereoscopes with variable zoom capabilities. Features within the entire

project extent were mapped to a minimum mapping unit (MMU) of 0.5 ha between map classes and a MMU of 2.0 ha between physiognomic modifiers within a map-class unit. Exceptions for mapping below the MMU (down to 0.25 ha, and even to 0.10 ha in some cases) were allowed for instances when vegetation unique to the immediate surroundings (e.g., herbaceous wetland within an upland forest or island within open-water river).[3] Interpreted data, such as map polygons and attributes, were applied to photo overlays covering the CIR photos. True-color (TC) aerial photos (1:12,000-scale) from April 2006 and 2007 were viewed digitally on computer and/or by using a Topcon (MS-3) mirror stereoscope with 3x binoculars to aid interpretation of the CIR photos.

The acquisition of the CIR aerial photography had captured flood waters of the lower section of the Saint Croix River from north of St. Croix Falls, Wisconsin to the confluence with the Mississippi River. Most of the herbaceous wetlands within the riverine corridor were inundated with flood waters to the point of making it impossible to interpret and classify them to individual map classes. Where these herbaceous wetlands were not recognizable on the October 2005-dated imagery, we performed onscreen, two-dimensional interpretation of summer 2006-dated TC digital orthophotographic imagery from the National Agriculture Imagery Program (NAIP). The stretch of river to which we applied this process was from Nevers Dam Landing south to the Mississippi River. Because NAIP imagery is acquired at a 1-meter ground sample distance, it did not provide enough resolution to map separately the individual vegetation types. We were, however, able to use the NAIP imagery to map the extents of herbaceous vegetation in general. A park-special map class was developed for this purpose.

Each diapositive photo was paired with the adjacent photo (stereo pair) so we could view the images three-dimensionally. We delineated features and scribed their corresponding map-attribute codes onto the acetate overlays by using Rapidograph ink pens (4x0-size, 0.18 mm) and Rapidraw black India ink (3084; waterproof, fast drying for film). We applied standard photo signature characteristics, including texture, color, pattern, and position in the landscape to guide placement of polygons. In addition to photo signature characteristics, understanding the environmental distribution of the vegetation types helped us not only to identify types, but also to properly place polygon boundaries. For each polygon, the appropriate map-class code and physiognomic modifier codes (collectively, the map-attribute code) were applied to each map polygon unit. For quality assurance, a second photointerpreter reviewed the interpreted work.

Digital Map Automation and Database Development

We converted the photointerpreted data[4] into a format usable in a geographic information system (GIS) by employing three fundamental processes, as follows: (1) orthorectify, (2) digitize, and (3) develop the geodatabase. All digital map automation was projected in Universal Transverse Mercator (UTM), Zone 15, by using the North American Datum of 1983 (NAD83).

Orthorectify: We orthorectified the interpreted overlays by using OrthoMapper, a softcopy photogrammetric software for GIS. One function of OrthoMapper is to create orthorectified imagery from scanned and nonrectified imagery (Image Processing Software, Inc., 2002). The

[3] It should also be noted that we allowed polygons as small as 0.10 ha once clipped by the project boundary.
[4] Except for the flood-inundated riverine portions of the lower Saint Croix River, which was mapped directly onscreen by using the NAIP 2006 orthophotographic imagery.

software features a method of visual orientation involving a point-and-click operation that uses existing orthorectified horizontal and vertical base maps. Of primary importance to us, OrthoMapper also has the capability to orthorectify the photointerpreted overlays of each photograph according to the reference information provided.

Digitize: To produce a polygon vector layer for use in GIS, we converted each raster-based image mosaic of orthorectified overlays containing the photointerpreted data into a grid format by using ArcGIS (Environmental Systems Research Institute [ESRI], Redlands, California). In ArcGIS, we used the ArcScan extension to trace the raster data and produce ESRI shapefiles. We digitally assigned map-attribute codes (both map-class and physiognomic modifier codes) to the polygons and checked the digital data against the photointerpreted overlays for line and attribute consistency. Ultimately, we merged the individual layers into a seamless layer.

Geodatabase: At this stage, the map layer would have only map-attribute codes assigned to each polygon. To assign meaningful information to each polygon (e.g., map-class names, physiognomic definitions, links to NVCS types), we produced a feature-class table, along with other supportive tables, and subsequently related them together via an ArcGIS Geodatabase. This geodatabase also links the map to other feature-class layers produced from this project, including vegetation sample plots, accuracy assessment (AA) sites, aerial photo locations, and the project boundary extent. A geodatabase provides access to a variety of interlocking data sets, is expandable, and equips resource managers and researchers with a powerful GIS tool.

Results

Map Classes

We developed 68 map classes (including map-class phases) to map the SACN and environs. Of these 68 map classes, 61 represent natural/semi-natural vegetation types[5] within the NVCS, four represent cultural vegetation types (agriculture and developed) within the NVCS, and three represent non-vegetation features (open water). Table 10 lists the map classes as they relate to the NVCS.

[5] One of these 61 map classes is a park-special class representing several vegetation types; most of these types are already represented by their own map class. This park-special map class was developed for use in mapping the flood-inundated waters that existed on the lower portion of the SACN during the time of acquiring aerial photography. We were able to use the existing NAIP imagery to locate wetland vegetation extents; however, the imagery did not provide sufficient resolution to map the individual map classes.

Table 10. Map classification with crosswalk to the National Vegetation Classification Standard, Version 2 (FGDC 2008), for the Saint Croix National Scenic Riverway (Minnesota/Wisconsin) vegetation mapping project.

[NVCS, National Vegetation Classification Standard; NLCD, National Land Cover Database]

Map-class Code	Map-class Name
1. FOREST & WOODLAND CLASS	
1.C.2.Na. (D008.) Eastern North American Cool Temperate Forest Division	
M153. Central Mesophytic Hardwood Forest Macrogroup	
G021. North-Central Beech - Maple - Basswood Forest Group	
Acer saccharum - *Tilia americana* / *Ostrya virginiana* - *Carpinus caroliniana* Forest Association (CEGL002062)	
FMT*	Sugar Maple - American Basswood Forest*
M012. Central Oak-Hardwood & Pine Forest Macrogroup	
G016. Chinkapin Oak - Ash - Red-cedar Alkaline Forest Group	
Quercus muehlenbergii - *Quercus* (*alba*, *velutina*) - (*Juniperus virginiana* var. *virginiana*) Bluff Woodland Association (CEGL002144)	
WRC	Eastern Red-cedar - (Hardwood) Bluff Woodland
G158. Northeastern & North-Central Oak - Hickory Forest Group	
Quercus alba - *Quercus rubra* - *Carya ovata* Glaciated Forest Association (CEGL002068)	
FWR	Midwestern White Oak - Red Oak Forest
Pinus strobus - *Quercus* (*alba*, *rubra*, *velutina*) Driftless Bluff Forest Association (CEGL005561)	
FPO*	White Pine - (Red Pine) - Oak Forest*
Quercus macrocarpa - *Quercus* (*alba*, *ellipsoidalis*, *velutina*) Woodland Association (CEGL005560)	
WOR	Oak Driftless Bluff Woodland
M013. Eastern North American Ruderal Forest & Plantation Macrogroup	
G032. Northern & Central Conifer & Hardwood Plantation Group	
FPE	Conifer Plantation
G030. Northern & Central Hardwood & Conifer Ruderal Forest Group	
FCX	Conifer Ruderal Forest
FDX	Hardwood Ruderal Forest
FMX	Conifer - Hardwood Ruderal Forest
M159. Northern & Eastern Pine - Oak Forest, Woodland & Barrens Macrogroup	
G025. White Pine - Red Pine - Jack Pine - Oak Forest & Woodland Group	
Pinus banksiana - (*Pinus resinosa*) - *Quercus ellipsoidalis* / *Carex pensylvanica* Forest Association (CEGL002478)	
FJO	Jack Pine - Northern Pin Oak Forest

Map-class Code	Map-class Name
Pinus resinosa - *Populus tremuloides* / *Diervilla lonicera* - *Vaccinium* spp. Forest Association (CEGL002520)	
FRA	Red Pine - Aspen - Birch Forest
Pinus resinosa / *Vaccinium* spp. Forest Association (CEGL002443)	
FRP	Red Pine / Blueberry Dry Forest
Pinus strobus - (*Pinus resinosa*) - *Quercus rubra* Forest Association (CEGL002480)	
FPO*	White Pine - (Red Pine) - Oak Forest*
Pinus strobus - *Populus tremuloides* / *Corylus cornuta* Forest Association (CEGL002479)	
FWA	White Pine - Aspen - Birch Forest
Pinus strobus / *Acer spicatum* - *Corylus cornuta* Forest Association (CEGL002445)	
FWM	White Pine / Mountain Maple Mesic Forest
Quercus ellipsoidalis - (*Quercus macrocarpa*) Forest Association (CEGL002077)	
FPB	Northern Pin Oak - (Bur Oak) Forest
G160. Great Lakes Pine Barrens Group	
Pinus banksiana - *Pinus resinosa* - (*Quercus ellipsoidalis*) / *Carex pensylvanica* Wooded Herbaceous Vegetation Association (CEGL005124)	
N/A	Jack Pine - Red Pine Barrens
Pinus banksiana - *Pinus resinosa* / *Quercus ellipsoidalis* Woodland Association (CEGL002484)	
WJO	Jack Pine - Red Pine / Scrub Oak Woodland
M151. Northern Great Plains Woodland Macrogroup	
G146. Eastern Great Plains Tallgrass Aspen Parkland Group	
Populus tremuloides / *Corylus americana* Forest Association (CEGL002063)	
FQA	Aspen / American Hazel Forest
G329. Great Plains Oak Woodland Group	
Quercus alba - *Quercus macrocarpa* - *Quercus rubra* / *Corylus americana* Woodland Association (CEGL002142)	
WBO	North-Central Dry-Mesic Oak Woodland
M014. Northern Mesic Hardwood & Conifer Forest Macrogroup	
G163. Northern Hardwood - Hemlock - White Pine Forest Group	
Acer saccharum - *Betula alleghaniensis* - (*Tilia americana*) Forest Association (CEGL002457)	
N/A	Maple - Yellow Birch Northern Hardwoods Forest
Acer saccharum - *Tilia americana* / *Ostrya virginiana* / *Lonicera canadensis* Forest Association (CEGL002458)	
FMT*	Sugar Maple - American Basswood Forest*
Betula papyrifera / *Acer saccharum* - Mixed Hardwoods Forest Association (CEGL002464)	
FPH	Paper Birch / Sugar Maple - Mixed Hardwoods Forest

Map-class Code	Map-class Name
Pinus strobus - (*Pinus resinosa*) Driftless Bluff Forest Association (CEGL002378)	
FPR	White Pine - (Red Pine) Driftless Bluff Forest
Populus tremuloides - *Betula papyrifera* - (*Acer rubrum*, *Populus grandidentata*) Forest Association (CEGL002467)	
FAM*	Aspen - Birch / Hardwood Forest*
Populus tremuloides - *Betula papyrifera* / *Acer saccharum* - Mixed Hardwoods Forest Association (CEGL002468)	
FAM*	Aspen - Birch / Hardwood Forest*
Quercus rubra - *Acer saccharum* - (*Betula alleghaniensis*) Forest Association (CEGL002461)	
FOM	Northern Red Oak - Sugar Maple Forest
1.C.3.Na. (D011.) Eastern North American Flooded & Swamp Forest Division	
M029. Northern & Central Floodplain Forest & Scrub Macrogroup	
G041. Eastern Cottonwood - Black Willow Flooded & Swamp Group	
Populus deltoides - *Salix nigra* Forest Association (CEGL002018)	
FHF*	Floodplain Hardwood Forest*
G040. Silver Maple - Green Ash - Sycamore Floodplain Group	
Acer saccharinum - *Ulmus americana* Forest Association (CEGL002586)	
FHF*	Floodplain Hardwood Forest*
Fraxinus pennsylvanica - *Celtis occidentalis* - *Tilia americana* - (*Quercus macrocarpa*) Forest Association (CEGL002081)	
FAL	Ash - Elm - Mixed Lowland Hardwood Forest (ash - elm phase)
FBL	Ash - Elm - Mixed Lowland Hardwood Forest (bur oak phase)
FQL	Ash - Elm - Mixed Lowland Hardwood Forest (aspen phase)
Fraxinus pennsylvanica - *Ulmus americana* - (*Acer negundo*, *Tilia americana*) Northern Forest Association (CEGL002089)	
FHF*	Floodplain Hardwood Forest*
M030. Northern & Central Swamp Forest Macrogroup	
G046. Northern & Central Conifer & Hardwood Alkaline Swamp Group	
Acer rubrum - *Fraxinus* spp. - *Betula papyrifera* / *Cornus canadensis* Forest Association (CEGL002071)	
FRM	Red Maple - Ash - Birch Swamp Forest
Fraxinus nigra - Mixed Hardwoods - Conifers / *Cornus sericea* / *Carex* spp. Forest Association (CEGL002105)	
FBA	Black Ash - Mixed Hardwood Swamp
Thuja occidentalis - *Fraxinus nigra* Forest Association (CEGL005165)	
FCA	White-cedar - Black Ash Swamp

Map-class Code	Map-class Name
M160. Northern & Central Tall Shrub Wetland Macrogroup	
G167. Northern & Central Shrub Swamp Group	
Alnus incana Swamp Shrubland Association (CEGL002381)	
SAS	Gray Alder Swamp
1.D.1.Na. (D014.) North American Boreal Forest Division	
M037. Eastern & Central North American Boreal Conifer & Hardwood Forest Macrogroup	
G047. Jack Pine - Black Spruce Forest Group	
Pinus banksiana Forest Alliance (A.116)	
FJP	Jack Pine Forest
Pinus banksiana - *Populus tremuloides* Forest Alliance (A.390)	
FJA	Jack Pine - Quaking Aspen Forest
G048. White Spruce - Balsam Fir Forest Group	
Picea glauca - *Abies balsamea* - *Populus tremuloides* / Mixed Herbs Forest Association (CEGL002475)	
FCP	Spruce - Fir - Aspen Forest
Picea glauca - *Abies balsamea* / *Acer spicatum* / *Rubus pubescens* Forest Association (CEGL002446)	
FSF	Spruce - Fir / Mountain Maple Forest
Populus tremuloides - *Betula papyrifera* / (*Abies balsamea*, *Picea glauca*) Forest Association (CEGL002466)	
FAC	Aspen - Birch / Boreal Conifer Forest
1.D.2.Na. (D016.) North American Boreal Flooded & Swamp Forest Division	
M299. North American Boreal Swamp Forest Macrogroup	
G050. Eastern Black Spruce - Tamarack Acidic Swamp Group	
Picea mariana - (*Larix laricina*) / *Ledum groenlandicum* / *Sphagnum* spp. Forest Association (CEGL005271)	
FST*	Black Spruce and/or Tamarack Swamp*
G051. Eastern Tamarack - Conifer Alkaline Swamp Group	
Larix laricina / *Alnus incana* Forest Association (CEGL002471)	
FST*	Black Spruce and/or Tamarack Swamp*
Thuja occidentalis - (*Picea mariana*, *Abies balsamea*) / *Alnus incana* Forest Association (CEGL002456)	
FCS	White-cedar - (Mixed Conifer) / Alder Swamp

Map-class Code	Map-class Name
2. SHRUBLAND & GRASSLAND CLASS	
2.C.1.Nb. (D023.) Great Plains Grassland & Shrubland Division	
M054. Great Plains Tallgrass Prairie & Shrubland Macrogroup	
G333. Central Great Plains Tallgrass Prairie Group	
Schizachyrium scoparium - *Sorghastrum nutans* - *Bouteloua curtipendula* Herbaceous Vegetation Association (CEGL002214)	
HMP*	Midwest Dry-Mesic Grassland Prairie*
G151. Sand & Gravel Tallgrass Prairie Group	
Schizachyrium scoparium - *Bouteloua curtipendula* Bedrock Bluff Herbaceous Vegetation Association (CEGL002245)	
N/A	Little Bluestem Bedrock Bluff Prairie
Schizachyrium scoparium - *Danthonia spicata* - *Carex pensylvanica* - (*Viola pedata*) Herbaceous Vegetation Association (CEGL002318)	
HDP	Midwest Dry Sand Prairie
Schizachyrium scoparium - *Sorghastrum nutans* - *Andropogon gerardii* - *Lespedeza capitata* Sand Herbaceous Vegetation Association (CEGL002210)	
HMP*	Midwest Dry-Mesic Grassland Prairie*
2.C.1.Nc. (D024.) Eastern North American Grassland, Meadow & Shrubland Division	
M123. Eastern North American Ruderal Shrubland & Grassland Macrogroup	
G059. Northern & Central Ruderal Meadow & Shrubland Group	
SDX	Deciduous Ruderal Shrubland
SMX	Conifer - Deciduous Ruderal Shrubland
HMX	Ruderal Grassland
Corylus cornuta - *Amelanchier* spp. Ruderal Shrubland Association (CEGL005562)	
SHZ	Hazelnut - Serviceberry Ruderal Shrubland
2.C.3.Na. (D026.) Eastern North American Dune & Coastal Grassland & Shrubland Division	
M176. Eastern North American Beach, Shoreline & Flat Macrogroup	
G343. Eastern North American River Shoreline Group [Placeholder]	
Igneous - Metamorphic Cobble - Gravel River Shore Sparse Vegetation Association (CEGL002304)	
VSB*	Riverine Cobble - Gravel - Sand Shore*
Riverine Sand Flats - Bars Sparse Vegetation Association (CEGL002049)	
VSB*	Riverine Cobble - Gravel - Sand Shore*

Map-class Code	Map-class Name
2.C.4.Na. (D029.) North American Bog & Fen Division	
M061. Appalachian, Interior Plateau & Prairie Fen Macrogroup	
G183. North-Central Appalachian, Interior & Prairie Fen Group	
Symplocarpus foetidus Herbaceous Vegetation Association (CEGL002385)	
N/A	Skunk-cabbage Seepage Meadow
M062. North American Boreal Bog & Fen Macrogroup	
G386. Eastern North American Boreal Acidic Bog & Poor Fen Group	
Betula pumila / *Chamaedaphne calyculata* / *Carex lasiocarpa* Shrubland Association (CEGL002494)	
SMW*	Mixed Shrub Swamp and/or Fen*
Carex lasiocarpa - *Carex oligosperma* / *Sphagnum* spp. Herbaceous Vegetation Association (CEGL002265)	
HSP	Northern Sedge Poor Fen
Chamaedaphne calyculata / *Carex oligosperma* / *Sphagnum* spp. Poor Fen Dwarf-shrubland Association (CEGL005277)	
DLF	Leatherleaf Poor Fen
Larix laricina / *Chamaedaphne calyculata* / *Carex lasiocarpa* Shrubland Association (CEGL005226)	
STS	Tamarack Scrub Poor Fen
G185. Eastern North American Boreal Alkaline Fen Group	
Carex lasiocarpa - (*Carex rostrata*) - *Equisetum fluviatile* Herbaceous Vegetation Association (CEGL005229)	
HSS	Woolly-fruit Sedge Shore Fen
Chamaedaphne calyculata - *Myrica gale* / *Carex lasiocarpa* Dwarf-shrubland Association (CEGL005228)	
DLS	Leatherleaf - Sweetgale Shore Fen
2.C.5.Na. (D030.) Eastern North American Freshwater Wet Meadow, Riparian & Marsh Division	
M165. Eastern North American Riverscour Wetland Macrogroup	
G194. Northern & Central Riverscour Wetland Group	
Salix interior Temporarily Flooded Shrubland Association (CEGL008562)	
SWL	Sandbar Willow Shrubland
M303. Eastern North American Ruderal Wet Meadow & Marsh Macrogroup	
G556. Northern & Central Ruderal Wet Meadow & Marsh Group	
Phalaris arundinacea Eastern Herbaceous Vegetation Association (CEGL006044)	
HPH / HME*	Reed Canarygrass Eastern Marsh / Flooded Meadow, Marsh, and Aquatic Herbaceous Vegetation Complex*
Phragmites australis Eastern North America Temperate Semi-natural Herbaceous Vegetation Association (CEGL004141)	
HPG / HME*	Eastern Reed Marsh / Flooded Meadow, Marsh, and Aquatic Herbaceous Vegetation Complex*

Map-class Code	Map-class Name
M069. Eastern North American Wet Meadow & Marsh Macrogroup	
G125. Eastern North American Freshwater Marsh Group	
Schoenoplectus tabernaemontani - *Typha* spp. - (*Sparganium* spp., *Juncus* spp.) Herbaceous Vegetation Association (CEGL002026)	
HMM* / HME*	Sedge Meadow and/or Emergent Herbaceous Marsh* / Flooded Meadow, Marsh, and Aquatic Herbaceous Vegetation Complex*
Typha spp. Midwest Herbaceous Vegetation Association (CEGL002233)	
HMM* / HME*	Sedge Meadow and/or Emergent Herbaceous Marsh* / Flooded Meadow, Marsh, and Aquatic Herbaceous Vegetation Complex*
Zizania (*aquatica*, *palustris*) Herbaceous Vegetation Association (CEGL002382)	
HWR / HME*	Wild Rice Marsh / Flooded Meadow, Marsh, and Aquatic Herbaceous Vegetation Complex*
G112. Eastern North American Wet Meadow Group	
HWM	Wet Meadow Mixed Herbaceous
Calamagrostis canadensis - *Eupatorium maculatum* Herbaceous Vegetation Association (CEGL005174)	
HCC	Bluejoint Wet Meadow
Carex (*rostrata*, *utriculata*) - *Carex lacustris* - (*Carex vesicaria*) Herbaceous Vegetation Association (CEGL002257)	
HMM* / HME*	Sedge Meadow and/or Emergent Herbaceous Marsh* / Flooded Meadow, Marsh, and Aquatic Herbaceous Vegetation Complex*
Carex stricta - *Carex* spp. Herbaceous Vegetation Association (CEGL002258)	
HUS	Upright Sedge Wet Meadow
Cornus sericea - *Salix* (*bebbiana*, *discolor*, *petiolaris*) / *Calamagrostis stricta* Shrubland Association (CEGL002187)	
SMW*	Mixed Shrub Swamp and/or Fen*
Spartina pectinata - *Carex* spp. - *Calamagrostis canadensis* - *Lythrum alatum* - (*Oxypolis rigidior*) Herbaceous Vegetation Association (CEGL002224)	
N/A	Central Cordgrass Wet Prairie
G325. Great Plains Freshwater Marsh Group	
Sagittaria latifolia - *Leersia oryzoides* Herbaceous Vegetation Association (CEGL005240)	
HME*	Flooded Meadow, Marsh, and Aquatic Herbaceous Vegetation Complex*

Map-class Code	Map-class Name
5. AQUATIC VEGETATION CLASS	
5.B.1.Na. (D049.) North American Freshwater Aquatic Vegetation Division	
M108. Eastern North American Freshwater Aquatic Vegetation Macrogroup	
G114. Eastern North American Freshwater Aquatic Vegetation Group	
Nuphar advena - *Nymphaea odorata* Herbaceous Vegetation Association (CEGL002386)	
HFA / HME*	Water-lily Aquatic Wetland / Flooded Meadow, Marsh, and Aquatic Herbaceous Vegetation Complex*
Potamogeton spp. - *Ceratophyllum* spp. Midwest Herbaceous Vegetation Association (CEGL002282)	
HSV / HME*	Midwest Pondweed Submerged Aquatic Wetland / Flooded Meadow, Marsh, and Aquatic Herbaceous Vegetation Complex*
6. NONVASCULAR & SPARSE VASCULAR ROCK VEGETATION CLASS	
6.B.2.Na. (D051.) Eastern North American Temperate Cliff, Scree & Rock Vegetation Division	
M111. Eastern North American Cliff & Rock Vegetation Macrogroup	
G106. Eastern North American Temperate Cliff Group	
Igneous - Metamorphic Northern Dry Cliff Sparse Vegetation Association (CEGL002300)	
N/A	Northern (Laurentian) Igneous - Metamorphic Dry Cliff
Limestone - Dolostone Midwest Moist Cliff Sparse Vegetation Association (CEGL002292)	
N/A	Midwest Moist Limestone - Dolostone Cliff
Sandstone Dry Cliff Sparse Vegetation Association (CEGL002045)	
N/A	Midwest Dry Sandstone Cliff
Sandstone Midwest Moist Cliff Sparse Vegetation Association (CEGL002287)	
N/A	Midwest Moist Sandstone Cliff
7. AGRICULTURAL VEGETATION CULTURAL CLASS	
Woody Agricultural Vegetation Subclass (L2)	
Woody Horticultural Crop Formation (L3)	
Bush fruit and berries (shrub) Subformation (L4)	
Berries Subgroup (L6)	
DCF	Cranberry Crop Field
Herbaceous Agricultural Vegetation Subclass (L2)	
Cultivated Crop Formation (L3)	
HCF	Herbaceous Crop Field
Pasture / Hay Formation (L3)	
Permanent Pasture & Hayland Subformation (L4)	
HPF	Pasture and Hay Field

Map-class Code	Map-class Name
8. DEVELOPED VEGETATION CULTURAL CLASS	
Herbaceous & Woody Developed Vegetation Cultural Subclass (L2)	
Other Developed Urban / Built Up Vegetation Formation (L3)	
Developed Area (NLCD 2001; 21-24)	
CDV	Developed Area
NON-NVCS UNITS	
Non-Vegetated Water & Land (<1% vegetated)	
Non-Vegetated Water	
Open Water (NLCD 2001; 11)	
NSR	Stream and River
NWP	Open Water Pond
NWL	Open Water Lake

*Map class also represents other vegetation types.

Map Classification Descriptions

We provide descriptions of map classes (and their phases) representing those vegetation types in the NVCS, as well as of non-vegetation features. These descriptions, which are provided in Appendix E: Descriptions of Map Classes point out the link between map classes and the types/units they represent. In addition, a succinct explanation is given of how map classes were employed during the AA analysis. Representative ground photos are provided as well.

Summary Report of the Map Layer

Table 11 provides a summary report of the spatial-data layer (map) of SACN and summarizes frequency, area, and average polygon size for each map class (including phases). Table 12 provides a summary report with map classes compiled at the macrogroup level within the NVCS. These summary reports organize the map classes by hierarchy within the NVCS and represent all lands within the established project boundary extent, including the environs.

Following the tables are some general observations and inferences we made from a quick study of the summary reports. Although many more inferences can be made, these are provided as an example of how one might begin to analyze the map layer and garner information from it.

Table 11. Frequencies and areas of map classes (organized via the National Vegetation Classification Standard, Version 2 [FGDC 2008]) represented in the vegetation map layer for the Saint Croix National Scenic Riverway (Minnesota/Wisconsin) vegetation mapping project.

[Freq, Frequency; Ha, Hectare; Ave, Average; Ac, Acre; NVCS, National Vegetation Classification Standard]

Map-class Code	Map-class Name	Freq	Area (Ha)	Ave (Ha)	Area (Ac)	Ave (Ac)
FOREST & WOODLAND CLASS						
Central Oak-Hardwood & Pine Forest Macrogroup						
WRC	Eastern Red-cedar - (Hardwood) Bluff Woodland	158	263.0	1.7	649.8	4.1
FWR	Midwestern White Oak - Red Oak Forest	529	1,938.8	3.7	4,790.9	9.1
WOR	Oak Driftless Bluff Woodland	28	74.3	2.7	183.5	6.6
Eastern North American Ruderal Forest & Plantation Macrogroup						
FPE	Conifer Plantation	960	2,331.6	2.4	5,761.6	6.0
FCX	Conifer Ruderal Forest	716	902.6	1.3	2,230.5	3.1
FDX	Hardwood Ruderal Forest	1,024	1,400.3	1.4	3,460.3	3.4
FMX	Conifer - Hardwood Ruderal Forest	779	1,014.7	1.3	2,507.4	3.2
Northern & Eastern Pine - Oak Forest, Woodland & Barrens Macrogroup						
FJO	Jack Pine - Northern Pin Oak Forest	538	735.8	1.4	1,818.3	3.4
FRA	Red Pine - Aspen - Birch Forest	781	799.0	1.0	1,974.3	2.5
FRP	Red Pine / Blueberry Dry Forest	341	343.6	1.0	849.0	2.5
FPO*	White Pine - (Red Pine) - Oak Forest*	408	545.9	1.3	1,348.9	3.3
FWA	White Pine - Aspen - Birch Forest	653	739.5	1.1	1,827.4	2.8
FWM	White Pine / Mountain Maple Mesic Forest	405	392.9	1.0	970.9	2.4
FPB	Northern Pin Oak - (Bur Oak) Forest	1,239	3,255.7	2.6	8,045.0	6.5
WJO	Jack Pine - Red Pine / Scrub Oak Woodland	17	42.7	2.5	105.5	6.2
Northern Great Plains Woodland Macrogroup						
FQA	Aspen / American Hazel Forest	85	82.4	1.0	203.7	2.4
WBO	North-Central Dry-Mesic Oak Woodland	682	1,204.1	1.8	2,975.3	4.4
Northern Mesic Hardwood & Conifer Forest Macrogroup						
FMT**	Sugar Maple - American Basswood Forest**	1,382	2,896.0	2.1	7,156.3	5.2
FPH	Paper Birch / Sugar Maple - Mixed Hardwoods Forest	2	0.7	0.4	1.8	0.9
FPR	White Pine - (Red Pine) Driftless Bluff Forest	17	28.9	1.7	71.3	4.2
FAM	Aspen - Birch / Hardwood Forest	3,886	8,344.6	2.1	20,619.8	5.3
FOM	Northern Red Oak - Sugar Maple Forest	1,354	3,445.9	2.5	8,515.0	6.3

Map-class Code	Map-class Name	Freq	Area (Ha)	Ave (Ha)	Area (Ac)	Ave (Ac)
Northern & Central Floodplain Forest & Scrub Macrogroup						
FHF	Floodplain Hardwood Forest	1,094	2,227.3	2.0	5,503.7	5.0
FAL	Ash - Elm - Mixed Lowland Hardwood Forest (ash - elm phase)	1,427	2,246.9	1.6	5,552.2	3.9
FBL	Ash - Elm - Mixed Lowland Hardwood Forest (bur oak phase)	460	668.9	1.5	1,652.9	3.6
FQL	Ash - Elm - Mixed Lowland Hardwood Forest (aspen phase)	201	180.8	0.9	446.7	2.2
Northern & Central Swamp Forest Macrogroup						
FRM	Red Maple - Ash - Birch Swamp Forest	176	223.7	1.3	552.8	3.1
FBA	Black Ash - Mixed Hardwood Swamp	1,123	2,717.1	2.4	6,714.1	6.0
FCA	White-cedar - Black Ash Swamp	484	743.9	1.5	1,838.3	3.8
Northern & Central Tall Shrub Wetland Macrogroup						
SAS	Gray Alder Swamp	1,488	1,687.4	1.1	4,169.7	2.8
Eastern & Central North American Boreal Conifer & Hardwood Forest Macrogroup						
FJP	Jack Pine Forest	581	757.3	1.3	1,871.3	3.2
FJA	Jack Pine - Quaking Aspen Forest	743	748.9	1.0	1,850.5	2.5
FCP	Spruce - Fir - Aspen Forest	749	773.5	1.0	1,911.4	2.6
FSF	Spruce - Fir / Mountain Maple Forest	328	255.8	0.8	632.0	1.9
FAC	Aspen - Birch / Boreal Conifer Forest	293	302.3	1.0	747.0	2.5
North American Boreal Swamp Forest Macrogroup						
FST	Black Spruce and/or Tamarack Swamp	618	645.3	1.0	1,594.6	2.6
FCS	White-cedar - (Mixed Conifer) / Alder Swamp	102	174.3	1.7	430.7	4.2
SHRUBLAND & GRASSLAND CLASS						
Great Plains Tallgrass Prairie & Shrubland Macrogroup						
HMP	Midwest Dry-Mesic Grassland Prairie	10	37.2	3.7	91.8	9.2
HDP	Midwest Dry Sand Prairie	4	8.3	2.1	20.6	5.2
Eastern North American Ruderal Shrubland & Grassland Macrogroup						
SDX	Deciduous Ruderal Shrubland	873	1,325.8	1.5	3,276.1	3.8
SMX	Conifer - Deciduous Ruderal Shrubland	100	147.3	1.5	364.0	3.6
HMX	Ruderal Grassland	1,235	1,846.3	1.5	4,562.2	3.7
SHZ	Hazelnut - Serviceberry Ruderal Shrubland	53	28.5	0.5	70.4	1.3

Map-class Code	Map-class Name	Freq	Area (Ha)	Ave (Ha)	Area (Ac)	Ave (Ac)
Eastern North American Beach, Shoreline & Flat Macrogroup						
VSB	Riverine Cobble - Gravel - Sand Shore	68	80.3	1.2	198.3	2.9
North American Boreal Bog & Fen Macrogroup						
HSP	Northern Sedge Poor Fen	138	98.0	0.7	242.2	1.8
DLF	Leatherleaf Poor Fen	149	125.7	0.8	310.7	2.1
STS	Tamarack Scrub Poor Fen	5	3.8	0.8	9.4	1.9
HSS	Woolly-fruit Sedge Shore Fen	26	20.3	0.8	50.2	1.9
DLS	Leatherleaf - Sweetgale Shore Fen	32	38.0	1.2	94.0	2.9
Eastern North American Riverscour Wetland Macrogroup						
SWL	Sandbar Willow Shrubland	16	12.3	0.8	30.4	1.9
Eastern North American Ruderal Wet Meadow & Marsh Macrogroup						
HPH	Reed Canarygrass Eastern Marsh	137	115.8	0.8	286.1	2.1
HPG	Eastern Reed Marsh	1	6.1	6.1	15.1	15.1
Eastern North American Wet Meadow & Marsh Macrogroup						
HMM	Sedge Meadow and/or Emergent Herbaceous Marsh	290	183.4	0.6	453.3	1.6
HWR	Wild Rice Marsh	48	75.2	1.6	185.8	3.9
HWM	Wet Meadow Mixed Herbaceous	289	183.0	0.6	452.1	1.6
HCC	Bluejoint Wet Meadow	264	177.0	0.7	437.4	1.7
HUS	Upright Sedge Wet Meadow	15	11.5	0.8	28.4	1.9
SMW***	Mixed Shrub Swamp and/or Fen***	351	417.4	1.2	1,031.5	2.9
AQUATIC VEGETATION CLASS						
Eastern North American Freshwater Aquatic Vegetation Macrogroup						
HFA	Water-lily Aquatic Wetland	105	123.5	1.2	305.1	2.9
HSV	Midwest Pondweed Submerged Aquatic Wetland	157	113.0	0.7	279.3	1.8
FLOODED VEGETATION CLASS COMPLEX (Park Special)						
Flooded Vegetation Macrogroup Complex (Park Special)						
HME	Flooded Meadow, Marsh, and Aquatic Herbaceous Vegetation Complex	268	761.6	2.8	1,881.9	7.0

Map-class Code	Map-class Name	Freq	Area (Ha)	Ave (Ha)	Area (Ac)	Ave (Ac)
AGRICULTURAL VEGETATION CULTURAL CLASS						
Berries Subgroup						
DCF	Cranberry Crop Field	1	31.6	31.6	78.1	78.1
Cultivated Crop Formation						
HCF	Herbaceous Crop Field	203	1,315.6	6.5	3,250.9	16.0
Permanent Pasture & Hayland Subformation						
HPF	Pasture and Hay Field	415	1,300.3	3.1	3,213.2	7.7
DEVELOPED VEGETATION CULTURAL CLASS						
Developed Area						
CDV	Developed Area	1,152	6,417.9	5.6	15,859.0	13.8
NON-NVCS UNITS						
Open Water						
NSR	Stream and River	21	3,762.2	179.2	9,296.7	442.7
NWP	Open Water Pond	58	87.2	1.5	215.4	3.7
NWL	Open Water Lake	10	3,778.2	377.8	9,336.0	933.6

*The White Pine - Oak Forest map class also represents, to a lesser degree, the Central Oak-Hardwood & Pine Forest Macrogroup.
**The Sugar Maple - American Basswood Forest map class also represents, to a lesser degree, the Central Mesophytic Hardwood Forest Macrogroup.
***The Mixed Shrub Swamp and/or Fen map class also represents, to a lesser degree, the North American Boreal Bog & Fen Macrogroup.

Table 12. Frequencies and areas of map classes (compiled at the macrogroup level in the National Vegetation Classification Standard, Version 2 [FGDC 2008]) represented in the vegetation map layer for the Saint Croix National Scenic Riverway (Minnesota/Wisconsin) vegetation mapping project.

[Freq, Frequency; Ha, Hectare; Ave, Average; Ac, Acre; NVCS, National Vegetation Classification Standard]

NVCS Class and Group Name	Freq	Area (Ha)	Ave (Ha)	Area (Ac)	Ave (Ac)
FOREST & WOODLAND CLASS	**25,851**	**45,136.4**	**1.7**	**111,534.5**	**4.3**
Central Oak-Hardwood & Pine Forest Macrogroup	715	2,276.0	3.2	5,624.2	7.9
Eastern North American Ruderal Forest & Plantation Macrogroup	3479	5,649.3	1.6	13,959.8	4.0
Northern & Eastern Pine - Oak Forest, Woodland & Barrens Macrogroup	4382	6,855.0	1.6	16,939.2	3.9
Northern Great Plains Woodland Macrogroup	767	1,286.5	1.7	3,179.0	4.1
Northern Mesic Hardwood & Conifer Forest Macrogroup	6641	14,716.1	2.2	36,364.3	5.5
Northern & Central Floodplain Forest & Scrub Macrogroup	3182	5,323.9	1.7	13,155.5	4.1
Northern & Central Swamp Forest Macrogroup	1783	3,684.8	2.1	9,105.3	5.1
Northern & Central Tall Shrub Wetland Macrogroup	1488	1,687.4	1.1	4,169.7	2.8
Eastern & Central North American Boreal Conifer & Hardwood Forest Macrogroup	2694	2,837.7	1.1	7,012.2	2.6
North American Boreal Swamp Forest Macrogroup	720	819.6	1.1	2,025.3	2.8
SHRUBLAND & GRASSLAND CLASS	**4,510**	**5,389.2**	**1.2**	**13,317.1**	**3.0**
Great Plains Tallgrass Prairie & Shrubland Macrogroup	14	45.5	3.2	112.4	8.0
Eastern North American Ruderal Shrubland & Grassland Macrogroup	2,261	3,347.8	1.5	8,272.7	3.7
Eastern North American Beach, Shoreline & Flat Macrogroup	68	80.3	1.2	198.3	2.9
North American Boreal Bog & Fen Macrogroup	350	285.9	0.8	706.4	2.0
Eastern North American Riverscour Wetland Macrogroup	16	12.3	0.8	30.4	1.9
Eastern North American Ruderal Wet Meadow & Marsh Macrogroup	138	121.9	0.9	301.1	2.2
Eastern North American Wet Meadow & Marsh Macrogroup	1,663	1,495.6	0.9	3,695.7	2.2
AQUATIC VEGETATION CLASS	**262**	**236.5**	**0.9**	**584.4**	**2.2**
Eastern North American Freshwater Aquatic Vegetation Macrogroup	262	236.5	0.9	584.4	2.2
VEGETATION CLASS COMPLEX	**268**	**761.6**	**2.8**	**1,882**	**7.0**
Flooded Vegetation Macrogroup Complex (Park Special)	268	761.6	2.8	1,881.9	7.0
NVCS Subtotal	**30,891**	**51,523.7**	**1.7**	**127,317.8**	**4.1**

NVCS Class and Group Name	Freq	Area (Ha)	Ave (Ha)	Area (Ac)	Ave (Ac)
AGRICULTURAL VEGETATION CULTURAL CLASS	**619**	**2,647.5**	**4.3**	**6,542.2**	**10.6**
Berries Subgroup	1	31.6	31.6	78.1	78.1
Cultivated Crop Formation	203	1,315.6	6.5	3,250.9	16.0
Permanent Pasture & Hayland Subformation	415	1,300.3	3.1	3,213.2	7.7
DEVELOPED VEGETATION CULTURAL CLASS	**1,152**	**6,417.9**	**5.6**	**15,859.0**	**13.8**
Other Developed Urban / Built Up Vegetation Formation	1,152	6,417.9	5.6	15,859.0	13.8
NVCS Cultural Subtotal	**1,771**	**9,065.5**	**5.1**	**22,401.2**	**12.6**
NON-NVCS UNITS	**89**	**7,627.6**	**85.7**	**18,848.1**	**211.8**
Open Water	89	7,627.6	85.7	18,848.1	211.8
Non-NVCS Subtotal	**89**	**7,627.6**	**85.7**	**18,848.1**	**211.8**
Grand Total	**32,751**	**68,216.7**	**2.1**	**168,567.2**	**5.1**

Brief Analysis and Discussion

Collectively, the SACN spatial database layer is composed of 32,751 polygons covering 68,216.7 ha, with an average polygon size of 2.1 ha. Map classes representing natural/semi-natural types in the NVCS apply to 30,891 polygons (94.3% of all polygons, with an average polygon size of 1.7 ha) and cover 51,523.7 ha (75.5% of the entire area). Map classes representing cultural types in the NVCS apply to 1,771 polygons (5.4% of all polygons, with an average polygon size of 5.1 ha) and cover 9,065.5 ha (13.3% of the entire area). Map classes representing Non-NVCS units apply to 88 polygons (0.3% of all polygons, with an average polygon size of 86.7 ha) and cover 7,627.6 ha (11.2% of the entire area).

The Forest & Woodland Class of the NVCS applies to the majority of polygons and area covered by types in the NVCS, with 25,851 polygons (83.7% of natural/semi-natural polygons, having an average polygon size of 1.7 ha) covering 45,136.4 ha (87.6% of area covered by the NVCS types). The Forest & Woodland Class is dominated, in polygon frequency (6,641 polygons or 25.7%) and in area (14,716.1 ha or 32.6%), by the Northern Mesic Hardwood & Conifer Forest Macrogroup (M014). The map class contributing the most to the M014 dominance is the Aspen - Birch / Hardwood Forest (FAM), followed closely by the Sugar Maple - American Basswood Forest (FMT) and the Northern Red Oak - Sugar Maple Forest (FOM). More specifically, however, further analysis would indicate that FAM dominates in the northern portions of the SACN, whereas FMT and FOM dominate in the southern portions of the SACN. One would find a similar separation in dominance when comparing the map classes Floodplain Hardwood Forest (FHF) and Ash - Elm - Mixed Lowland Hardwood Forest (all phases combined, FAL, FBL, and FQL). The FHF map class dominates the floodplains in the lower reaches of the SACN and essentially becomes non-existent in the upper reaches, whereas the combined map class of the FAL/FBL/FQL (three phases of the same map class) dominates the upper reaches, yet has a significant presence in the lower reaches. Overall, the combined FAL/FBL/FQL map class is dominant over FHF in both polygon frequency and area throughout the entire project boundary extent. Because of the range in geographic latitude SACN covers, with further analysis, one would find this scenario of changing dominance true in many cases.

The Shrubland & Grassland Class of the NVCS applies to 4,510 polygons (14.6% of natural/semi-natural polygons, having an average polygon size of 1.2 ha) covering 5,389.2 ha (10.5% of area covered by the NVCS types). Indicating the extensive degree of human disturbance to vegetation along the SACN corridor, the Shrubland & Grassland Class is dominated, in polygon frequency (2,262 polygons or 50.2%) and in area (3,348.3 ha or 62.1%), by the Eastern North American Ruderal Shrubland & Grassland Macrogroup (M123). The map class largely contributing to this dominance is the Ruderal Grassland (HMX), providing 54.6% of the M123 polygons and 55.1% of the M123 area. The Eastern North American Wet Meadow & Marsh Macrogroup (M069) is also a big contributor, again both in polygon frequency (1,662 polygons or 36.9%) and in area (1,495.1 ha or 27.7%), within the Shrubland & Grassland Class. These numbers would actually be higher if the lower reach of the SACN had not received extensive flooding at the time of collecting aerial photography for the mapping project. Several map classes that contribute to M069 are also included into the Flooded Meadow, Marsh, and Aquatic Herbaceous Vegetation Complex (HME) map class; the HME map class was developed specifically to map non-distinct herbaceous vegetation within the flood-inundated portions in lower reach of the SACN.

The Aquatic Vegetation Class is made up of the Eastern North American Freshwater Aquatic Vegetation Macrogroup (M108), which consists of 262 polygons (0.8% of natural/semi-natural polygons, having an average polygon size of 0.9 ha) covering 236.5 ha (0.5% of area covered by the NVCS types).

Non-vegetation land cover features (those not in the NVCS) consist of only 89 polygons (0.3% of all polygons) in total but cover 7,627.6 ha (11.2% of the entire area). The average polygon size for map classes representing non-vegetation features (on average 85.7 ha.) is considerably larger than that of map classes representing NVCS types. This discrepancy in polygon size is due to the large, continuous polygons of the Saint Croix River and Namekagon River, either when as a free-flowing river and attributed to the Stream and River (NSR) map class or when as a riverine lake or flowage reservoir and attributed to the Open Water Lake (NWL) map class.

The cultural landscape of the SACN, as classified according to the NVCS, consists of 1,771 polygons (5.4% of all polygons) and covers 9,065.5 ha (13.3% of the entire area). The average polygon size is 5.1 ha. The Developed Vegetation Cultural Class (consisting of one map class) has almost two-thirds the number of polygons and covers over two-thirds the area than does the Agricultural Vegetation Cultural Class (consisting of three map classes).

Considerably more analyses and deductions can be attained even from these simple summary reports. Other summary tables can be derived from the map layer of localized areas (e.g., the SACN-owned lands excluding the administrative lands and the environs, geographic regions, Saint Croix River and Namekagon River) by clipping the map layer to its desired location and running a new summary. Also, more complex summary reports can be derived, either from the map layer alone (e.g., employing physiognomic modifiers such as coverage, pattern, and height) or from introducing other spatial-data layers (e.g., soils, geology, invasive species, animal distribution, historical land use). By performing various modifications to the vegetation map layer, one can make further deductions regarding vegetation and associated ecology.

Map Layer Presentation

Figure 19 presents the map layer produced for the SACN vegetation mapping project. The finest level of the map (the map-attribute codes consisting of map classes and physiognomic modifiers) is too detailed to present; therefore, the map in Figure 19 is generalized, collapsing map classes at the macrogroup level of the NVCS.

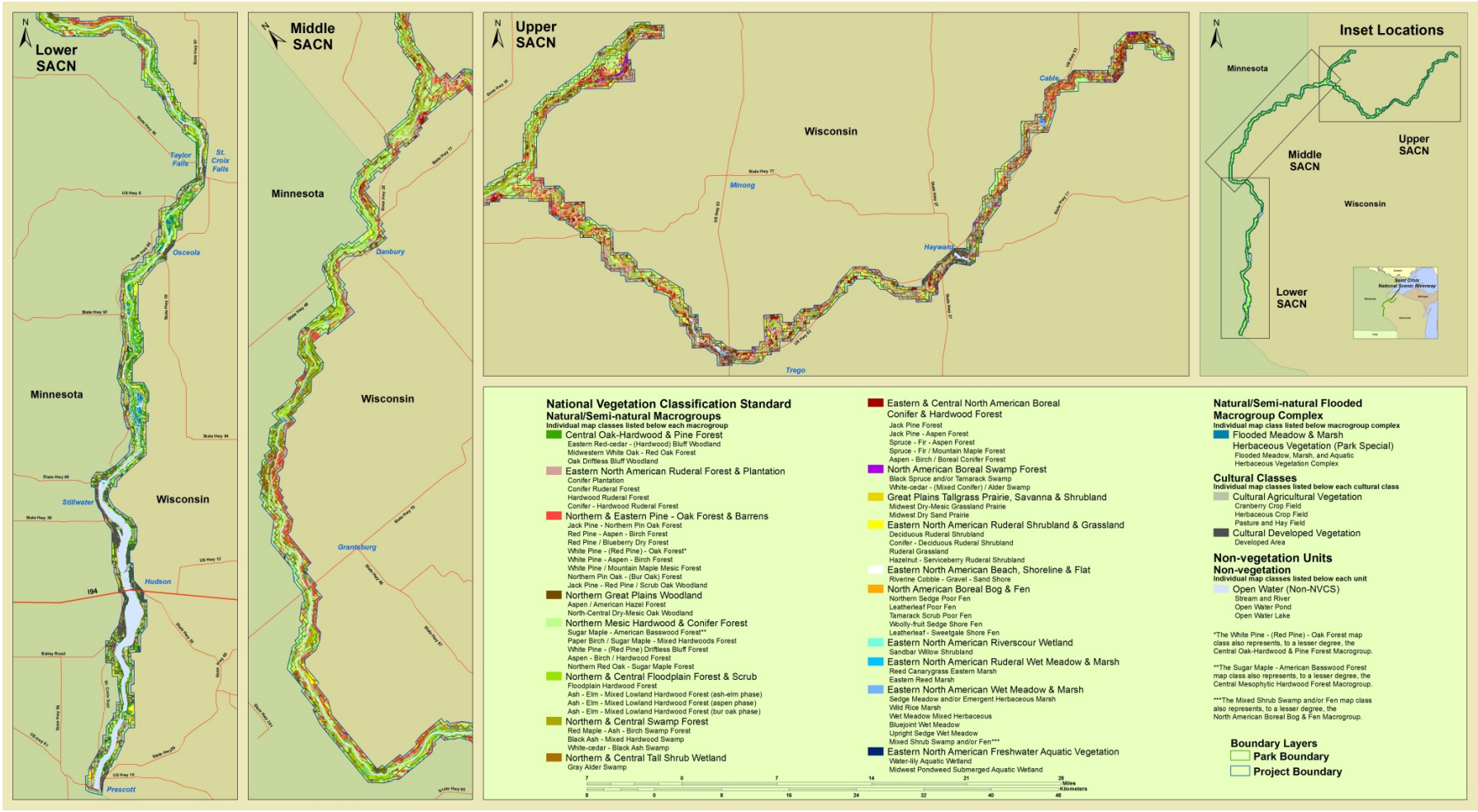


Figure 19. Vegetation of the Saint Croix National Scenic Riverway (SACN; Minnesota/Wisconsin) and environs, presented at the natural/semi-natural macrogroup and the cultural class levels of the National Vegetation Classification Standard, Version 2 (FGDC 2008).

Accuracy Assessment

Methods

Purpose

The objective of an accuracy assessment (AA) is to measure the probability that a particular location has been assigned its correct vegetation class. The purpose of an AA is to estimate thematic errors in the data, giving users information needed to determine data suitability for a particular application. At the same time, data producers are able to learn more about the nature of errors in the data. Thus, the two views of an AA are "users' accuracy," which is the probability that the map actually represents what was found on the ground, and "producers' accuracy," which is the probability that an AA site has been mapped correctly. An error in mapping from a users' perspective is one of commission where a map class was mapped that did not exist at the site of assessment. An error in mapping from a producers' perspective is one of omission where a map class was not mapped that existed at the site of assessment. Both producers' and users' accuracies can be obtained from the same set of data by using different analyses. Errors occur when map classes are not the same as the classes observed in the field. A major assumption of AA is that the process of mapping and the process of the assessment (e.g., the application of the classification system) are identical, so that a "false error" is not detected because of procedural differences. In actuality, the process of AA is based on field observance, and the process of mapping is based on aerial photointerpretation with different perspectives of scale and observation.

Sampling Design

We used a stratified random sampling approach to select AA sites at Saint Croix National Scenic Riverway (SACN). We included all map classes representing natural/semi-natural floristic vegetation types[6] in the National Vegetation Classification Standard (NVCS) as the individual themes to randomly select sites. Map-class phases were collapsed into the primary map class they belonged to. (Recall that a map-class phase is a version of a vegetation type recognizable in mapping and is important for either management or ecological interests.) All locations within the SACN project boundary having public access were included in the sampling design.

The number of samples needed for each map class (theme) was determined by using National Park Service (NPS) Vegetation Inventory Program (VIP) recommendations for a medium-sized park (TNC et al. 1994), as suggested in the following scenarios:

- Scenario A: The class is abundant. It covers more than 50 ha of the total area and consists of at least 30 polygons. The recommended sample size is 30.
- Scenario B: The class is relatively abundant. It covers more than 50 ha of the total area but consists of fewer than 30 polygons. The recommended sample size is 20. The rationale for reducing the sample size for this type of class is that sample sites are more difficult to find because of the lower frequency of the class.

[6] Map classes representing ruderal vegetation were classified at the group level in the NVCS and were not included in the AA sampling design (because of the inherent variability in vegetation), with one exception—the Wet Meadow Mixed Herbaceous (HWM) map class (which was classified as the Eastern North American Wet Meadow Group [G112] in the NVCS).

- Scenario C: The class is relatively rare. It covers less than 50 ha of the total area but consists of more than 30 polygons. The recommended sample size is 20. The rationale for reducing the sample size is that the class occupies a small area. At the same time, however, the class consists of a considerable number of distinct polygons that are possibly widely distributed. The number of samples, therefore, remains relatively high because of the high frequency of the class.
- Scenario D: The class is rare. It has more than five but fewer than 30 polygons and covers less than 50 ha of the area. The recommended number of samples is five. The rationale for reducing the sample size is that the class consists of small polygons and the frequency of the polygons is low. Specifying more than five sample sites would, therefore, probably result in multiple sample sites being sampled within the same (small) polygon. Collecting samples at five sites will allow for an accuracy estimate to be computed, although it will not be very precise.
- Scenario E: The class is very rare. It has fewer than five polygons and occupies less than 50 ha of the total area. In this case, it is recommended that the existence of the class be confirmed by a visit to each sample site. The rationale for this recommendation is that with fewer than five sample sites (assuming one site per polygon), no estimate of the level of confidence can be established for the sample (the existence of the class can only be confirmed through field checking).

The recommendations above take into account both the statistical and operational aspects of sampling. The accuracy estimate associated with rare classes cannot be stated with the same level of confidence as with more abundant classes. For example, with a sample size of five, the level of error in the estimate is closer to 25% at a 90% confidence level, as opposed to 10% with a sample size of 27. This has implications for our ability to accept a given point estimate as meeting accuracy requirements. Whether or not a given accuracy estimate is accepted as one that meets accuracy requirements depends on the width of the confidence interval associated with the point estimate and the outcome of a hypothesis test that determines if a given point estimate is equivalent to or exceeds requirements.

We used the above guidelines in selecting the appropriate number of sites for each map class. A 10-m buffer was applied interior to the polygon boundaries to promote global positioning system (GPS) navigation into the correct polygon. Random AA points (coordinates) were generated for each map class by using Hawth's Tools for ArcGIS (Beyer 2004). The AA points were then assigned a random number used to identify each AA site location.

We equipped the field crews with several tools to maximize their ability to accurately locate each AA site. We plotted 1:12,000-scale, hard-copy maps showing locations of the AA sites, the unlabeled polygon boundaries of the vegetation map, and the project boundary with the color-infrared aerial photomosaic displayed as a background. The AA-site coordinates were uploaded into GPS receivers and then projected in Universal Transverse Mercator (UTM), Zone 15, by using the North American Datum of 1983 (NAD83).

Field Data Collection

Once an AA site was reached by using the tools described above, an area equal to the size of a minimum mapping unit (MMU) within the map polygon was to be evaluated. Using the field key, the field crews determined the appropriate vegetation type. The field crews also recorded

the GPS coordinate location in the field, dominant species, environmental data, and pertinent comments (Figure 20). For a sample data sheet, refer to Appendix F: Accuracy Assessment Form. If the area was not homogeneous (containing more than one vegetation type), the other appropriate vegetation types were also listed on the data sheet.



Figure 20. A field botanist collecting data at an accuracy assessment site for the Saint Croix National Scenic Riverway (Minnesota/Wisconsin) vegetation mapping project.

Data Analyses

Field data for 1,290 AA sites were collected and entered into the NPS PLOTS Database, Version 2 (NatureServe 2005). A total of 1,440 sites were originally recommended, but 167 of these sites were not collected during the two field seasons. The database was subsequently reviewed for data-entry errors. Analyses of map accuracy included the following steps:

- Initial comparative analysis of the field and map data,
- Review of all disagreements and correction of false errors as necessary,
- Final comparative analysis of the field and map data,
- Individual map-class analysis,
- Final output of results into a contingency matrix, and
- Final output of the analyses and results into a spatial database for use in a geographic information system (GIS).

Initial Comparative Analysis

We completed a spatial join of the AA field-site data and the map-polygon data. This allowed us to compare each AA field-site call (vegetation type) to the corresponding map-polygon call (map class representing a vegetation type). We used Microsoft Excel 2007 (Microsoft Corporation) to compare and tabulate the field-site call to the map-polygon call. Our comparison accounted for alternate field calls indicated on the field-data sheets, accepting map-polygon calls as correct when matching these alternate calls.

Review of Disagreements

All mismatches (disagreements) were subsequently reviewed for false errors. A false error is defined as a mismatch between the AA field-site call and the map-polygon call if caused by an accuracy error in the GPS field-site coordinates, a missing or misapplied field-site call, or a field-site assessment of an area smaller than the MMU (an inclusion). This review process involved looking at the AA sites and their corresponding polygons by using ArcGIS (Version 9.3, © 2008 Environmental Systems Research Institute, Redlands, California) to locate them and by then viewing them on aerial photographs with a Topcon (MS-3) mirror stereoscope with 3x binoculars. We also reviewed the field-data sheet to gain fuller context of the ground data. From this process, we determined whether an initial disagreement was either a true error or indeed a match. The following paragraphs further explain our process:

Spatial Error

A spatial error might occur in one of two of the following ways: (1) the GPS device acquired inaccurate field coordinates or (2) a geospatial error existed within the vegetation map layer (called a "map-layer shift"). Either of these spatial errors could displace the newly acquired field coordinate inside an adjacent polygon on the map layer. From selecting sites more than 10 m from polygon edges, we were able to minimize spatial errors in GPS coordinates, yet occasionally GPS accuracy could fall outside this parameter.

Questionable Field Call

A field assessment call might be questioned during the analysis, especially when the perspective from the ground was limited by poor vantage points, such as heavy cover of vegetation or wet soils preventing the field worker from walking around the MMU. If the MMU area was diverse, with more than one map class represented, it was possible to miss or not recognize other vegetation types present. We reviewed these situations by checking the aerial photographs for diversity at the site and by reviewing the field-data sheets to check for possible problems. We also reviewed the data for the possibility of an incorrect vegetation class or another vegetation class not having been recorded. Thus, we were able to update our analysis tables to reflect any additions or changes to the field-site call in preparation for the second comparative analysis. (We also updated the PLOTS Database.)

Inclusion

The area assessed in the field during the AA might fall below the MMU for mapping (termed an inclusion). We discovered several instances wherein, after reviewing the aerial photographs, we could conclude that the site in question contained vegetation that was an inclusion to the surrounding map class. Certain vegetation features can be quite distinct from each other on aerial photographs (e.g., open woodland versus dense forest), allowing easy assessment of site inclusions in the lab. Another type of inclusion occurred when an area in the field was a valid

MMU, but the assessed area overlapped into an adjacent polygon. Particularly in the case of smaller polygons adjacent to those having similar vegetation types, it was sometimes difficult to determine if the assessed area actually fell within the intended polygon.

Final Comparison

Of the 1,290 AA sites originally collected, we dropped several sites because of problems with the data (e.g., missing UTM coordinates, nonrectifiable spatial errors, or incomplete data). About a dozen more sites were dropped because they were duplicates—the same site was visited by two different crews. We used the remaining 1,257 AA sites for the final comparative analysis of the vegetation map layer (Figure 21).

Individual Map-class Analysis

For individual map-class accuracies falling below standards of the NPS VIP, we compared map classes to determine which were in confusion. If a repetitive confusion was evident, we then determined whether to merge the map classes to gain higher accuracy or to leave the map classes as they were, even if it resulted in lower accuracy. These determinations were made with input from NPS staff (SACN and Great Lakes Inventory & Monitoring Network).

Final Output

The results of the final analyses were transferred into a contingency table (matrix) where we calculated percentages of users' and producers' accuracies for each map class. The matrix shows both the frequency of agreement and placement of disagreements.

AA Spatial Database

For use in a GIS, we produced a feature-class layer of the AA site locations, along with supporting tables, and incorporated them into the geodatabase for the SACN vegetation mapping project. The field data for AA are also included in the PLOTS Database.

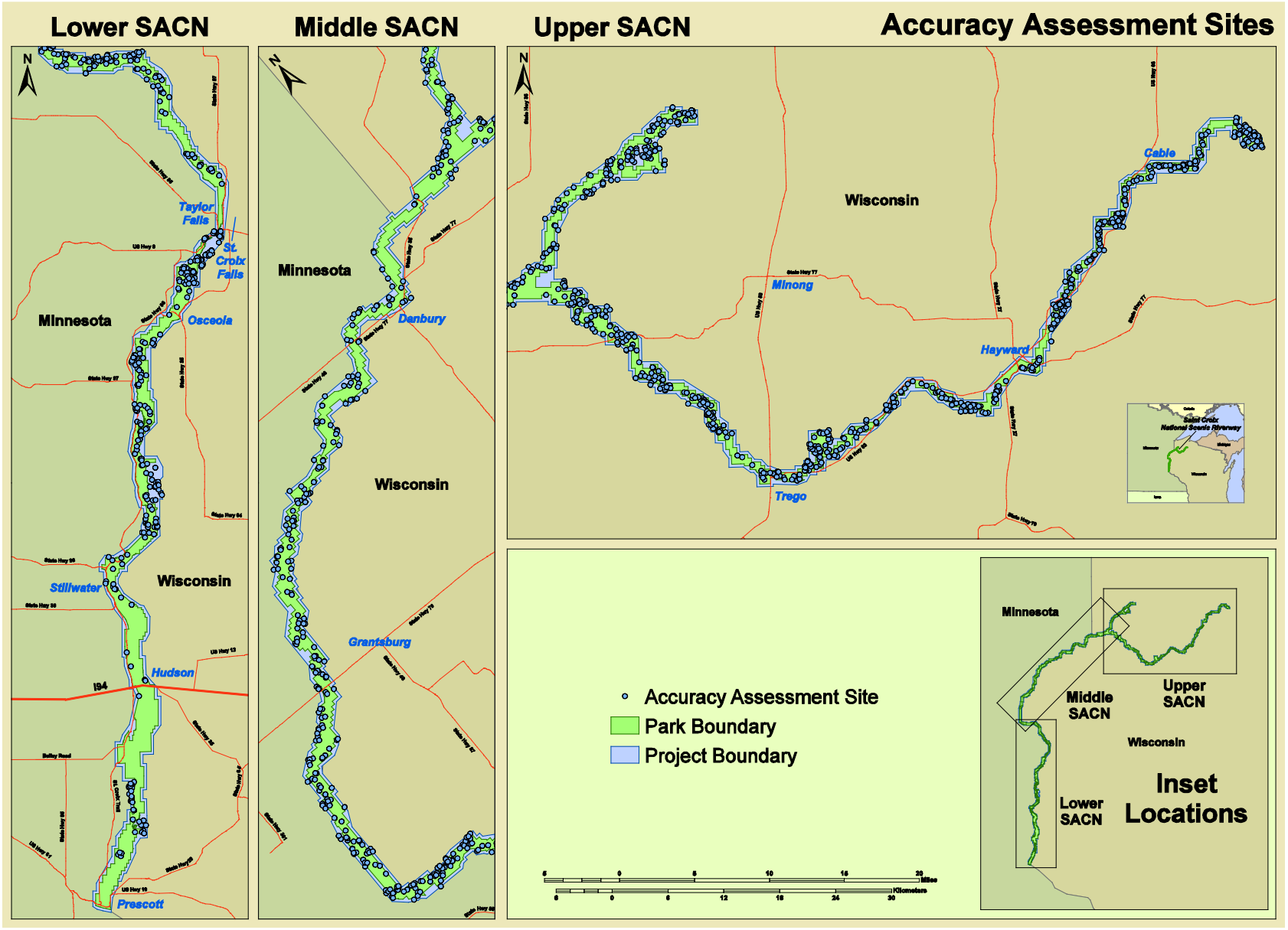


Figure 21. Locations of accuracy assessment sites used to validate the vegetation map layer for the Saint Croix National Scenic Riverway (SACN; Minnesota/Wisconsin) vegetation mapping project.

Results

Overall accuracy is 77.2% for primary map classes representing natural/semi-natural floristic vegetation types in the NVCS. A kappa adjustment for chance agreements resulted in an accuracy of 76.4%. The contingency matrix for AA results is provided in Appendix G: Accuracy Assessment Contingency Table. The matrix shows the accuracy of each map class (along with 90% confidence intervals), with the users' accuracy reflecting errors of inclusion (commission errors) and producers' accuracy reflecting errors of exclusion (omission errors). The width of each confidence interval is affected by the sample size used to derive the point estimate.

Our overall AA fell short of the accuracy requirement of 80% established by the NPS VIP; however, this level of accuracy was determined by the NPS as an output nevertheless useful to users of the vegetation database layer. The most important factors affecting accuracy were disagreements about the relative densities of deciduous trees to one another, difficulties distinguishing lowland types from upland types, disagreements between estimates of percent covers of the strata, and lack of distinction of wet herbaceous species from one another (and their densities), and overly generalized mapping. From our past experiences we have noticed that field estimates of cover are generally lower than aerial estimates, so some errors are simply a result of two somewhat different perspectives.

Some individual map-class accuracies did not meet the 80% requirement (taking into account 90% confidence intervals). In general, errors of omission (producers' accuracy) occurred in fewer map classes than did errors of commission (users' accuracy). The following are map classes for which the mapping project did not meet the required rates of accuracy, in terms of either the actual percentage or the confidence intervals.

Users' Accuracy (Errors of Commission)

The users' accuracy for the Ash - Elm - Mixed Lowland Hardwood Forest map class (ash - elm phase [FAL], bur oak phase [FBL], and aspen phase [FQL]) was 60%, with a 90% confidence interval of 42–78%. Of the 25 polygons mapped as FAL, FBL, and FQL, 10 AA sites within those polygons were found to contain vegetation types different from that which was mapped, with errors attributed as follows:

- One Floodplain Hardwood Forest (FHF) site was mapped as FAL because of disagreement between the percentages of cottonwood present;
- One Floodplain Hardwood Forest (FHF) site was mapped as FBL because of disagreement between the percentages of silver maple present;
- Two Aspen - Birch / Hardwood Forest (FAM) sites were both mapped as FAL because of not interpreting upland areas within FAL polygons;
- Of two Sugar Maple - American Basswood Forest (FMT) sites, one was mapped as FAL and one as FBL because of misinterpreting the percentages of tree species;
- One Red Maple - Ash - Birch Swamp Forest (FRM) site was mapped as FBL because of overestimating the percentage of bur oak;
- One Midwestern White Oak - Red Oak Forest (FWR) site was mapped as FQL because the polygon could have been drawn differently;
- One Gray Alder Swamp (SAS) site was mapped as FAL because of disagreement about the percentage of trees present;
- One Mixed Shrub Swamp and/or Fen (SMW) site was mapped as FAL because of disagreement about the percentage of trees present.

The users' accuracy for the Sugar Maple - American Basswood Forest (FMT) map class was 60%, with a 90% confidence interval of 42–78%. The FMT map class includes two associations, including the North-central Maple - Basswood Forest and the Northern Maple - Basswood Forest. Of the 25 polygons mapped as FMT, 10 sites within those polygons were found to contain vegetation types different from FMT, with errors attributed as follows:

- Two Floodplain Hardwood Forest (FHF) sites—as the Northern Ash - Elm Floodplain Forest association of FHF—were mapped as FMT because of misinterpreting the percentage of silver maple trees and the upland/lowland gradation;
- Four Ash - Elm - Mixed Lowland Hardwood Forest (FAL, FBL, FQL) sites were mapped as FMT because of misinterpreting the subtle difference between lowland and upland forests, possibly mistaking leaf-off ash for leaf-off basswood;
- One Aspen - Birch / Hardwood Forest (FAM) site was mapped as FMT because of misinterpreting tree species;
- One White Pine - Oak Forest (FPO) site was mapped as FMT because of underestimating the percentage of pines;
- One Midwestern White Oak - Red Oak Forest (FWR) site was mapped as FMT because of overestimating the presence of basswood and maple.
- One Hazelnut - Serviceberry Ruderal Shrubland (SHZ) site was mapped as FMT because of overestimating relative density of trees present which were obscured by shadow that was captured during aerial photography.

The users' accuracy for the Northern Red Oak - Sugar Maple Forest (FOM) map class was 37%, with a 90% confidence interval of 20–54%. The FOM map class includes two associations, including the Northern Red Oak - Sugar Maple Forest and the Northern Red Oak - White Oak - (Maple) Forest. Of the 27 polygons mapped as FOM, 17sites within those polygons were found to contain vegetation types different from that which was mapped, with errors attributed as follows:

- Five Ash - Elm - Mixed Lowland Hardwood Forest (FAL, FBL, FQL) sites were mapped as FOM because of overestimating the relative densities of sugar maple and oak species;
- One Aspen - Birch / Hardwood Forest (FAM) site was mapped as FOM because of not including AA site with adjacent FAM polygon;
- One Jack Pine - Quaking Aspen Forest (FJA) site was mapped as FOM because of mapping FOM too broadly;
- One Northern Pin Oak - (Bur Oak) Forest (FPB) site was mapped as FOM because of overestimating the relative density of sugar maple;
- One White Pine - Aspen - Birch Forest (FWA) site was mapped as FOM because of mapping FOM too broadly—a polygon of FWA could have been delineated;
- Three Midwestern White Oak - Red Oak Forest (FWR) sites were mapped as FOM because of overestimating the relative density of sugar maple;
- Five North-Central Dry-mesic Oak Woodland (WBO) sites were mapped as FOM because of overestimating the relative density of sugar maple.

The users' accuracy for the Northern Pin Oak - (Bur Oak) Forest map class (FPB) was 61%, with a 90% confidence interval of 44–78%. Of the 28 polygons mapped as FPB, 11 sites within those polygons were found to contain vegetation types different from that which was mapped, with errors attributed as follows:

- One Ash - Elm - Mixed Lowland Hardwood Forest (FAL, FBL, FQL) site was mapped as FPB because of overestimating the relative density of pin oak;
- Three Northern Red Oak - Sugar Maple Forest (FOM) sites were mapped as FPB because of a lack of pin oak and of underestimating the relative density of maple coverage;
- One White Pine - Oak Forest (FPO) site was mapped as FPB because of difficulty in estimating relative density of aspen versus oak in a small polygon;
- One Red Maple - Ash - Birch Swamp Forest (FRM) site was mapped as FPB because of mapping FPB too broadly—an area of FRM was not mapped within a larger FPB polygon;
- One Red Pine / Blueberry Dry Forest (FRP) site was mapped as FPB because of not recognizing the relative density of red pine;
- One White Pine / Mountain Maple Mesic Forest (FWM) site was mapped as FPB because of mapping FPB too broadly and not creating a polygon for the mixed type;
- Three Midwestern White Oak - Red Oak Forest (FWR) sites were mapped as FPB because of overestimating the relative density of pin oak and because of a disagreement between the key and FWR map class as to how much red oak was needed—the key required >50% density, but the map-class convention was set at >75%.

The users' accuracy for the Leatherleaf Poor Fen map class (DLF) map class was 62%, with a 90% confidence interval of 46–79%. Of the 29 polygons mapped as DLF, 11 sites within those polygons were found to contain vegetation types different from that which was mapped, with errors attributed as follows:

- One Black Spruce and/or Tamarack Swamp (FST) site was mapped as DLF because of mapping shrub-height black spruce incorrectly;
- One Leatherleaf - Sweet Gale Shore Fen (DLS) site was mapped as DLF because the site was a floating mat;
- One Gray Alder Swamp (SAS) site was mapped as DLF because of confusing the relative densities of the shrub species;
- Three Mixed Shrub Swamp and/or Fen (SMW) sites were mapped as DLF because of the inability to estimate relative densities of bog birch and leatherleaf and because of the inability to estimate relative densities of willows;
- Two Tamarack Scrub Poor Fen (STS) sites were mapped as DLF because of underestimating the cover of tall shrubs;
- One Sedge Meadow and/or Emergent Herbaceous Marsh (HMM) site was mapped as DFL because of overestimating the percent cover of shrubs;
- One Northern Sedge Poor Fen (HSP) site was mapped as DLF because of overestimating the percent cover of shrubs;
- One Upright Sedge Wet Meadow (HUS) site was mapped as DLF because of overestimating the percent cover of shrubs.

The users' accuracy for the Bluejoint Wet Meadow map class (HCC) was 57%, with a 90% confidence interval of 37–77%. Of the 21 polygons mapped as HCC, nine sites within those polygons were found to contain vegetation types different from that which was mapped, with errors attributed as follows:

- One Ash - Elm - Mixed Lowland Hardwood Forest (FAL, FBL, FQL) site was mapped as HCC because of underestimating the percent cover of trees along the edge of a polygon;
- One Mixed Shrub Swamp and/or Fen (SMW) site—as the Dogwood - Mixed Willow Shrubland association of SMW—was mapped as HCC because of disagreement in the percent cover of shrubs;
- Three Reed Canarygrass Eastern Marsh (HPH) sites were mapped as HCC because of confusion between reed canary and bluejoint grass signatures;
- One Sedge Meadow and/or Emergent Herbaceous Marsh (HMM) site—as the Northern Sedge Wet Meadow association of HMM—was mapped as HCC because of difficulty with interpreting wetland signatures;
- One Tussock Sedge Wet Meadow (HTS) site was mapped as HCC because of underestimating the relative density of sedges;
- Two Wet Meadow Mixed Herbaceous (HWM) sites were mapped as HCC because of misinterpreting the degree of disturbance.

The users' accuracy for the Northern Sedge Poor Fen (HSP) map class was 62%, with a 90% confidence interval of 44–79%. Of the 26 polygons mapped as HSP, 10 sites within those polygons were found to contain vegetation types different from that which was mapped, with errors attributed as follows:

- One Leatherleaf Poor Fen (DLF) site was mapped as HSP because of underestimating the percent cover of shrubs in a shadowed polygon;
- One Mixed Shrub Swamp and/or Fen (SMW) site was mapped as HSP because of underestimating the percent cover of shrubs;
- Two Bluejoint Wet Meadow (HCC) sites were mapped as HSP because of difficulty discerning relative density of bluejoint;
- Four Sedge Meadow and/or Emergent Herbaceous Marsh (HMM) sites were mapped as HSP because of misidentifying the signatures;
- One Tussock Sedge Wet Meadow (HTS) site was mapped as HSP because of underestimating the relative density of sedges;
- One Wet Meadow Mixed Herbaceous (HWM) site was mapped as HSP because of misidentifying the signature for HWM.

The users' accuracy for Wet Meadow Mixed Herbaceous (HSS) map class was 0%, with a 90% confidence interval of -25–25%. Of the two polygons mapped as HSS, all sites within those polygons were found to contain vegetation types different from that which was mapped, with errors attributed as follows:

- One Northern Tamarack Rich Swamp (FTS) site was mapped as HSS because of underestimating the percentage of tree cover;
- One Leatherleaf- Sweet Gale Shore Fen (DLS) site was mapped as HSS because of underestimating the percentage of shrub cover.

The users' accuracy for the Wet Meadow Mixed Herbaceous (HWM) map class was 52%, with a 90% confidence interval of 32–73%. Of the 21 polygons mapped as HWM, 10 sites within those polygons were found to contain vegetation types different from that which was mapped, with errors attributed as follows:

- One Floodplain Hardwood Forest Complex (FHF) site mapped as HWM because of including an area of trees within the polygon that should have been mapped separately;
- One North-Central Dry-mesic Oak Woodland (WBO) site was mapped as HWM because of including forested area within the polygon;
- Three Mixed Shrub Swamp and/or Fen (SMW) sites were mapped as HWM because of underestimating the percent cover of shrubs;
- One Hazelnut - Serviceberry Ruderal Shrubland (SHZ) site was mapped as HWM because of underestimating the percent cover of shrubs;
- One Bluejoint Wet Meadow (HCC) site was mapped as HWM because of underestimating the relative cover of bluejoint;
- One Reed Canarygrass Eastern Marsh (HPH) site was mapped as HWM because of underestimating the relative cover of reed canary grass;
- One Sedge Meadow and/or Emergent Herbaceous Marsh (HMM) site was mapped as HWM because of underestimating the relative cover of sedges.
- One Upright Sedge Wet Meadow (HUS) site was mapped as HWM because of difficulty associated with mapping a flooded site.

Producers' Accuracy (Errors of Omission)

The producers' accuracy for the Ash - Elm - Mixed Lowland Hardwood Forest map class (ash - elm phase [FAL], bur oak phase [FBL], and aspen phase [FQL]) was 33%, with a 90% confidence interval of 21–46%. Of the 45 AA sites classified in the field as Ash - Elm - Mixed Lowland Hardwood Forest, 30 sites fell within polygons that were mapped as other vegetation types, with errors attributed as follows:

- Five polygons were mapped as Floodplain Hardwood Forest (FHF) because of overestimating the relative cover of silver maple or cottonwood;
- One polygon was mapped as Aspen - Birch / Hardwood Forest (FAM) because of mapping upland aspen rather than lowland;
- Four polygons were mapped as Sugar Maple - American Basswood Forest (FMT) because of missing the subtle gradation between the two types;
- Five polygons were mapped as Northern Red Oak - Sugar Maple Forest (FOM) because of overestimating the relative cover of oak and maple species;
- Two polygons were mapped Oak Driftless Bluff Woodland (WOR) because of misidentifying the signature;
- One polygon was mapped as Northern Pin Oak - (Bur Oak) Forest (FPB) because of overestimating the percent cover of pin oak.
- One polygon was mapped as Red Maple - Ash - Birch Swamp Forest (FRM) because of underestimating the relative cover of ash and elm species;
- Five polygons were mapped as North-Central Dry-mesic Oak Woodland (WBO) because of mapping upland bur oak instead of the lowland bur oak;
- Two polygons were mapped as Chinquapin Oak Bluff Woodland (WRC) because of overestimating the relative cover of conifers;
- One polygon was mapped as Gray Alder Swamp (SAS) because of overestimating the percent cover of tree species. In addition, part of the polygon was in shadow, making it difficult to determine relative percentages of upper strata;
- Two polygons were mapped as Mixed Shrub Swamp and/or Fen (SMW) because of overestimating the percent cover of tree species;

- One polygon was mapped as Bluejoint Wet Meadow (HCC) because the polygon was drawn incorrectly.

The producers' accuracy for the Midwestern White Oak - Red Oak Forest (FWR) map class was 57%, with a 90% confidence interval of 42–72%. Of the 35 AA sites classified in the field as FWR, 15 sites fell within polygons that were mapped as other vegetation types, with errors attributed as follows:

- One polygon was mapped as Ash - Elm - Mixed Lowland Hardwood Forest (aspen phase, FQL) because of drawing the polygon incorrectly;
- One polygon was mapped as (FAM) because of mapping FAM too broadly—a smaller polygon of FWR could have been delineated within the larger FAM polygon;
- One polygon was mapped as Sugar Maple - American Basswood Forest (FMT) because of misidentifying the relative percentages of sugar maple and basswood;
- Three polygons were mapped as Northern Red Oak - Sugar Maple Forest (FOM) because of overestimating the relative cover of sugar maple;
- Three polygons were mapped as Northern Pin Oak - (Bur Oak) Forest (FPB) because of overestimating the relative cover of pin oak in the polygons;
- Two polygons were mapped as White Pine - Oak Forest (FPO) because of overestimating the relative cover of conifers in the polygons;
- One polygon was mapped as Aspen / American Hazel Forest (FQA) because of mapping FQA too broadly—a smaller FWR exists at point;
- Three polygons were mapped as Chinquapin Oak Bluff Woodland (WRC) because of overestimating the relative cover of cedar in the polygons.

The producers' accuracy for the (WBO) map class was 58%, with a 90% confidence interval of 42–74%. Of the 31 AA sites classified in the field as WBO, 13 sites fell within polygons that were mapped as other vegetation types, with errors attributed as follows:

- Three polygons were mapped as Aspen - Birch / Hardwood Forest (FAM) because of misjudging polygon borders with adjacent polygons;
- Five polygons were mapped as Northern Red Oak - Sugar Maple Forest (FOM) because of overestimating the relative cover of sugar maple;
- Two polygons were mapped as Jack Pine - Red Pine / Scrub Oak Woodland (WJO) because of overestimating the relative density of conifers in the polygons;
- Two polygons were mapped a Hazelnut - Serviceberry Ruderal Shrubland (SHZ) because of underestimating the relative density of trees in the polygons;
- One polygon was mapped as Wet Meadow Mixed Herbaceous (HWM) because of drawing the polygon incorrectly.

The producers' accuracy for the Speckled Alder Swamp (SAS) map class was 60%, with a 90% confidence interval of 47–73%. Of the 45 AA sites classified in the field as SAS, 18 sites fell within polygons that were mapped as other vegetation types, with errors attributed as follows:

- One polygon was mapped as Ash - Elm - Mixed Lowland Hardwood Forest (FAL) because of underestimating the relative density of the tree canopy, limited by shadow;
- Three polygons were mapped as Black Ash - Mixed Hardwood Swamp (FBA) because of overestimating the relative density of the tree canopy;

- Three polygons were mapped as Red Maple - Ash - Birch Swamp Forest (FRM) because of overestimating the relative density of the tree canopy;
- One polygon was mapped as Leatherleaf Poor Fen (DLF) because of confusing relative densities of shrubs;
- Nine polygons were mapped as Mixed Shrub Swamp and Fen Complex (SMW) because of overestimating the relative density of bog birch or of dogwood and willow;
- One polygon was mapped as Sedge Meadow and/or Emergent Herbaceous Marsh (HMM) because of drawing the polygon border incorrectly.

The producers' accuracy for the Wet Meadow Mixed Herbaceous (HWM) map class was 52%, with a 90% confidence interval of 32–73%. Of the 21 AA sites classified in the field as HWM, 10 sites fell within polygons that were mapped as other vegetation types, with errors attributed as follows:

- One polygon was mapped as Oak Driftless Bluff Woodland (WOR) because of misinterpretation of the signature;
- Two polygons were mapped as Bluejoint Wet Meadow (HCC) because of overestimating the relative density of bluejoint;
- Two polygons were mapped as Reed Canarygrass Eastern Marsh (HPH) because of overestimating the relative density of reed canarygrass;
- Two polygons were mapped as Midwest Pondweed Submerged Aquatic Wetland (HSV) because of misinterpreting the HSV signature;
- Two polygons were mapped as Sedge Meadow and/or Emergent Herbaceous Marsh (HMM) because of overestimating the relative density of cattail in one polygon and of a flooded area in the other;
- One polygon was mapped as Northern Sedge Poor Fen (HSP) because of overestimating the relative density of sedges.

The producers' accuracy for the Wiregrass Sedge shore Fen (HSS) map class is zero because no AA sites were classified as HSS.

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Appendix A: Plot Sampling Form

NATIONAL PARK VEGETATION MAPPING PROGRAM: PLOT SURVEY FORM

IDENTIFIERS/LOCATORS

Plot Code_____ Polygon Code_____

Provisional CommunityName_____

State____ Park Name_____ Park Site Name_____

Quad Name_____ Quad Code_____

GPS file name_____ Field UTM X__ __ __ __ __ __ m E Field UTM Y__ __ __ __ __ __ __ m N

Waypoint_____ Zone_____ Datum_____ Error +/-_____ m Elevation_____

please do not complete the following information when in the field

Corrected UTM X___ ___ ___ ___ ___ ___ m E Corrected UTM Y___ ___ ___ ___ ___ ___ ___ m N

Survey Date_____ Surveyors_____

Directions to Plot:

Plot length____ (m) Plot width____ (m) Camera_____ Number of images____ Time of Photos_____

Plot representativeness:

Is the surrounding ~1 hectare area all the same? ___yes ___no

Please draw a map of plot here with plot shape,
where plot photos were taken, potential community
boundary breaks, and important landmarks.

ENVIRONMENTAL DESCRIPTION

Slope_____Aspect_____

Topographic Position

Landform

Surficial Geology

Cowardian System
___Upland
___Riverine
___Palustrine
___Lacustrine

Non-Tidal
___Permanently Flooded
___Semipermanently Flooded
___Seasonally/Temporarily Flooded
___Saturated
___Seasonally Flooded/Saturated
___Intermittently Flooded

Environmental Comments:	Soil Taxon/Description
	Unvegetated Surface: *(percent – total should equal 100%)* ___Bedrock ___Litter, duff ___Wood (> 1 cm) ___Large rocks (cobbles, boulders > 10 cm) ___Small rocks (gravel, 0.2-10 cm) ___Sand (0.1-2 mm) ___Bare soil ___Other:_____
Soil Texture ___sand ___loamy sand ___sandy loam ___loam ___silt loam ___silt ___clay loam ___silty clay ___silty clay loam ___clay ___peat ___muck	Soil Drainage ___Rapidly drained ___Well drained ___Moderately well drained ___Somewhat poorly drained ___Poorly drained ___Very poorly drained

VEGETATION DESCRIPTION

Leaf phenology (of dominant stratum)	Leaf Type (of dominant stratum)	Physiognomic class	Cover Scale for Strata		Height Scale for Strata	
<u>Trees and Shrubs</u>		___Forest	P	5%		
___Evergreen	___Broad-leaved	___Woodland	01	10%	01	<0.5 m
___Cold-deciduous	___Needle-leaved	___Shrubland	02	20%	02	0.5-1m
___Drought-deciduous	___Mixed Needle-leaved - Broad-leaved	___Dwarf Shrubland	03	30%	03	1-2 m
___Mixed evergreen - cold-deciduous	___Microphyllous	___Herbaceous	04	40%	04	2-5 m
___Mixed evergreen - drought-deciduous	___Graminoid	___Nonvascular	05	50%	05	5-10 m
<u>Herbs</u>	___Forb	___Sparsely Vegetated	06	60%	06	10-15 m
___Annual	___Pteridophyte		07	70%	07	15-20 m
___Perennial			08	80%	08	20-35 m
			09	90%	09	35-50 m
			10	100%	10	>50 m

Strata	Height Class	Cover Class	Diagnostic species (if known)
T1 Emergent	_____	_____	_____
T2 Canopy	_____	_____	_____
T3 Sub-canopy	_____	_____	_____
S1 Tall shrub	_____	_____	_____
S2 Short Shrub	_____	_____	_____
S3 Dwarf-Shrub	_____	_____	_____
H Herbaceous	_____	_____	_____
A1 FltngLvdAquatic	_____	_____	_____
A2 Submerged Aquatic	_____	_____	_____
N Non-vascular	_____	_____	_____
V Vine/liana	_____	_____	_____
E Epiphyte	_____	_____	_____

please see above table for height and cover scales

Animal Use Evidence

Natural and Anthropogenic Disturbance Comments:

Overall Qualitative Assessment:

Plot Code ____

Species/percent cover: Starting with the uppermost stratum, list all species with cover class for each species in the stratum. For forests and woodlands, on a separate line below each tree species, list the DBH of all trees above 10 cm diameter. Separate measurements with a comma. Put an asterisk next to any species that are known diagnostics for a particular community in the classification.

Stratum	Species Name	Cover Class	Stratum	Species Name	Cover Class

Cover Scale for Species: T=<1%; P=1-5%; 01=5-15%; 02=15-25%; 03=25-35%; 04=35-45%; 05=45-55%; 06=55-65%; 07=65-75%; 08=75-85%; 09=85-95%; 10=>95%

Appendix B: Descriptions of Vegetation Types

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U.S. NATIONAL VEGETATION CLASSIFICATION

Associations of
Saint Croix National Scenic Riverway

19 July 2011

by

NatureServe

4600 North Fairfax Drive, 7th Floor
Arlington, VA 22203

P.O. Box 9354
St. Paul, MN 55109

This subset of the International Ecological Classification Standard covers vegetation associations attributed to Saint Croix National Scenic Riverway. This classification has been developed in consultation with many individuals and agencies and incorporates information from a variety of publications and other classifications. Comments and suggestions regarding the contents of this subset should be directed to Mary J. Russo, Central Ecology Data Manager, Durham, NC <mary_russo@natureserve.org> and Jim Drake, Regional Vegetation Ecologist, Minneapolis, MN <jim_drake@natureserve.org>.



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[1] NatureServe is an international organization including NatureServe regional offices, a NatureServe central office, U.S. State Natural Heritage Programs, and Conservation Data Centres (CDC) in Canada and Latin America and the Caribbean. Ecologists from the following organizations have contributed the development of the ecological systems classification:

United States
Central NatureServe Office, Arlington, VA; Eastern Regional Office, Boston, MA; Midwestern Regional Office, Minneapolis, MN; Southeastern Regional Office, Durham, NC; Western Regional Office, Boulder, CO; Alabama Natural Heritage Program, Montgomery AL; Alaska Natural Heritage Program, Anchorage, AK; Arizona Heritage Data Management Center, Phoenix AZ; Arkansas Natural Heritage Commission Little Rock, AR; Blue Ridge Parkway, Asheville, NC; California Natural Heritage Program, Sacramento, CA; Colorado Natural Heritage Program, Fort Collins, CO; Connecticut Natural Diversity Database, Hartford, CT; Delaware Natural Heritage Program, Smyrna, DE; District of Columbia Natural Heritage Program/National Capital Region Conservation Data Center, Washington DC; Florida Natural Areas Inventory, Tallahassee, FL; Georgia Natural Heritage Program, Social Circle, GA; Great Smoky Mountains National Park, Gatlinburg, TN; Gulf Islands National Seashore, Gulf Breeze, FL; Hawaii Natural Heritage Program, Honolulu, Hawaii; Idaho Conservation Data Center, Boise, ID; Illinois Natural Heritage Division/Illinois Natural Heritage Database Program, Springfield, IL; Indiana Natural Heritage Data Center, Indianapolis, IN; Iowa Natural Areas Inventory, Des Moines, IA; Kansas Natural Heritage Inventory, Lawrence, KS; Kentucky Natural Heritage Program, Frankfort, KY; Louisiana Natural Heritage Program, Baton Rouge, LA; Maine Natural Areas Program, Augusta, ME; Mammoth Cave National Park, Mammoth Cave, KY; Maryland Wildlife & Heritage Division, Annapolis, MD; Massachusetts Natural Heritage & Endangered Species Program, Westborough, MA; Michigan Natural Features Inventory, Lansing, MI; Minnesota Natural Heritage & Nongame Research and Minnesota County Biological Survey, St. Paul, MN; Mississippi Natural Heritage Program, Jackson, MI; Missouri Natural Heritage Database, Jefferson City, MO; Montana Natural Heritage Program, Helena, MT; National Forest in North Carolina, Asheville, NC; National Forests in Florida, Tallahassee, FL; National Park Service, Southeastern Regional Office, Atlanta, GA; Navajo Natural Heritage Program, Window Rock, AZ; Nebraska Natural Heritage Program, Lincoln, NE; Nevada Natural Heritage Program, Carson City, NV; New Hampshire Natural Heritage Inventory, Concord, NH; New Jersey Natural Heritage Program, Trenton, NJ; New Mexico Natural Heritage Program, Albuquerque , NM; New York Natural Heritage Program, Latham, NY; North Carolina Natural Heritage Program, Raleigh, NC; North Dakota Natural Heritage Inventory, Bismarck, ND; Ohio Natural Heritage Database, Columbus, OH; Oklahoma Natural Heritage Inventory, Norman, OK; Oregon Natural Heritage Program, Portland, OR; Pennsylvania Natural Diversity Inventory, PA; Rhode Island Natural Heritage Program, Providence, RI; South Carolina Heritage Trust, Columbia, SC; South Dakota Natural Heritage Data Base, Pierre, SD; Tennessee Division of Natural Heritage, Nashville, TN; Tennessee Valley Authority Heritage Program, Norris, TN; Texas Conservation Data Center, San Antonio, TX; Utah Natural Heritage Program, Salt Lake City, UT; Vermont Nongame & Natural Heritage Program, Waterbury, VT; Virginia Division of Natural Heritage, Richmond, VA; Washington Natural Heritage Program, Olympia, WA; West Virginia Natural Heritage Program, Elkins, WV; Wisconsin Natural Heritage Program, Madison, WI; Wyoming Natural Diversity Database, Laramie, WY

Canada
Alberta Natural Heritage Information Centre, Edmonton, AB, Canada; Atlantic Canada Conservation Data Centre, Sackville, New Brunswick, Canada; British Columbia Conservation Data Centre, Victoria, BC, Canada; Manitoba Conservation Data Centre. Winnipeg, MB, Canada; Ontario Natural Heritage Information Centre, Peterborough, ON, Canada; Quebec Conservation Data Centre, Quebec, QC, Canada; Saskatchewan Conservation Data Centre, Regina, SK, Canada; Yukon Conservation Data Centre, Yukon, Canada

Latin American and Caribbean
Centro de Datos para la Conservacion de Bolivia, La Paz , Bolivia; Centro de Datos para la Conservacion de Colombia, Cali,Valle, Columbia; Centro de Datos para la Conservacion de Ecuador, Quito, Ecuador; Centro de Datos para la Conservacion de Guatemala, Ciudad de Guatemala , Guatemala; Centro de Datos para la Conservacion de Panama, Querry Heights , Panama; Centro de Datos para la Conservacion de Paraguay, San Lorenzo , Paraguay; Centro de Datos para la Conservacion de Peru, Lima, Peru; Centro de Datos para la Conservacion de Sonora, Hermosillo, Sonora , Mexico; Netherlands Antilles Natural Heritage Program, Curacao , Netherlands Antilles; Puerto Rico-Departmento De Recursos Naturales Y Ambientales, Puerto Rico; Virgin Islands Conservation Data Center, St. Thomas, Virgin Islands.

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Table of Contents

1. FOREST & WOODLAND **11**
1.C.2. Cool Temperate Forest **11**
1.C.2.Na. Eastern North American Cool Temperate Forest **11**
M153. Central Mesophytic Hardwood Forest **11**
G021. North-Central Beech - Maple - Basswood Forest **11**
North-Central Maple - Basswood Forest 11
M012. Central Oak-Hardwood & Pine Forest **14**
G016. Chinkapin Oak - Ash - Red-cedar Alkaline Forest **14**
Chinquapin Oak Bluff Woodland 14
G158. Northeastern & North-Central Oak - Hickory Forest **16**
Midwestern White Oak - Red Oak Forest 16
Eastern White Pine - Oak Driftless Bluff Forest 19
Oak Driftless Bluff Woodland 20
M159. Northern & Eastern Pine - Oak Forest & Barrens **22**
G025. White Pine - Red Pine - Jack Pine - Oak Forest & Woodland Group **22**
Jack Pine - Northern Pin Oak Forest 22
Red Pine - Aspen - Birch Forest 24
Red Pine / Blueberry Dry Forest 26
White Pine - Red Oak Forest 29
White Pine - Aspen - Birch Forest 32
White Pine / Mountain Maple Mesic Forest 35
Northern Pin Oak - (Bur Oak) Forest 37
G160. Great Lakes Pine Barrens **40**
Jack Pine - Red Pine Barrens 40
Jack Pine - Red Pine / Scrub Oak Woodland 43
M151. Northern Great Plains Woodland **45**
G146. Eastern Great Plains Tallgrass Aspen Parkland **45**
Aspen / American Hazel Forest 45
G329. Great Plains Oak Woodland **47**
North-Central Dry-Mesic Oak Woodland 47
M014. Northern Mesic Hardwood & Conifer Forest **51**
G163. Northern Hardwood - Hemlock - White Pine Forest **51**
Maple - Yellow Birch Northern Hardwoods Forest 51
Northern Maple - Basswood Forest 54
Paper Birch / Sugar Maple - Mixed Hardwoods Forest 57
White Pine - (Red Pine) Driftless Bluff Forest 59
Aspen - Birch - Red Maple Forest 61
Aspen - Birch / Sugar Maple - Mixed Hardwoods Forest 64
Northern Red Oak - Sugar Maple Forest 66

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1.C.3. Temperate Flooded & Swamp Forest **69**
1.C.3.Na. Eastern North American Flooded & Swamp Forest **69**
M029. Northern & Central Floodplain Forest & Scrub **69**
G041. Eastern Cottonwood - Black Willow Flooded & Swamp **69**
Midwestern Cottonwood - Black Willow Forest 69
G040. Silver Maple - Green Ash - Sycamore Floodplain **72**
Silver Maple - Elm Forest 72
Ash - Elm - Mixed Lowland Hardwood Forest 76
Northern Ash - Elm Floodplain Forest 78
M030. Northern & Central Swamp Forest **81**
G046. Northern & Central Conifer & Hardwood Alkaline Swamp **81**
Red Maple - Ash - Birch Swamp Forest 81
Black Ash - Mixed Hardwood Swamp 84
White-cedar - Black Ash Swamp 87
M160. Northern & Central Tall Shrub Wetland **90**
G167. Northern & Central Shrub Swamp **90**
Gray Alder Swamp 90
1.D.1. Boreal Forest **93**
1.D.1.Na. North American Boreal Forest **93**
M037. Eastern & Central North American Boreal Conifer & Hardwood Forest **93**
G047. Jack Pine - Black Spruce Forest Group **93**
Jack Pine Forest Alliance 93
Jack Pine - Quaking Aspen Forest Alliance 95
G048. White Spruce - Balsam Fir Forest **97**
Spruce - Fir - Aspen Forest 97
Spruce - Fir / Mountain Maple Forest 100
Aspen - Birch / Boreal Conifer Forest 103
1.D.2. Boreal Swamp & Flooded Forest **105**
1.D.2.Na. North American Boreal Flooded & Swamp Forest **105**
M299. North American Boreal Swamp Forest **105**
G050. Eastern Black Spruce - Tamarack Acidic Swamp Forest **105**
Black Spruce - Tamarack / Labrador-tea Poor Swamp 105
G051. Eastern Tamarack - Conifer Alkaline Swamp **108**
Northern Tamarack Rich Swamp 108
White-cedar - (Mixed Conifer) / Alder Swamp 111

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2. SHRUBLAND & GRASSLAND 114
2.C.1. Temperate Grassland, Meadow, and Shrubland 114
2.C.1.Nb. Great Plains Grassland & Shrubland 114
M054. Great Plains Tallgrass Prairie, Savanna & Shrubland 114
G333. Central Great Plains Tallgrass Prairie 114
Midwest Dry-Mesic Prairie 114
G151. Sand & Gravel Tallgrass Prairie 117
Little Bluestem Bedrock Bluff Prairie 117
Midwest Dry Sand Prairie 120
Midwest Dry-Mesic Sand Prairie 123
2.C.1.Nc. Eastern North American Grassland, Meadow & Shrubland 125
M123. Eastern North American Ruderal Shrubland & Grassland 125
G059. Northern & Central Ruderal Meadow & Shrubland 125
Hazelnut - Serviceberry Ruderal Shrubland 125
2.C.3. Temperate & Boreal Scrub & Herb Coastal Vegetation 127
2.C.3.Na. Eastern North American Dune & Coastal Grassland & Shrubland 127
M176. Eastern North American Beach, Shoreline & Flat 127
G343. Eastern North American River Shoreline [Placeholder] 127
Riverine Igneous - Metamorphic Cobble - Gravel Shore 127
Riverine Sand Flats 129
2.C.4. Temperate & Boreal Bog & Fen 131
2.C.4.Na. North American Bog & Fen 131
M061. Appalachian, Interior Plateau & Prairie Fen 131
G183. North-Central Appalachian, Interior & Prairie Fen 131
Skunk-cabbage Seepage Meadow 131
M062. North American Boreal Bog & Fen 134
G386. Eastern North American Boreal Acidic Bog & Poor Fen 134
Bog Birch - Leatherleaf Rich Fen 134
Northern Sedge Poor Fen 137
Leatherleaf Poor Fen 140
Tamarack Scrub Poor Fen 143
G185. Eastern North American Boreal Alkaline Fen 145
Woolly-fruit Sedge Shore Fen 145
Leatherleaf - Sweetgale Shore Fen 147

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2.C.5. Temperate & Boreal Freshwater Wet Meadow & Marsh **149**
2.C.5.Na. Eastern North American Freshwater Wet Meadow, Riparian & Marsh **149**
M165. Eastern North American Riverscour Wetland **149**
G194. Northern & Central Riverscour Wetland **149**
Sandbar Willow Shrubland 149
M303. Eastern North American Ruderal Wet Meadow & Marsh **151**
G556. Northern & Central Ruderal Wet Meadow & Marsh **151**
Reed Canarygrass Eastern Marsh 151
Eastern Reed Marsh 154
M069. Eastern North American Wet Meadow & Marsh **156**
G125. Eastern North American Freshwater Marsh **156**
Bulrush - Cattail - Bur-reed Shallow Marsh 156
Midwest Cattail Deep Marsh 159
Wild Rice Marsh 161
G112. Eastern North American Wet Meadow **163**
Bluejoint Wet Meadow 163
Northern Sedge Wet Meadow 166
Upright Sedge Wet Meadow 169
Dogwood - Mixed Willow Shrub Meadow 172
Central Cordgrass Wet Prairie 174
M071. Great Plains Wet Meadow, Wet Prairie & Marsh **177**
G325. Great Plains Freshwater Marsh **177**
Arrowhead - Rice Cutgrass Marsh 177
5. AQUATIC WETLAND VEGETATION **179**
5.B.1. Freshwater Aquatic Vegetation **179**
5.B.1.Na. North American Freshwater Aquatic Vegetation **179**
M108. Eastern North American Freshwater Aquatic Vegetation **179**
G114. Eastern North American Freshwater Aquatic Vegetation **179**
Water-lily Aquatic Wetland 179
Midwest Pondweed Submerged Aquatic Wetland 182
6. ROCK VEGETATION **185**
6.B.2. Temperate & Boreal Cliff, Scree & Rock Vegetation **185**
6.B.2.Na. Eastern North American Temperate Cliff, Scree & Rock Vegetation **185**
M111. Eastern North American Cliff & Rock Vegetation **185**
G106. Eastern North American Temperate Cliff **185**
Northern (Laurentian) Igneous - Metamorphic Dry Cliff 185
Midwest Moist Limestone - Dolostone Cliff 187
Midwest Dry Sandstone Cliff 189
Midwest Moist Sandstone Cliff 192

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1. FOREST & WOODLAND

1.C.2. Cool Temperate Forest

1.C.2.Na. Eastern North American Cool Temperate Forest

M153. Central Mesophytic Hardwood Forest

G021. North-Central Beech - Maple - Basswood Forest

North-Central Maple - Basswood Forest
***Acer saccharum - Tilia americana / Ostrya virginiana - Carpinus caroliniana* Forest**
Sugar Maple - American Basswood / Hophornbeam - American Hornbeam Forest
Identifier: CEGL002062

NVC CLASSIFICATION

Division	Eastern North American Cool Temperate Forest (1.C.2.Na)
Macrogroup	Central Mesophytic Hardwood Forest (M153)
Group	North-Central Beech - Maple - Basswood Forest (G021)
Association (Common name)	North-central Maple - Basswood Forest

ELEMENT CONCEPT

Global Summary: This maple - basswood forest is found in the north-central United States. Stands occur on flat to steep slopes on loamy soils derived from glacial till or, less commonly, loess. The soils are well-drained, fertile, and deep. The tree canopy of this community is moderately dense to dense and greatly affects the composition of the understory. *Acer saccharum* (sugar maple) and *Tilia americana* (American basswood) are the most prevalent tree species. Other common tree species include *Carpinus caroliniana* (American hornbeam), *Carya cordiformis* (bitternut hickory), *Carya ovata* (shagbark hickory), *Fraxinus pennsylvanica* (green ash), *Juglans nigra* (black walnut), *Ostrya virginiana* (hophornbeam), *Quercus alba* (white oak), *Quercus rubra* (northern red oak), and *Ulmus* (elm) spp. The scattered shrub layer contains species such as *Cornus alternifolia* (alternateleaf dogwood), *Ribes* (currant) spp., *Sambucus* (elderberry) spp., and *Zanthoxylum americanum* (common pricklyash). Spring ephemerals are a distinctive part of the herbaceous layer. Common herbaceous species include *Anemone quinquefolia* (wood anemone), *Claytonia* (springbeauty) spp., *Dicentra cucullaria* (Dutchman's breeches), *Erythronium* (fawnlily) spp., *Polygonatum pubescens* (hairy Solomon's seal), *Sanicula odorata* (clustered blacksnakeroot), *Trillium grandiflorum* (white trillium), and *Uvularia grandiflora* (largeflower bellwort).

ENVIRONMENTAL DESCRIPTION

Saint Croix National Scenic Riverway Environment: This maple - basswood forest was sampled at three locations in the park. Sites are located on moderate to steep slopes of ravines with moderately well-drained sandy loam and silt loam soils. The unvegetated surface, where documented, is dominated by leaf litter (96% cover) with some large rocks (2%), wood (1%) and dead plant stems (1%). Evidence of disturbance includes possible past logging, grazing in surrounding uplands, and the presence of exotic plants.
Global Environment: This community is found on flat to steep slopes on loamy soils derived from glacial till or, less commonly, loess (Curtis 1959). The soils are well-drained, fertile, and deep (MNNHP 1993).

VEGETATION DESCRIPTION

Saint Croix National Scenic Riverway Vegetation: Height or cover data were provided for only one of the sampled plots. The dense (80% cover) tree canopy, 20-35 m tall, is dominated by *Acer saccharum* (sugar maple) and may include *Carpinus caroliniana* (American hornbeam), *Ostrya virginiana* (hophornbeam), *Quercus alba* (white oak), *Quercus ellipsoidalis* (northern pin oak), *Quercus macrocarpa* (bur oak), *Quercus rubra* (northern red oak), *Tilia americana* (American basswood), *Ulmus americana* (American elm), and others. The very sparse (5%) subcanopy (10-15 m) and very sparse (5%) tall-shrub layer (2-5 m) are made up of canopy species. The very sparse (10%) short-shrub layer (0.5-1 m) may include *Cornus alternifolia* (alternateleaf dogwood), *Dirca palustris* (eastern leatherwood), *Prunus virginiana* (chokecherry), and *Ribes cynosbati* (eastern prickly gooseberry). The moderate (60%) herbaceous layer may be dominated by *Eurybia macrophylla* (bigleaf aster), *Carex pensylvanica* (Pennsylvania sedge), *Desmodium glutinosum* (pointedleaf ticktrefoil), *Osmorhiza claytonii* (Clayton's sweetroot), *Osmunda claytoniana* (interrupted fern), and/or *Uvularia grandiflora* (largeflower bellwort); additional species include *Adiantum pedatum* (northern maidenhair), *Athyrium filix-femina* (common ladyfern), *Caulophyllum thalictroides* (blue cohosh), *Geranium maculatum* (spotted geranium), *Hepatica nobilis* (hepatica), *Hydrophyllum virginianum* (eastern waterleaf), *Pteridium aquilinum* (western brackenfern), *Sanicula marilandica* (Maryland sanicle), *Solidago flexicaulis* (zigzag goldenrod), *Uvularia grandiflora* (largeflower bellwort), and *Viola pubescens* (downy yellow violet). In addition, this community may support Minnesota and Wisconsin state-vulnerable *Juglans cinerea* (butternut).
Global Vegetation: The tree canopy of this community is moderately dense to dense and greatly affects the composition of the understory. Only shade-tolerant species are able to persist (Curtis 1959). *Acer saccharum* (sugar maple) and *Tilia americana* (American basswood) are the most prevalent tree species. Other common tree species include *Carpinus caroliniana* (American

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hornbeam), *Carya cordiformis* (bitternut hickory), *Carya ovata* (shagbark hickory), *Fraxinus pennsylvanica* (green ash), *Juglans nigra* (black walnut), *Ostrya virginiana* (hophornbeam), *Quercus alba* (white oak), *Quercus rubra* (northern red oak), and *Ulmus* (elm) spp. The scattered shrub layer contains species such as *Cornus alternifolia* (alternateleaf dogwood), *Ribes* (currant) spp., *Sambucus* (elderberry) spp., and *Zanthoxylum americanum* (common pricklyash). Spring ephemerals are a distinctive part of the herbaceous layer. Common herbaceous species include *Anemone quinquefolia* (wood anemone), *Claytonia* (springbeauty) spp., *Dicentra cucullaria* (Dutchman's breeches), *Erythronium* (fawnlily) spp., *Polygonatum pubescens* (hairy Solomon's seal), *Sanicula odorata* (clustered blacksnakeroot), *Trillium grandiflorum* (white trillium), and *Uvularia grandiflora* (largeflower bellwort) (Curtis 1959, MNNHP 1993). In more disturbed examples of this association such as those found at Effigy Mounds National Monument in Iowa, *Laportea canadensis* (Canadian woodnettle) can range from moderate to very dense and can almost exclusively dominate the understory in some examples.

MOST ABUNDANT SPECIES

Saint Croix National Scenic Riverway

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Acer saccharum* (sugar maple), *Quercus alba* (white oak), *Quercus macrocarpa* (bur oak), *Ulmus americana* (American elm)
Herb (field)	Forb	*Desmodium glutinosum* (pointedleaf ticktrefoil), *Eurybia macrophylla* (bigleaf aster), *Uvularia grandiflora* (largeflower bellwort)
Herb (field)	Graminoid	*Carex pensylvanica* (Pennsylvania sedge)

CHARACTERISTIC SPECIES

Saint Croix National Scenic Riverway: *Acer saccharum* (sugar maple), *Carex pensylvanica* (Pennsylvania sedge), *Desmodium glutinosum* (pointedleaf ticktrefoil), *Eurybia macrophylla* (bigleaf aster), *Ostrya virginiana* (hophornbeam), *Quercus alba* (white oak), *Quercus macrocarpa* (bur oak), *Tilia americana* (American basswood), *Ulmus americana* (American elm), *Uvularia grandiflora* (largeflower bellwort)

OTHER NOTEWORTHY SPECIES

Saint Croix National Scenic Riverway: Vulnerable: *Juglans cinerea* (butternut, MN & WI state-vulnerable, G4); **Exotic/Invasive**: *Cerastium fontanum* ssp. *vulgare* (big chickweed, invasive/exotic), *Lonicera tatarica* (Tatarian honeysuckle, invasive/exotic, High/Medium), *Rhamnus cathartica* (common buckthorn, invasive/exotic, High/Medium)

CONSERVATION STATUS RANK

Global Rank & Reasons: G3G4 (3-Mar-2000). These rich mesic hardwood forests are poorly protected throughout their range. They were once the matrix forests over large parts of the upper Midwest, and now occur primarily in small (<1000 acres) fragments, many of which have been logged or grazed.

CLASSIFICATION

Status: Standard

Classification Confidence: 1 - Strong

Global Comments: This type may be in Indiana [see Lindsey et al. (1969), p. 532-533 at Ecology Cove Dune State Park]. Pure basswood stands in the western part of range are placed in *Tilia americana - (Quercus macrocarpa) / Ostrya virginiana* Forest (CEGL002012). Stands in northwestern Wisconsin probably should go with *Acer saccharum - Tilia americana / Ostrya virginiana / Lonicera canadensis* Forest (CEGL002458). Compare with *Acer saccharum - Acer nigrum - Tilia americana - Quercus rubra / Ostrya virginiana* Forest (CEGL002061) in the central Midwest.

Global Similar Associations:

- *Acer saccharum - Acer nigrum - Tilia americana - Quercus rubra / Ostrya virginiana* Forest (CEGL002061)
- *Acer saccharum - Carya cordiformis / Asimina triloba* Floodplain Forest (CEGL005035)
- *Acer saccharum - Tilia americana / Ostrya virginiana / Lonicera canadensis* Forest (CEGL002458)
- *Tilia americana - (Quercus macrocarpa) / Ostrya virginiana* Forest (CEGL002012)

Global Related Concepts:

- *Acer* Forest (Cahayla-Wynne and Glenn-Lewis 1978) <
- *Tilia* Forest (Cahayla-Wynne and Glenn-Lewis 1978) <
- Maple-Basswood Forest (Big Woods Section) (MNNHP 1993) <
- Maple-Basswood Forest (East Central Section) (MNNHP 1993) <
- Maple-Basswood Forest (Southeast Section) (MNNHP 1993) <
- Maple-Basswood Forest (West Central Section) (MNNHP 1993) ><
- Southern Mesic Forest (Curtis 1959) >
- Southern Mesic Forest Maple-Basswood Southern Subtype (Faber-Langendoen 2001) =

ELEMENT DISTRIBUTION

Global Range: This maple - basswood forest is found in the north-central United States, ranging from northern Illinois west to South Dakota.

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Nations: US
States/Provinces: IA:S4?, IL, IN, MN, SD:S2, WI:S3, WY
TNC Ecoregions: 35:C, 36:C, 44:C, 45:C, 46:C, 47:C, 48:C
USFS Ecoregions (1994/95): 212Hd:CCC, 212Jl:CCC, 212Kb:CCC, 212Nc:CCC, 222Ga:CCC, 222Hf:CCC, 222Jj:CCC, 222Ke:CCC, 222Kf:CCC, 222Kg:CCC, 222Kh:CCC, 222Kj:CCC, 222Lc:CCC, 222Ld:CCC, 222Le:CCC, 222Lf:CCC, 222Ma:CCC, 222Mb:CCC, 222Mc:CCC, 222Md:CCC, 222Me:CCC, 251Aa:CCC, 251Ba:CCC, 251Bb:CCC, 251Be:CCC, 251Cf:CCC, 251De:CCC, 251Df:CCC
Federal Lands: NPS (Effigy Mounds, Indiana Dunes, Saint Croix)

ELEMENT SOURCES

Saint Croix National Scenic Riverway Map Code: FMT
Saint Croix National Scenic Riverway Plots: SACN.204, SACN.3533, SACN.5494.
Local Description Authors: M.J. Russo
Global Description Authors: J. Drake
References: Cahayla-Wynne and Glenn-Lewis 1978, Curtis 1959, Daubenmire 1936, Faber-Langendoen 2001, Grimm 1984, Hop et al. 2005, Hop et al. 2009, INAI unpubl. data, Lindsey et al. 1969, MNNHP 1993, Midwestern Ecology Working Group n.d., WNHIP unpubl. data

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M012. Central Oak-Hardwood & Pine Forest

G016. Chinkapin Oak - Ash - Red-cedar Alkaline Forest

Chinquapin Oak Bluff Woodland

***Quercus muehlenbergii - Quercus (alba, velutina) - (Juniperus virginiana* var. *virginiana)* Bluff Woodland**
Chinkapin Oak - (White Oak, Black Oak) - (Eastern Red-cedar) Bluff Woodland
Identifier: CEGL002144

NVC CLASSIFICATION

Division	Eastern North American Cool Temperate Forest (1.C.2.Na)
Macrogroup	Central Oak-Hardwood & Pine Forest (M012)
Group	Chinkapin Oak - Ash - Red-cedar Alkaline Forest (G016)
Association (Common name)	Chinquapin Oak Bluff Woodland

ELEMENT CONCEPT

Global Summary: This chinquapin oak woodland type occurs primarily on bluffs of large rivers in the midwestern United States. Stands occur in scattered areas along steep southwest-facing bluffs or slopes, particularly on the Mississippi River. Presumably the underlying soils and bedrock have a calcareous influence. Stands contain an open tree layer, with *Quercus muehlenbergii* (chinkapin oak) as the characteristic dominant, and *Quercus alba* (white oak), *Quercus velutina* (black oak), *Quercus macrocarpa* (bur oak), and *Juniperus virginiana* (eastern red-cedar) as common associates. *Cornus racemosa* (gray dogwood) may be common in the shrub layer. The ground layer may contain a dry to dry-mesic prairie flora, but little is known about this type and few stands are available for characterization.

ENVIRONMENTAL DESCRIPTION

Saint Croix National Scenic Riverway Environment: This association is found on thin, loamy soil, usually over basalt bedrock. Basalt bedrock and boulders are common on the surface. This association was found only in the area around Interstate Park. This type at Saint Croix National Scenic Riverway probably developed after disturbance of white pine or white pine-oak forests, given that the substrate (calcareous sedimentary rock) and understory composition (more prairie-influence understory) do not match those in the bulk of the range further south.
Global Environment: Stands occur in scattered areas along steep, southwest-facing bluffs or slopes, particularly on the Mississippi River. Presumably the underlying soils and bedrock have a calcareous influence.

VEGETATION DESCRIPTION

Saint Croix National Scenic Riverway Vegetation: This open forest/woodland is characterized by a short canopy, either conifer-dominated or a mix of conifers and deciduous trees. *Juniperus virginiana* (eastern red-cedar) is always co-dominant to dominant. Associated trees include *Pinus strobus* (eastern white pine), *Tilia americana* (American basswood), *Quercus alba* (white oak), *Quercus rubra* (northern red oak), *Quercus macrocarpa* (bur oak) and *Populus* spp. (aspen). Tree regeneration is similar to the canopy composition, though it tends to have fewer *Quercus* spp. (oaks) and *Pinus strobus* (eastern white pine). Shrubs can be moderate to abundant. In addition to small *Juniperus virginiana* (eastern red-cedar), *Rhamnus cathartica* (common buckthorn), *Zanthoxylum americanum* (common pricklyash), *Rubus* spp. (blackberry spp.) can be common. The herbaceous layer contains *Carex pensylvanica* (Pennsylvania sedge), *Parthenocissus quinquefolia* (Virginia creeper), *Galium* spp. (bedstraw spp.), and *Toxicodendron rydbergii* (western poison ivy), among other species.
Global Vegetation: Stands contain an open tree layer, with *Quercus muehlenbergii* (chinkapin oak) as the characteristic dominant, and *Quercus alba* (white oak), *Quercus velutina* (black oak), *Quercus macrocarpa* (bur oak), and *Juniperus virginiana* (eastern red-cedar) as common associates. *Cornus racemosa* (gray dogwood) may be common in the shrub layer. The ground layer may contain a dry to dry-mesic prairie flora, but little is known about this type, and few stands are available for characterization.

MOST ABUNDANT SPECIES

Saint Croix National Scenic Riverway

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Juniperus virginiana* (eastern red-cedar)
Tall shrub/sapling	Needle-leaved tree	*Juniperus virginiana* (eastern red-cedar)
Short shrub/sapling	Broad-leaved deciduous shrub	*Zanthoxylum americanum* (common pricklyash), *Rhamnus cathartica* (common buckthorn)
Herb (field)	Forb	*Parthenocissus quinquefolia* (Virginia creeper), *Toxicodendron rydbergii* (western poison ivy)
Herb (field)	Graminoid	*Carex pensylvanica* (Pennsylvania sedge)

Global

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Quercus muehlenbergii* (chinkapin oak)

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CHARACTERISTIC SPECIES

Saint Croix National Scenic Riverway
Global: *Cornus racemosa* (gray dogwood), *Juniperus virginiana* (eastern red-cedar), *Quercus alba* (white oak), *Quercus macrocarpa* (bur oak), *Quercus muehlenbergii* (chinkapin oak), *Quercus velutina* (black oak)

OTHER NOTEWORTHY SPECIES

Saint Croix National Scenic Riverway
Global: Vulnerable: *Panax quinquefolius* (American ginseng, collection pressure, G3G4)

CONSERVATION STATUS RANK

Global Rank & Reasons: G2G3 (17-Mar-2000). This type has a relatively restricted range, occurring in small patches on large bluffs along big rivers. Further evidence from Iowa concerning its status there is needed to more firmly establish the rank of this type.

CLASSIFICATION

Status: Standard
Classification Confidence: 3 - Weak
Global Comments: This association is similar in some respects to limestone glades farther south, such as *Quercus muehlenbergii - Juniperus virginiana / Schizachyrium scoparium - Manfreda virginica* Wooded Herbaceous Vegetation (CEGL005131), and may represent the more northern equivalent of this type. This type is poorly defined and may currently only consist of small inclusions on steep slopes, especially on Mississippi River bluffs. In Wisconsin, this type is almost of historic note only, occurring now in a few locations where cedar glades or bedrock bluff prairies also occur. A single occurrence of good quality in Grant County along the Mississippi River is now being managed to maintain its woodland character (Eric Epstein, WINHP, pers. comm. 1999). In northeast Iowa, stands of this type can be codominated by *Juniperus virginiana* var. *virginiana* (eastern red-cedar) and contain an understory dominated by prairie flora with a more open canopy grading into flora more typical of dry forests as the canopy becomes more closed. Type may have varied from more open savanna or glade-like conditions to more closed-canopy conditions.
Global Similar Associations:
- *Quercus muehlenbergii - (Juniperus virginiana* var. *virginiana)* Unglaciated Bluff Woodland (CEGL004267)
- *Quercus muehlenbergii - Cercis canadensis / Packera obovata - Lithospermum canescens* Woodland (CEGL006231)
- *Quercus muehlenbergii - Juniperus virginiana / Schizachyrium scoparium - Manfreda virginica* Wooded Herbaceous Vegetation (CEGL005131) occurs farther south.

Global Related Concepts:
- Cedar Glade (Faber-Langendoen 2001) =
- Inland Oak Opening (Chapman et al. 1989) >

ELEMENT DISTRIBUTION

Global Range: This chinquapin oak woodland type occurs primarily on bluffs of large rivers in the midwestern United States, ranging from Iowa and Illinois to Michigan and Wisconsin.
Nations: US
States/Provinces: IA:S3, IL?, MI, MN, WI:S4
TNC Ecoregions: 46:C, 47:C, 48:C
USFS Ecoregions (1994/95): 222Lc:CCC, 251:P
Federal Lands: NPS (Effigy Mounds, Saint Croix)

ELEMENT SOURCES

Saint Croix National Scenic Riverway Map Code: WRC
Saint Croix National Scenic Riverway Plots: SACN.6, SACN.0485.
Local Description Authors: J. Drake
Global Description Authors: D. Faber-Langendoen
References: Chapman et al. 1989, Faber-Langendoen 2001, Hop et al. 2005, INAI unpubl. data, Midwestern Ecology Working Group n.d., WNHIP unpubl. data

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G158. Northeastern & North-Central Oak - Hickory Forest

Midwestern White Oak - Red Oak Forest

***Quercus alba - Quercus rubra - Carya ovata* Glaciated Forest**
White Oak - Northern Red Oak - Shagbark Hickory Glaciated Forest
Identifier: CEGL002068

NVC CLASSIFICATION

Division	Eastern North American Cool Temperate Forest (1.C.2.Na)
Macrogroup	Central Oak-Hardwood & Pine Forest (M012)
Group	Northeastern & North-Central Oak - Hickory Forest (G158)
Association (Common name)	Midwestern White Oak - Red Oak Forest

ELEMENT CONCEPT

Global Summary: This oak forest community is widespread in the north-central United States. Stands occur primarily on glaciated, rolling topography on a wide variety of soils that have a dry-mesic moisture condition. The canopy is variable but typically closed (>80%). *Quercus alba* (white oak) and *Quercus rubra* (northern red oak) are the leading dominants, but *Quercus ellipsoidalis* (northern pin oak), *Quercus macrocarpa* (bur oak), *Quercus velutina* (black oak), and *Carya ovata* (shagbark hickory) can also be codominant. Typical associates include *Juglans nigra* (black walnut) and, more south or east, *Carya alba* (mockernut hickory) and *Carya glabra* (pignut hickory). The subcanopy contains *Ostrya virginiana* (hophornbeam), *Prunus serotina* (black cherry), *Sassafras albidum* (sassafras), and, increasingly, *Acer rubrum* (red maple) or *Acer saccharum* (sugar maple). The shrub layer is quite variable but can include *Cornus alternifolia* (alternateleaf dogwood), *Cornus florida* (flowering dogwood) (southward), *Cornus foemina* (stiff dogwood), *Corylus americana* (American hazelnut) (northward), *Parthenocissus quinquefolia* (Virginia creeper), *Ribes cynosbati* (eastern prickly gooseberry), and *Zanthoxylum americanum* (common pricklyash). The herbaceous layer includes *Amphicarpaea bracteata* (American hogpeanut), *Anemone virginiana* (tall thimbleweed), *Symphyotrichum cordifolium* (common blue wood aster), *Botrychium virginianum* (rattlesnake fern), *Brachyelytrum erectum* (bearded shorthusk), *Circaea lutetiana* ssp. *canadensis* (broadleaf enchanter's nightshade), *Desmodium glutinosum* (pointedleaf ticktrefoil), *Galium concinnum* (shining bedstraw), *Geranium maculatum* (spotted geranium), *Osmorhiza claytonii* (Clayton's sweetroot), *Sanicula odorata* (clustered blacksnakeroot), and *Maianthemum racemosum* (feathery false lily of the valley).

ENVIRONMENTAL DESCRIPTION

Saint Croix National Scenic Riverway Environment: This common mixed oak forest was sampled at 20 locations in the park. Sites range from upland flats to gentle to steep ridges and slopes with northeast-, north-, southeast- and south-facing aspects. Soils include well-drained clay loam, loamy sand, silt and silt loam. The unvegetated surface is dominated by leaf litter (88-90% cover) with some large rocks (0-1%), wood (2-6%), bare soil (0-2%) and dead plant stems (3-9%). There is very little evidence of disturbance, except for the presence of exotic plants.
Global Environment: This community is found primarily on glaciated, rolling topography on a wide variety of soils that have a dry-mesic moisture condition. It is also found in the unglaciated Driftless Area of the upper Midwest.

VEGETATION DESCRIPTION

Saint Croix National Scenic Riverway Vegetation: The moderate dense (50-80% cover) tree canopy, 15-35 m tall, is dominated by *Quercus alba* (white oak), *Quercus macrocarpa* (bur oak), and/or *Quercus rubra* (northern red oak); additional species may include *Acer rubrum* (red maple), *Fraxinus pennsylvanica* (green ash), *Prunus serotina* (black cherry), *Tilia americana* (American basswood), *Ulmus americana* (American elm), and others. The very sparse moderate (5-40%) subcanopy (10-15 m) is dominated by *Ostrya virginiana* (hophornbeam). The tall-shrub layer (2-5 m), when present (0-40%), and short-shrub layer (0.5-1 m), when present (0-50%), may include *Acer saccharum* (sugar maple), *Carpinus caroliniana* (American hornbeam), *Corylus cornuta* (beaked hazelnut), *Ostrya virginiana* (hophornbeam), *Prunus virginiana* (chokecherry), *Ulmus americana* (American elm), and *Zanthoxylum americanum* (common pricklyash). The sparse to moderately dense (10-70%) herbaceous layer may include *Adiantum pedatum* (northern maidenhair), *Aralia nudicaulis* (wild sarsaparilla), *Carex pensylvanica* (Pennsylvania sedge), *Desmodium glutinosum* (pointedleaf ticktrefoil), *Eurybia macrophylla* (bigleaf aster), *Osmorhiza claytonii* (Clayton's sweetroot), *Pteridium aquilinum* (western brackenfern), *Uvularia sessilifolia* (sessileleaf bellwort), and others. In addition, this community may support Minnesota state-vulnerable *Desmodium nudiflorum* (nakedflower ticktrefoil), *Juglans cinerea* (butternut) (also Wisconsin state-vulnerable), and *Panax quinquefolius* (American ginseng).
Global Vegetation: The canopy is variable but typically closed (>80%). *Quercus alba* (white oak) and *Quercus rubra* (northern red oak) are the leading dominants, but *Quercus ellipsoidalis* (northern pin oak), *Quercus macrocarpa* (bur oak), *Quercus velutina* (black oak), and *Carya ovata* (shagbark hickory) can also be codominant. Typical associates include *Juglans nigra* (black walnut), and more south or east, *Carya alba* (mockernut hickory) and *Carya glabra* (pignut hickory). The subcanopy contains *Ostrya virginiana* (hophornbeam), *Prunus serotina* (black cherry), *Sassafras albidum* (sassafras), and, increasingly, *Acer rubrum* (red maple) or *Acer saccharum* (sugar maple). The shrub layer is quite variable but can include *Cornus alternifolia* (alternateleaf dogwood), *Cornus florida* (flowering dogwood) (southward), *Cornus foemina* (stiff dogwood), *Corylus americana* (American hazelnut) (northward), *Parthenocissus quinquefolia* (Virginia creeper), *Ribes cynosbati* (eastern prickly gooseberry), and *Zanthoxylum americanum* (common pricklyash). The herbaceous layer includes *Amphicarpaea bracteata* (American hogpeanut), *Anemone virginiana* (tall thimbleweed),

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Symphyotrichum cordifolium (common blue wood aster), *Botrychium virginianum* (rattlesnake fern), *Brachyelytrum erectum* (bearded shorthusk), *Circaea lutetiana* ssp. *canadensis* (broadleaf enchanter's nightshade), *Desmodium glutinosum* (pointedleaf ticktrefoil), *Galium concinnum* (shining bedstraw), *Geranium maculatum* (spotted geranium), *Osmorhiza claytonii* (Clayton's sweetroot), *Sanicula odorata* (clustered blacksnakeroot), and *Maianthemum racemosum* (feathery false lily of the valley) (Curtis 1959, Nelson 1985, MNNHP 1993, Anderson 1996).

MOST ABUNDANT SPECIES

Saint Croix National Scenic Riverway

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Acer rubrum* (red maple), *Quercus alba* (white oak), *Quercus macrocarpa* (bur oak), *Quercus rubra* (northern red oak)
Tree subcanopy	Broad-leaved deciduous tree	*Ostrya virginiana* (hophornbeam)
Tall shrub/sapling	Broad-leaved deciduous shrub	*Carpinus caroliniana* (American hornbeam), *Corylus cornuta* (beaked hazelnut), *Zanthoxylum americanum* (common pricklyash)
Herb (field)	Forb	*Desmodium glutinosum* (pointedleaf ticktrefoil), *Eurybia macrophylla* (bigleaf aster), *Uvularia sessilifolia* (sessileleaf bellwort)
Herb (field)	Graminoid	*Carex pensylvanica* (Pennsylvania sedge)

CHARACTERISTIC SPECIES

Saint Croix National Scenic Riverway: *Acer rubrum* (red maple), *Carex pensylvanica* (Pennsylvania sedge), *Carpinus caroliniana* (American hornbeam), *Corylus cornuta* (beaked hazelnut), *Desmodium glutinosum* (pointedleaf ticktrefoil), *Eurybia macrophylla* (bigleaf aster), *Ostrya virginiana* (hophornbeam), *Quercus alba* (white oak), *Quercus macrocarpa* (bur oak), *Quercus rubra* (northern red oak), *Uvularia sessilifolia* (sessileleaf bellwort), *Zanthoxylum americanum* (common pricklyash)

OTHER NOTEWORTHY SPECIES

Saint Croix National Scenic Riverway: Vulnerable: *Desmodium nudiflorum* (nakedflower ticktrefoil, MN state-vulnerable, G5), *Juglans cinerea* (butternut, MN & WI state-vulnerable, G4), *Panax quinquefolius* (American ginseng, MN state-vulnerable, G3G4); **Exotic/Invasive**: *Arctium minus* (lesser burdock, invasive/exotic, Medium/Insignificant), *Galeopsis tetrahit* (brittlestem hempnettle, invasive/exotic), *Leonurus cardiaca* (common motherwort, invasive/exotic), *Lonicera tatarica* (Tatarian honeysuckle, invasive/exotic, High/Medium), *Rhamnus cathartica* (common buckthorn, invasive/exotic, High/Medium), *Stellaria media* (common chickweed, invasive/exotic, Low), *Taraxacum officinale* (common dandelion, invasive/exotic), *Urtica dioica* (stinging nettle, invasive/exotic)
Global: Vulnerable: *Panax quinquefolius* (American ginseng, collection pressure, G3G4)

CONSERVATION STATUS RANK

Global Rank & Reasons: G4? (3-Oct-1996). Many sites have been cleared, logged, and grazed. It is not clear how many high quality, large tracts exist.

CLASSIFICATION

Status: Standard
Classification Confidence: 1 - Strong
Global Comments: This type rarely has any other oak species in it beyond *Quercus alba* (white oak), *Quercus rubra* (northern red oak), *Quercus velutina* (black oak), and occasional *Quercus macrocarpa* (bur oak) or *Quercus ellipsoidalis* (northern pin oak), unlike stands farther south with southern oak species. This type is primarily found on glaciated terrain, including Wisconsinan through Kansan, but its distribution may extend beyond that. Where stands have either *Acer rubrum* (red maple) or *Acer saccharum* (sugar maple) at >20% canopy coverage or basal area, they should be placed in *Quercus rubra - (Acer saccharum*, *Quercus alba)* Forest (CEGL005017), an oak-maple type. Also compare to *Quercus alba - Quercus rubra - Carya ovalis / Acer saccharum / Polystichum acrostichoides* Forest (CEGL007233) of the southeastern states.
Global Similar Associations:

- *Quercus alba - Quercus rubra - Acer saccharum* Sand Forest (CEGL005187)
- *Quercus alba - Quercus rubra - Carya (alba, ovata) / Cornus florida* Acidic Forest (CEGL002067) an unglaciated white oak-red oak type
- *Quercus alba - Quercus rubra - Carya ovalis / Acer saccharum / Polystichum acrostichoides* Forest (CEGL007233)
- *Quercus alba - Quercus rubra - Quercus muehlenbergii / Cercis canadensis* Forest (CEGL002070) an unglaciated white oak-red oak type
- *Quercus alba - Quercus rubra - Quercus prinus - Acer saccharum / Lindera benzoin* Forest (CEGL002059) a red oak-white oak-maple type; generally more mesic or more maple-dominated.
- *Quercus prinus - Quercus (alba, coccinea, velutina) / Viburnum acerifolium - (Kalmia latifolia)* Forest (CEGL005023)
- *Quercus prinus - Quercus* spp. / *Vaccinium arboreum - (Kalmia latifolia, Styrax grandifolius)* Forest (CEGL007700)
- *Quercus rubra - (Acer saccharum, Quercus alba)* Forest (CEGL005017) a red oak-white oak-maple type; generally more mesic or more maple-dominated.
- *Quercus rubra - Quercus alba - (Quercus velutina, Acer rubrum) / Viburnum acerifolium* Forest (CEGL002462)
-

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Global Related Concepts:
- Dry-Mesic Forest (Nelson 1985) >
- Dry-Mesic Southern Forest - White Oak (Red Oak)-Hickory (Chapman et al. 1989) >
- Oak Forest (Big Woods Section) Mesic Subtype (MNNHP 1993) <
- Oak Forest (Central Section) Mesic Subtype (MNNHP 1993) <
- Oak Forest (Southeast Section) Mesic Subtype (MNNHP 1993) <
- Oak-Hickory Forests (Anderson 1996) =
- Southern Dry-Mesic Forest (Curtis 1959) =
- Southern Dry-Mesic Forest White Oak-Red Oak Subtype (Faber-Langendoen 2001) =

ELEMENT DISTRIBUTION

Global Range: This oak forest community is widespread in the north-central United States, ranging from Ohio west to Minnesota, south to Iowa, and east to Indiana.
Nations: CA, US
States/Provinces: IA:S4, IL, IN, MI, MN, MO, NY, OH, ON, QC:S3?, WI:S3
TNC Ecoregions: 35:C, 36:C, 37:C, 38:C, 44:C, 45:C, 46:C, 47:C, 48:C, 49:C
USFS Ecoregions (1994/95): 212Fb:PPP, 212Jj:P??, 212Ka:P??, 221Ea:CCC, 221Ec:CCC, 221Ee:CCC, 221Ef:CCC, 221Eg:CCC, 221Fa:CCC, 221Fb:CCP, 221Fc:CCC, 222Aa:CCC, 222Ak:CCC, 222Ao:CCC, 222Aq:CCC, 222Fe:CCC, 222Ga:CCC, 222Gb:CCC, 222Gc:CCC, 222Ha:CCC, 222Hb:CCC, 222Hf:CCC, 222Id:CCP, 222If:CCC, 222Ja:CCC, 222Jb:CCC, 222Jg:CCC, 222Jh:CCC, 222Ji:CCC, 222Jj:CCC, 222Ke:CCC, 222Kf:CCC, 222Kg:CCC, 222Kh:CCC, 222Kj:CCC, 222Lb:CCC, 222Lc:CCC, 222Qb:CCC, 251Be:CCC, 251Cb:CCC, 251Cc:CCC, 251Cd:CCC, 251Ce:CCC, 251Cf:CCC, 251Cg:CCC, 251Cj:CCC, 251Ck:CCC, 251Dc:CCC, 251Dd:CCC, 251De:CCC, 251Df:CCC, 251Dh:CCP
Federal Lands: NPS (Cuyahoga Valley, Effigy Mounds, Indiana Dunes, Saint Croix); USFS (Finger Lakes)

ELEMENT SOURCES

Saint Croix National Scenic Riverway Map Code: FWR
Saint Croix National Scenic Riverway Plots: SACN.13, SACN.17, SACN.18, SACN.22, SACN.69, SACN.256, SACN.0162, SACN.0166, SACN.0172, SACN.0366, SACN.0665, SACN.0675, SACN.0677, SACN.3518, SACN.4066, SACN.4067, SACN.4731, SACN.5067, SACN.5503, SACN.5511.
Local Description Authors: M.J. Russo
Global Description Authors: D. Faber-Langendoen
References: Abrams 1992, Anderson 1996, Chapman et al. 1989, Curtis 1959, Faber-Langendoen 2001, Hop et al. 2005, Hop et al. 2009, INAI unpubl. data, MNNHP 1993, Midwestern Ecology Working Group n.d., Nelson 1985, WNHIP unpubl. data

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Eastern White Pine - Oak Driftless Bluff Forest

***Pinus strobus - Quercus (alba, rubra, velutina)* Driftless Bluff Forest**
Eastern White Pine - (White Oak, Northern Red Oak, Black Oak) Driftless Bluff Forest
Identifier: CEGL005561

NVC CLASSIFICATION

Division	Eastern North American Cool Temperate Forest (1.C.2.Na)
Macrogroup	Central Oak-Hardwood & Pine Forest (M012)
Group	Northeastern & North-Central Oak - Hickory Forest (G158)
Association (Common Name)	Eastern White Pine – Oak Driftless Bluff Forest

Global Summary: Information not available.

ENVIRONMENTAL DESCRIPTION

Saint Croix National Scenic Riverway Environment: This association was found on thin to moderately deep loamy soils over basalt bedrock. Basalt boulders and/or bedrock outcrops are common. Slopes can be gentle to moderately steep. This association was only found near Interstate Park.
Global Environment: Information not available.

VEGETATION DESCRIPTION

Saint Croix National Scenic Riverway Vegetation: This forest association has a moderate canopy cover composed largely of *Pinus strobus* (eastern white pine) and *Quercus rubra* (northern red oak) with *Acer saccharum* (sugar maple), *Quercus alba* (white oak), and *Pinus resinosa* (red pine) as common associates or co-dominants. *Ostrya virginiana* (hophornbeam) and *Acer saccharum* (sugar maple) are the most common members of the tree subcanopy and regeneration strata. Shrubs have moderate to sparse cover and include *Zanthoxylum americanum* (common pricklyash), *Rhamnus* spp. (buckthorn spp.), and *Lonicera canadensis* (American fly honeysuckle). The herbaceous stratum typically has moderate cover and is dominated by *Eurybia macrophylla* (bigleaf aster), *Aralia nudicaulis* (wild sarsaparilla), and *Carex pennsylvanica* (Pennsylvania sedge).
Global Vegetation: Information not available.

MOST ABUNDANT SPECIES

Saint Croix National Scenic Riverway

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Pinus strobus* (eastern white pine)
Tree canopy	Broad-leaved deciduous tree	*Acer saccharum* (sugar maple), *Quercus alba* (white oak), *Quercus rubra* (northern red oak)
Short shrub/sapling	Broad-leaved deciduous shrub	*Acer saccharum* (sugar maple), *Ostrya virginiana* (hophornbeam)
Herb (field)	Forb	*Aralia nudicaulis* (wild sarsaparilla), *Eurybia macrophylla* (bigleaf aster)
Herb (field)	Graminoid	*Carex pensylvanicum* (Pennsylvania sedge)

CHARACTERISTIC SPECIES

Saint Croix National Scenic Riverway:

OTHER NOTEWORTHY SPECIES

Saint Croix National Scenic Riverway: Exotic/Invasive:

CONSERVATION STATUS RANK

Global Rank & Reasons: GNR (17-Jun-2009).

CLASSIFICATION

Status: Standard

ELEMENT DISTRIBUTION

Global Range: This association has only been identified in the area near Interstate Park in eastern Minnesota and western Wisconsin though its range likely extends further south.
Nations: US
States/Provinces: MN, WI
Federal Lands: NPS (Saint Croix)

ELEMENT SOURCES

Saint Croix National Scenic Riverway Map Code: FPO
Saint Croix National Scenic Riverway Plots: No plots.
Local Description Authors: J. Drake
Global Description Authors:
References: Midwestern Ecology Working Group n.d.

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Oak Driftless Bluff Woodland

***Quercus macrocarpa - Quercus (alba, ellipsoidalis, velutina)* Woodland**
Bur Oak - (White Oak, Northern Pin Oak, Black Oak) Woodland
Identifier: CEGL005560

NVC CLASSIFICATION

Division	Eastern North American Cool Temperate Forest (1.C.2.Na)
Macrogroup	Central Oak-Hardwood & Pine Forest (M012)
Group	Northeastern & North-Central Oak - Hickory Forest (G158)
Association (Common name)	Oak Driftless Bluff Woodland

Global Summary: Information not available.

ENVIRONMENTAL DESCRIPTION

Saint Croix National Scenic Riverway Environment: This association was found on shallow loamy soils over basalt bedrock with boulders or bedrock outcrops common. Slopes can be gentle to moderately steep. Sites are limited to the area of basalt bedrock outcrops near Interstate Park.
Global Environment: Information not available.

VEGETATION DESCRIPTION

Saint Croix National Scenic Riverway Vegetation: This association has a moderately open (40-70%) tree canopy which can be moderately tall (15-20 m) on richer sites with deeper soil to short (5-10 m) on sites with thin soil and/or steeper slopes. *Quercus* spp. (oaks) make up the majority of the canopy. *Quercus alba* (white oak), *Q. macrocarpa* (bur oak), *Q. rubra* (northern red oak), and *Q. ellipsoidalis* (northern pin oak) can all contribute significantly to the canopy. *Juniperus virginiana* (eastern red cedar) is often present in small amounts and is also common in the subcanopy and sapling strata. *Ostrya virginiana* (hophornbeam) is very common in the subcanopy and sapling, also. The open to moderate shrub layer is composed largely of tree regeneration. The most common species in the herbaceous layer are *Carex pensylvanica* (Pennsylvania sedge) and *Eurybia macrophylla* (bigleaf aster). Other species are a mix of forest/woodland species such as *Amphicarpaea bracteata* (American hogpeanut), *Desmodium* spp. (ticktrefoil), and tree seedlings, and grassland species such as *Andropogon gerardii* (big bluestem), *Bouteloua* spp. (grama), *Festuca occidentalis* (western fecue), and *Schizachyrium scoparium (* little bluestem*)*.
Global Vegetation: Information not available.

MOST ABUNDANT SPECIES

Saint Croix National Scenic Riverway

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Quercus alba* (white oak), *Quercus ellipsoidalis* (northern pin oak), *Quercus macrocarpa* (bur oak), *Quercus rubra* (northern red oak)
Short shrub/sapling	Needle-leaved tree	*Juniperus virginiana* (eastern red-cedar)
Herb (field)	Forb	*Eurybia macrophylla* (bigleaf aster)
Herb (field)	Graminoid	*Carex pensylvanica* (Pennsylvania sedge)

CHARACTERISTIC SPECIES

Saint Croix National Scenic Riverway:

OTHER NOTEWORTHY SPECIES

Saint Croix National Scenic Riverway: Exotic/Invasive:

CONSERVATION STATUS RANK

Global Rank & Reasons: GNR (17-Jun-2009).

CLASSIFICATION

Status: Standard

ELEMENT DISTRIBUTION

Global Range: This association has only been identified in the area near Interstate Park in eastern Minnesota and western Wisconsin though its range likely extends further south.
Nations: US
States/Provinces: MN, WI
Federal Lands: NPS (Saint Croix)

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ELEMENT SOURCES

Saint Croix National Scenic Riverway Map Code: WOR
Saint Croix National Scenic Riverway Plots: No plots.
Local Description Authors: J. Drake
Global Description Authors:
References: Midwestern Ecology Working Group n.d.

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M159. Northern & Eastern Pine - Oak Forest & Barrens

G025. White Pine - Red Pine - Jack Pine - Oak Forest & Woodland Group

Jack Pine - Northern Pin Oak Forest

***Pinus banksiana - (Pinus resinosa) - Quercus ellipsoidalis / Carex pensylvanica* Forest**
Jack Pine - (Red Pine) - Northern Pin Oak / Pennsylvania Sedge Forest
Identifier: CEGL002478

NVC CLASSIFICATION

Division	Eastern North American Cool Temperate Forest (1.C.2.Na)
Macrogroup	Northern & Eastern Pine - Oak Forest & Barrens (M159)
Group	Great Lakes Pine - Oak Forest & Woodland (G025)
Association (Common name)	Jack Pine - Northern Pin Oak Forest

ELEMENT CONCEPT

Global Summary: This jack pine - oak forest community type is found near the western Great Lakes of the United States and Canada on well-drained, sandy, infertile soils. Sites are typically relatively flat and occur on outwash plains or glaciolacustrine beds. The overstory of this forest community has a moderately closed to closed canopy. Tree density can be very high (up to several hundred trees/ha). The dominant canopy species are *Pinus banksiana* (jack pine) and *Quercus ellipsoidalis* (northern pin oak). In some stands these two species constitute nearly the entire canopy. Where other trees are present, they typically include *Acer rubrum* (red maple), *Pinus resinosa* (red pine), and *Populus tremuloides* (quaking aspen). The shrub layer is sparse to well-defined. *Vaccinium angustifolium* (lowbush blueberry) is very common, but *Corylus cornuta* (beaked hazelnut), *Corylus americana* (American hazelnut), *Rosa* (rose) spp., and *Rubus* (blackberry) spp. are other common constituents. *Gaylussacia baccata* (black huckleberry) is common in central Michigan and Wisconsin. The herbaceous layer contains species such as *Carex pensylvanica* (Pennsylvania sedge), *Fragaria virginiana* (Virginia strawberry), *Lysimachia quadrifolia* (whorled yellow loosestrife), *Maianthemum canadense* (Canada mayflower), *Maianthemum racemosum* (feathery false lily of the valley), and *Pteridium aquilinum* (western brackenfern).

ENVIRONMENTAL DESCRIPTION

Saint Croix National Scenic Riverway Environment: This jack pine - oak forest was sampled once in the park. The site is a flat barren with well-drained sandy loam soil. The unvegetated surface is dominated by leaf litter (90% cover) with some wood (2%), bare soil (1%) and dead plant stems (7%). Evidence of disturbance includes dead standing jack pine and no reproduction, downed wood, lack of fire, and the presence of exotic plants.
Global Environment: This community is found on well-drained, sandy, infertile soils (Curtis 1959). Sites are typically relatively flat and occur on outwash plains or glaciolacustrine beds (MNNHP 1993).

VEGETATION DESCRIPTION

Saint Croix National Scenic Riverway Vegetation: The moderate (50% cover) tree canopy, 10-15 m tall, is dominated by *Pinus banksiana* (jack pine), *Quercus ellipsoidalis* (northern pin oak), and *Quercus macrocarpa* (bur oak). The sparse (30%) subcanopy (5-10 m) is dominated by *Quercus ellipsoidalis X rubra* and includes small amounts of *Fraxinus pennsylvanica* (green ash) and *Prunus serotina* (black cherry). The moderate (60%) short-shrub layer (1-2 m) is dominated by *Prunus virginiana* (chokecherry), *Quercus ellipsoidalis X rubra*, and *Rubus occidentalis* (black raspberry). Additional shrubs in small amounts include *Cornus racemosa* (gray dogwood), *Corylus americana* (American hazelnut), *Ilex verticillata* (common winterberry), *Prunus virginiana* (chokecherry), *Quercus macrocarpa* (bur oak), *Ribes cynosbati* (eastern prickly gooseberry), *Rubus allegheniensis* (Allegheny blackberry), *Toxicodendron rydbergii* (western poison-ivy), *Viburnum rafinesquianum* (downy arrow-wood), and *Vaccinium angustifolium* (lowbush blueberry) (dwarf-shrub). The moderately dense (70%) herbaceous layer is dominated by *Maianthemum canadense* (Canada mayflower), *Pteridium aquilinum* (western brackenfern), and *Schizachne purpurascens* (false melic).
Global Vegetation: *Vaccinium angustifolium* (lowbush blueberry) is very common, but *Corylus americana* (American hazelnut), *Corylus cornuta* (beaked hazelnut), *Rosa* (rose) spp., and *Rubus* (blackberry) spp. are other common constituents. *Gaylussacia baccata* (black huckleberry) is common in central Michigan and Wisconsin. The herbaceous layer contains species such as *Carex pensylvanica* (Pennsylvania sedge), *Fragaria virginiana* (Virginia strawberry), *Lysimachia quadrifolia* (whorled yellow loosestrife), *Maianthemum canadense* (Canada mayflower), *Maianthemum racemosum* (feathery false lily of the valley), and *Pteridium aquilinum* (western brackenfern) (Curtis 1959, MNNHP 1993).

MOST ABUNDANT SPECIES

Saint Croix National Scenic Riverway

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Pinus banksiana* (jack pine)
Tree canopy	Broad-leaved deciduous tree	*Quercus ellipsoidalis* (northern pin oak), *Quercus macrocarpa* (bur oak)
Short shrub/sapling	Broad-leaved deciduous shrub	*Prunus virginiana* (chokecherry), *Rubus occidentalis* (black raspberry)

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Herb (field)	Forb	*Maianthemum canadense* (Canada mayflower)
Herb (field)	Graminoid	*Schizachne purpurascens* (false melic)
Herb (field)	Fern or fern ally	*Pteridium aquilinum* (western brackenfern)

CHARACTERISTIC SPECIES

Saint Croix National Scenic Riverway: *Maianthemum canadense* (Canada mayflower), *Pinus banksiana* (jack pine), *Prunus virginiana* (chokecherry), *Pteridium aquilinum* (western brackenfern), *Quercus ellipsoidalis* (northern pin oak), *Quercus macrocarpa* (bur oak), *Rubus occidentalis* (black raspberry), *Schizachne purpurascens* (false melic)

OTHER NOTEWORTHY SPECIES

Saint Croix National Scenic Riverway: Exotic/Invasive: *Poa pratensis* (Kentucky bluegrass, invasive/exotic, Medium), *Taraxacum officinale* (common dandelion, invasive/exotic)

CONSERVATION STATUS RANK

Global Rank & Reasons: G4G5 (3-Oct-1996).

CLASSIFICATION

Status: Standard

Classification Confidence: 2 - Moderate

Global Comments: *Pinus strobus* (eastern white pine), *Quercus rubra* (northern red oak), *Quercus macrocarpa* (bur oak) and *Quercus velutina* (black oak) may also occur in this type. The distinction between this type and *Pinus banksiana / (Quercus rubra*, *Quercus ellipsoidalis)* Forest (CEGL002440) is that the latter is primarily found on bedrock, with oaks occurring primarily as grubs and only rarely are in the canopy. This type also overlaps with *Pinus banksiana / Vaccinium* spp. / *Pleurozium schreberi* (Schreber's big red stem moss) Forest (CEGL002441), especially in Wisconsin, where timber management can cause a lot of variation in the proportion of oak and pine (E. Epstein pers. comm. 2000).

Global Similar Associations:

- *Pinus banksiana / (Quercus rubra, Quercus ellipsoidalis)* Forest (CEGL002440) This is a dry, pure evergreen jack pine type with some oak in the understory, found most typically on bedrock.
- *Pinus banksiana / Vaccinium* spp. / *Pleurozium schreberi* Forest (CEGL002441) This is the pure evergreen jack pine type.

Global Related Concepts:

- Dry Northern Forest - Red Pine-Jack Pine (Oak) (Chapman et al. 1989) >
- Mixed Pine - Hardwood Forest (MNNHP 1993) >
- Northern Dry Forest Jack Pine-Oak Subtype (Faber-Langendoen 2001) =

ELEMENT DISTRIBUTION

Global Range: This community is found in northern Minnesota, northern and central Wisconsin, northern Michigan, and Ontario.

Nations: CA, US

States/Provinces: MI, MN, ON, WI

TNC Ecoregions: 46:C, 47:C, 48:C

USFS Ecoregions (1994/95): 212Hb:CCP, 212He:CCP, 212Hi:CCP, 212Hm:CCP, 212Hp:CCC, 212Hq:CCP, 212Hr:CCP, 212Hs:CCP, 212Ht:CCP, 212Hu:CCP, 212Hv:CCP, 212Hw:CCP, 212Hy:CCP, 212Ia:CCC, 212Ja:CPP, 212Jb:CP?, 212Jc:CPP, 212Jj:CPP, 212Jl:CPP, 212Jm:CPP, 212Jn:CPP, 212Jo:CPP, 212Jr:CPP, 212Ka:CPP, 212Na:CCP, 212Nb:CCP, 212Nc:CCC, 222Ka:CCC

Federal Lands: NPS (Apostle Islands, Saint Croix, Sleeping Bear Dunes, Voyageurs); USFS (Chequamegon, Chequamegon-Nicolet, Chippewa, Huron, Huron-Manistee, Manistee, Nicolet, Ottawa)

ELEMENT SOURCES

Saint Croix National Scenic Riverway Map Code: FJO

Saint Croix National Scenic Riverway Plots: SACN.5.

Local Description Authors: M.J. Russo

Global Description Authors: J. Drake

References: Chapman et al. 1989, Curtis 1959, Faber-Langendoen 2001, Hop et al. 2010a, MNNHP 1993, Midwestern Ecology Working Group n.d., WNHIP unpubl. data

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Red Pine - Aspen - Birch Forest

***Pinus resinosa - Populus tremuloides / Diervilla lonicera - Vaccinium* spp. Forest**
Red Pine - Quaking Aspen / Northern Bush-honeysuckle - Blueberry species Forest
Identifier: CEGL002520

NVC CLASSIFICATION

Division	Eastern North American Cool Temperate Forest (1.C.2.Na)
Macrogroup	Northern & Eastern Pine - Oak Forest & Barrens (M159)
Group	Great Lakes Pine - Oak Forest & Woodland (G025)
Association (Common name)	Red Pine - Aspen - Birch Forest

ELEMENT CONCEPT

Global Summary: This red pine - hardwood mixed forest is found in the boreal regions of the midwestern United States and in central and possibly eastern Canada. Stands are found on well-drained upland sites on a variety of landforms. Soils are coarse sandy and shallow to deep. Stands contain a mix of deciduous and evergreen trees, comprising mainly *Pinus resinosa* (red pine) as the conifer, with some *Pinus banksiana* (jack pine), *Pinus strobus* (eastern white pine), and *Abies balsamea* (balsam fir). Less frequent associates include *Picea glauca* (white spruce) and *Picea mariana* (black spruce). Hardwoods include *Betula papyrifera* (paper birch), *Populus grandidentata* (bigtooth aspen) and *Populus tremuloides* (quaking aspen). The shrub and herb layers vary from dense to open. Tall and dwarf-shrubs include *Abies balsamea* (balsam fir), *Acer spicatum* (mountain maple), *Amelanchier* (serviceberry) spp., *Corylus cornuta* (beaked hazelnut), *Diervilla lonicera* (northern bush honeysuckle), *Linnaea borealis* (twinflower), *Lonicera canadensis* (American fly honeysuckle), *Vaccinium angustifolium* (lowbush blueberry), and *Vaccinium myrtilloides* (velvetleaf huckleberry). Herbs include *Eurybia macrophylla* (bigleaf aster), *Aralia nudicaulis* (wild sarsaparilla), *Clintonia borealis* (bluebead), *Cornus canadensis* (bunchberry dogwood), and *Maianthemum canadense* (Canada mayflower). Large patches of feathermoss can develop on the forest floor. Moss species include *Dicranum polysetum* (dicranum moss) and *Pleurozium schreberi* (Schreber's big red stem moss).

ENVIRONMENTAL DESCRIPTION

Saint Croix National Scenic Riverway Environment: This red pine - hardwood mixed forest was sampled at 13 locations in the park. Sites are generally flat to gently sloping uplands; one site is a somewhat steep, southwest-facing bluff. Soils are rapidly drained sand and well-drained loamy sand and sandy loam. The unvegetated surface is dominated by leaf litter (87-97% cover) with some large rocks (0-4%), small rocks (0-2%), wood (1-8%), bare soil (0-1%) and dead plant stems (2-8%). Evidence of disturbance includes trails, possible past selective logging, downed wood (windthrows and tip-up mounds), and the presence of exotic plants.
Global Environment: Stands are found on well-drained upland sites on a variety of landforms. Soils are coarse sandy, and shallow to deep (Sims et al. 1989, McCarthy et al. 1994).

VEGETATION DESCRIPTION

Saint Croix National Scenic Riverway Vegetation: The very sparse to dense (5-80% cover) tree canopy, 15-35 m tall, is dominated by *Pinus resinosa* (red pine); additional species may include *Acer rubrum* (red maple), *Betula papyrifera* (paper birch), *Populus grandidentata* (bigtooth aspen), *Populus tremuloides* (quaking aspen), and *Quercus rubra* (northern red oak). The very sparse to moderate (5-40%) subcanopy (5-15 m) is made up of canopy species. The very sparse to moderate (40%) tall-shrub layer (1-5 m) and very sparse to moderate (5-40%) short-shrub layer (0.5-2 m) may include *Corylus americana* (American hazelnut), *Corylus cornuta* (beaked hazelnut), *Diervilla lonicera* (northern bush honeysuckle), *Ostrya virginiana* (hophornbeam), *Prunus virginiana* (chokecherry), *Viburnum rafinesquianum* (downy arrow-wood), and *Rubus allegheniensis* (Allegheny blackberry). *Gaultheria procumbens* (eastern teaberry) and *Vaccinium angustifolium* (lowbush blueberry) may form a moderate (up to 50% when present) dwarf-shrub layer. The very sparse to moderate (5-60%) herbaceous layer is dominated by *Eurybia macrophylla* (bigleaf aster) and *Pteridium aquilinum* (western brackenfern); additional herbs include *Amphicarpaea bracteata* (American hogpeanut), *Anemone quinquefolia* (wood anemone), *Apocynum androsaemifolium* (spreading dogbane), *Aquilegia canadensis* (red columbine), *Aralia nudicaulis* (wild sarsaparilla), *Carex pensylvanica* (Pennsylvania sedge), *Galium circaezans* (licorice bedstraw), *Lathyrus ochroleucus* (cream pea), *Lysimachia quadriflora* (fourflower yellow loosestrife) (Minnesota state-vulnerable), *Maianthemum canadense* (Canada mayflower), *Maianthemum racemosum* (feathery false lily of the valley), *Melampyrum lineare* (narrowleaf cowwheat), *Oryzopsis asperifolia* (roughleaf ricegrass), *Thalictrum dioicum* (early meadowrue), *Trientalis borealis* (starflower), *Uvularia sessilifolia* (sessileleaf bellwort), and others. In addition, this community may support Minnesota state-vulnerable *Sanicula trifoliata* (largefruit blacksnakeroot).
Global Vegetation: Stands contain a mix of deciduous and evergreen trees, comprising mainly *Pinus resinosa* (red pine) as the conifer, with some *Pinus banksiana* (jack pine), *Pinus strobus* (eastern white pine), and *Abies balsamea* (balsam fir). Less frequent associates include *Picea glauca* (white spruce) and *Picea mariana* (black spruce). Hardwoods include *Betula papyrifera* (paper birch), *Populus grandidentata* (bigtooth aspen) and *Populus tremuloides* (quaking aspen). The shrub and herb layer varies from dense to open. Tall and dwarf-shrubs include *Abies balsamea* (balsam fir), *Acer spicatum* (mountain maple), *Amelanchier* (serviceberry) spp., *Corylus cornuta* (beaked hazelnut), *Diervilla lonicera* (northern bush honeysuckle), *Linnaea borealis* (twinflower), *Lonicera canadensis* (American fly honeysuckle), *Vaccinium angustifolium* (lowbush blueberry), and *Vaccinium myrtilloides* (velvetleaf huckleberry). Herbs include *Eurybia macrophylla* (bigleaf aster), *Aralia nudicaulis* (wild sarsaparilla), *Clintonia borealis* (bluebead), *Cornus canadensis* (bunchberry dogwood), and *Maianthemum canadense* (Canada mayflower). Large patches of feathermoss can

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develop on the forest floor. Moss species include *Dicranum polysetum* (dicranum moss) and *Pleurozium schreberi* (Schreber's big red stem moss) (Sims et al. 1989, McCarthy et al. 1994).

MOST ABUNDANT SPECIES

Saint Croix National Scenic Riverway

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Pinus resinosa* (red pine)
Tree canopy	Broad-leaved deciduous tree	*Acer rubrum* (red maple), *Populus tremuloides* (quaking aspen), *Quercus rubra* (northern red oak)
Tall shrub/sapling	Broad-leaved deciduous shrub	*Corylus americana* (American hazelnut)
Short shrub/sapling	Broad-leaved deciduous shrub	*Rubus allegheniensis* (Allegheny blackberry), *Rubus pensilvanicus* (Pennsylvania blackberry), *Corylus cornuta* (beaked hazelnut)
Short shrub/sapling	Dwarf-shrub	*Vaccinium angustifolium* (lowbush blueberry)
Herb (field)	Forb	*Eurybia macrophylla* (bigleaf aster)
Herb (field)	Fern or fern ally	*Pteridium aquilinum* (western brackenfern)

CHARACTERISTIC SPECIES

Saint Croix National Scenic Riverway: *Acer rubrum* (red maple), *Corylus americana* (American hazelnut), *Corylus cornuta* (beaked hazelnut), *Eurybia macrophylla* (bigleaf aster), *Pinus resinosa* (red pine), *Populus tremuloides* (quaking aspen), *Pteridium aquilinum* (western brackenfern), *Quercus rubra* (northern red oak), *Rubus allegheniensis* (Allegheny blackberry), *Rubus pensilvanicus* (Pennsylvania blackberry), *Vaccinium angustifolium* (lowbush blueberry)

OTHER NOTEWORTHY SPECIES

Saint Croix National Scenic Riverway: Vulnerable: *Lysimachia quadrifolia* (whorled yellow loosestrife, MN state-vulnerable, G5), *Sanicula trifoliata* (largefruit blacksnakeroot, MN state-vulnerable, G4); **Exotic/Invasive**: *Hieracium aurantiacum* (orange hawkweed, invasive/exotic, Medium/Low)

CONSERVATION STATUS RANK

Global Rank & Reasons: GNR (3-Oct-1996).

CLASSIFICATION

Status: Standard
Classification Confidence: 2 - Moderate
Global Comments: This type overlaps floristically with *Pinus resinosa / Vaccinium* spp. Forest (CEGL002443), the pure evergreen red pine forest, but is somewhat more diverse in the shrub and herb layers.
Global Similar Associations:
- *Pinus resinosa / Vaccinium* spp. Forest (CEGL002443)

Global Related Concepts:
- Mixed Pine - Hardwood Forest (MNNHP 1993) >
- Red Pine Mixedwood (V13) (Sims et al. 1989) =
- Red Pine Mixedwood (V5) (McCarthy et al. 1994) =

ELEMENT DISTRIBUTION

Global Range: This red pine-hardwood mixed forest community type is found in the boreal regions of the midwestern United States and in central and possibly eastern Canada, ranging from Minnesota north and east to Manitoba, Ontario and possibly elsewhere in eastern Canada.
Nations: CA, US
States/Provinces: MB?, MI, MN, ON, QC, WI
TNC Ecoregions: 47:C, 48:C
USFS Ecoregions (1994/95): 212Hi:CCC, 212Ia:CCC, 212Ja:CCC, 212Kb:CCC, 212La:CCP, 212Lb:CCC, 212Ld:CCC
Federal Lands: NPS (Apostle Islands, Pictured Rocks, Saint Croix, Sleeping Bear Dunes, Voyageurs); USFS (Superior?)

ELEMENT SOURCES

Saint Croix National Scenic Riverway Map Code: FRA
Saint Croix National Scenic Riverway Plots: SACN.10, SACN.48, SACN.50, SACN.133, SACN.200, SACN.210, SACN.223, SACN.257, SACN.275, SACN.4018, SACN.5057, SACN.5120, SACN.7502.
Local Description Authors: M.J. Russo
Global Description Authors: D. Faber-Langendoen
References: Greenall 1996, Hop et al. 2010a, Hop et al. 2010c, MNNHP 1993, McCarthy et al. 1994, Midwestern Ecology Working Group n.d., Sims et al. 1989

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Red Pine / Blueberry Dry Forest

***Pinus resinosa / Vaccinium* spp. Forest**
Red Pine / Blueberry species Forest
Identifier: CEGL002443

NVC CLASSIFICATION

Division	Eastern North American Cool Temperate Forest (1.C.2.Na)
Macrogroup	Northern & Eastern Pine - Oak Forest & Barrens (M159)
Group	Great Lakes Pine - Oak Forest & Woodland (G025)
Association (Common name)	Red Pine / Blueberry Dry Forest

ELEMENT CONCEPT

Global Summary: This upland red pine community is found in the boreal regions of the midwestern United States and in central and possibly eastern Canada. This community occurs on Precambrian bedrock, overlaid with medium deep, coarse sand or coarse loam soils. Moisture varies from dry to dry-mesic, and stands are on mid to upper gentle slopes. Stands contain a pine overstory and a poorly developed understory. *Pinus resinosa* (red pine) is the dominant overstory species (generally >80% cover). *Pinus strobus* (eastern white pine) can be prominent in the canopy and is often numerous in the sapling and seedling classes. Other species include *Abies balsamea* (balsam fir), *Pinus banksiana* (jack pine), *Picea mariana* (black spruce), *Picea glauca* (white spruce), and *Populus tremuloides* (quaking aspen). Northern hardwoods, such as *Acer rubrum* (red maple) and *Betula papyrifera* (paper birch), sometimes form a subcanopy. The understory ranges from moderately herb- and shrub-rich to extremely poor. In the tall-shrub strata, the important species are *Amelanchier* (serviceberry) spp. and *Corylus cornuta* (beaked hazelnut). The short-shrub layer includes *Linnaea borealis* (twinflower), *Gaultheria procumbens* (eastern teaberry), *Vaccinium angustifolium* (lowbush blueberry), and *Vaccinium myrtilloides* (velvetleaf huckleberry), particularly where gaps in the canopy occur. The herb layer is very poorly represented in most parts of this community's range and includes *Aralia nudicaulis* (wild sarsaparilla), *Eurybia macrophylla* (bigleaf aster), *Cornus canadensis* (bunchberry dogwood), *Maianthemum canadense* (Canada mayflower), *Pteridium aquilinum* (western brackenfern), and *Trientalis borealis* (starflower). Mosses are abundant, especially *Dicranum* (dicranum moss) spp. (including *Dicranum polysetum* (dicranum moss)) and *Pleurozium schreberi* (Schreber's big red stem moss). Diagnostic features include the dominance of *Pinus resinosa* (red pine) and the ericaceous understory.

ENVIRONMENTAL DESCRIPTION

Saint Croix National Scenic Riverway Environment: This upland red pine forest was sampled at seven locations in the park. Sites are located on rocky slopes and rock terraces with very shallow, excessively drained soils often with exposed bedrock. Evidence of disturbance includes dead standing trees and cut stumps and the presence of exotic plants.
Global Environment: This community occurs on Precambrian bedrock, overlaid with medium deep (>60 cm), coarse sand or coarse loam soils. Moisture varies from dry to dry-mesic, and stands are on mid to upper gentle slopes. The climate is highly variable, with temperature extremes between -46 and 38 degrees C, and with anywhere from 58-91 cm of precipitation.

VEGETATION DESCRIPTION

Saint Croix National Scenic Riverway Vegetation: No height or cover data were provided. The tree canopy is dominated by *Pinus resinosa* (red pine) (15-85% cover) and may include lesser amounts of *Acer rubrum* (red maple), *Betula papyrifera* (paper birch), *Populus grandidentata* (bigtooth aspen), *Quercus rubra* (northern red oak), and others. The shrub layer may be dominated by (62-85% cover) or include *Corylus cornuta* (beaked hazelnut), *Vaccinium angustifolium* (lowbush blueberry), or *Rubus* (blackberry) sp. along with lesser amounts of *Diervilla lonicera* (northern bush honeysuckle), *Gaultheria procumbens* (eastern teaberry), *Vaccinium myrtilloides* (velvetleaf huckleberry), and tree saplings. The herbaceous layer is typically dominated by the fern *Pteridium aquilinum* (western brackenfern) (1-37.5% cover) and forb *Maianthemum canadense* (Canada mayflower) (1-15% cover) and may include other species such as *Amphicarpaea bracteata* (American hogpeanut), *Apocynum androsaemifolium* (spreading dogbane), *Aralia nudicaulis* (wild sarsaparilla), *Carex pensylvanica* (Pennsylvania sedge), *Clintonia borealis* (bluebead), *Cornus canadensis* (bunchberry dogwood), *Cypripedium acaule* (moccasin flower), *Danthonia spicata* (poverty oatgrass), *Eurybia macrophylla* (bigleaf aster), *Melampyrum lineare* (narrowleaf cowwheat), *Oryzopsis asperifolia* (roughleaf ricegrass), *Polypodium virginianum* (rock polypody), and others. Nonvascular species (mosses and lichens) can cover up to 65% of the surface and include species of *Cladina* (reindeer lichen), *Dicranum* (dicranum moss), *Leucobryum* (leucobryum moss), *Plagiomnium* (plagiomnium moss), *Polytrichum* (polytrichum moss), and *Pleurozium schreberi* (Schreber's big red stem moss).
Global Vegetation: This community is characterized by a pine overstory and a poorly developed understory. *Pinus resinosa* (red pine) is present in the canopy at higher cover and basal area than other conifers (typically 80% or more). *Pinus strobus* (eastern white pine) can be common in the canopy. Mesic sites tend to include not only *Pinus resinosa* (red pine) in the canopy, but also *Picea mariana* (black spruce), *Picea glauca* (white spruce), and *Abies balsamea* (balsam fir), whereas on dry sites, *Pinus banksiana* (jack pine) is found (MNNHP 1993). Beneath the canopy, northern hardwoods, such as *Acer rubrum* (red maple) and *Betula papyrifera* (paper birch), sometimes form a subcanopy. The understory ranges from moderately herb- and shrub-rich to extremely poor. In the tall shrub class, the important species are *Amelanchier* (serviceberry) spp. and *Corylus cornuta* (beaked hazelnut). The short-shrub layer includes *Gaultheria procumbens* (eastern teaberry), *Linnaea borealis* (twinflower), *Vaccinium angustifolium* (lowbush blueberry), and *Vaccinium myrtilloides* (velvetleaf huckleberry), particularly where gaps in the canopy occur (Ohmann and Ream 1971). The herb layer is very poorly represented in most parts of this community's range and includes *Aralia nudicaulis* (wild sarsaparilla), *Eurybia*

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macrophylla (bigleaf aster), *Cornus canadensis* (bunchberry dogwood), *Maianthemum canadense* (Canada mayflower), *Pteridium aquilinum* (western brackenfern), and *Trientalis borealis* (starflower). Mosses can have very high cover and typically include *Dicranum* (dicranum moss) spp. (including *Dicranum polysetum* (dicranum moss)) and *Pleurozium schreberi* (Schreber's big red stem moss). The average coverage of feathermoss is greater in the northwest region of Ontario than in the north-central region (Sims et al. 1989).

MOST ABUNDANT SPECIES

Saint Croix National Scenic Riverway

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Pinus resinosa* (red pine)
Tree canopy	Broad-leaved deciduous tree	*Acer rubrum* (red maple), *Betula papyrifera* (paper birch), *Populus grandidentata* (bigtooth aspen)
Tall shrub/sapling	Broad-leaved deciduous shrub	*Corylus cornuta* (beaked hazelnut)
Short shrub/sapling	Dwarf-shrub	*Gaultheria procumbens* (eastern teaberry), *Vaccinium angustifolium* (lowbush blueberry), *Vaccinium myrtilloides* (velvetleaf huckleberry)
Herb (field)	Forb	*Maianthemum canadense* (Canada mayflower)
Herb (field)	Fern or fern ally	*Pteridium aquilinum* (western brackenfern)
Nonvascular	Moss	*Pleurozium schreberi* (Schreber's big red stem moss)

Global

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Pinus resinosa* (red pine)
Tall shrub/sapling	Broad-leaved deciduous shrub	*Corylus cornuta* (beaked hazelnut)
Short shrub/sapling	Dwarf-shrub	*Vaccinium angustifolium* (lowbush blueberry), *Vaccinium myrtilloides* (velvetleaf huckleberry)
Nonvascular	Moss	*Pleurozium schreberi* (Schreber's big red stem moss)

CHARACTERISTIC SPECIES

Saint Croix National Scenic Riverway: *Acer rubrum* (red maple), *Aralia nudicaulis* (wild sarsaparilla), *Betula papyrifera* (paper birch), *Corylus cornuta* (beaked hazelnut), *Diervilla lonicera* (northern bush honeysuckle), *Gaultheria procumbens* (eastern teaberry), *Maianthemum canadense* (Canada mayflower), *Pinus resinosa* (red pine), *Pleurozium schreberi* (Schreber's big red stem moss), *Populus grandidentata* (bigtooth aspen), *Pteridium aquilinum* (western brackenfern), *Vaccinium angustifolium* (lowbush blueberry), *Vaccinium myrtilloides* (velvetleaf huckleberry)
Global: *Corylus cornuta* (beaked hazelnut), *Pinus resinosa* (red pine), *Vaccinium angustifolium* (lowbush blueberry), *Vaccinium myrtilloides* (velvetleaf huckleberry)

CONSERVATION STATUS RANK

Global Rank & Reasons: G3 (6-Feb-2007). There are probably over 100 occurrences of this community rangewide. Currently there are 77 occurrences documented from Michigan (where it is ranked S3), Minnesota (S3), and Wisconsin (S3); it is also reported from Manitoba (S3) and Ontario (S?). There are probably over 10,000 acres of this community rangewide. Currently 5545 acres have been documented from 45 occurrences in Michigan, Minnesota, and Wisconsin. Many sites have been degraded by logging, but there are also many mature to old-growth stands remaining.

CLASSIFICATION

Status: Standard
Classification Confidence: 1 - Strong
Global Comments: Stands are dominated by *Pinus resinosa* (red pine), with at least 60% cover, and typically 80% or more. Stands can intergrade with white pine, and these mixed stands are placed with the white pine types, either White Pine-Mountain Maple Mesic Forest, *Pinus strobus / Acer spicatum - Corylus cornuta* Forest (CEGL002445), or White Pine/Blueberry Dry-mesic Forest, *Pinus strobus / Vaccinium* spp. Forest (CEGL002444). Red pine stands in the central Great Lakes region, often on sandy outwash, are treated with more boreal stands as one type, since the ericaceous component is similar. It remains to be seen whether the central stands lack enough of the more common boreal elements of the northern stands to warrant a separate type.

A survey of vegetation of the dunes of Lake Michigan in Manistee National Forest in Michigan (Hazlett 1986) found a community very similar to *Pinus resinosa / Vaccinium* spp. Forest. This pine forest would appear to belong with the Great Lakes Dune Pine Forest, *Pinus banksiana - Pinus resinosa - Pinus strobus* Dune Forest (CEGL002589). The described community was closely associated with bogs within the lake dunes. The forest canopy was dominated by *Pinus resinosa* (red pine) (75-100% cover), although on the drier ridges inclusions of *Quercus velutina* (black oak) and *Populus grandidentata* (bigtooth aspen) were common. Other trees that were found in the canopy included *Acer rubrum* (red maple), *Betula papyrifera* (paper birch), *Quercus alba* (white oak), and *Quercus rubra* (northern red oak). In the understory, species that were found in this community subtype, but not in the main community type, included *Gaylussacia baccata* (black huckleberry), *Hamamelis virginiana* (American witch-hazel), and *Viburnum nudum* var. *cassinoides* (withe-rod). Many species of herbs were present, but no feathermosses were listed.

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Global Similar Associations:
- *Pinus banksiana - (Pinus resinosa) / Corylus cornuta* Forest (CEGL002442)
- *Pinus banksiana - (Quercus ellipsoidalis) / Schizachyrium scoparium* - Prairie Forbs Wooded Herbaceous Vegetation (CEGL002490)
- *Pinus banksiana - Pinus resinosa - (Quercus ellipsoidalis) / Carex pensylvanica* Wooded Herbaceous Vegetation (CEGL005124)
- *Pinus banksiana - Pinus resinosa - Pinus strobus* Dune Forest (CEGL002589)
- *Pinus resinosa - Populus tremuloides / Diervilla lonicera - Vaccinium* spp. Forest (CEGL002520) is dominated by red pine and aspen and/or birch.
- *Pinus strobus - Populus tremuloides / Corylus cornuta* Forest (CEGL002479) is dominated by white pine and aspen.
- *Pinus strobus / Acer spicatum - Corylus cornuta* Forest (CEGL002445)
- *Pinus strobus / Vaccinium* spp. Forest (CEGL002444) pure white pine type on drier sites with blueberry/feathermoss understory that resembles red pine stands.

Global Related Concepts:
- Dry Northern Forest - Red Pine-Jack Pine (Oak) (Chapman et al. 1989) **>**
- Northern Dry Forest Red Pine Subtype (Faber-Langendoen 2001) **=**
- Red Pine (Ohmann and Ream 1971) **=**
- Red Pine Conifer (V27) (Sims et al. 1989) **?**
- Red Pine Forest (MNNHP 1993) **=**
- Red Pine-White Pine-Jack Pine-Blueberry-Feathermoss (V30) (Chambers et al. 1997) **<**
- Red Pine-White Pine-Jack Pine-Largetooth Aspen-White Pine Shrub-Wintergreen (V31) (Chambers et al. 1997) **<**

ELEMENT DISTRIBUTION

Global Range: This upland red pine community type is found in the boreal regions of the midwestern United States and in central and possibly eastern Canada, ranging from Minnesota and southwestern Manitoba east to Michigan, Ontario, and possibly further east.
Nations: CA, US
States/Provinces: MB:S1, MI, MN:S3, ON, QC:S3?, WI:S3
TNC Ecoregions: 46:C, 47:C, 48:C
USFS Ecoregions (1994/95): 212Ha:CCC, 212Hb:CCP, 212He:CC?, 212Hh:CCC, 212Hi:CCP, 212Hj:CCC, 212Hk:CC?, 212Hl:CCC, 212Hm:CCP, 212Ho:CCC, 212Hp:CCP, 212Hq:CCC, 212Hr:CCP, 212Hs:CCP, 212Ht:CCP, 212Hu:CCP, 212Hv:CCP, 212Hw:CCC, 212Hx:CCP, 212Hy:CCP, 212Ia:CCC, 212Ja:CCC, 212Jb:CCP, 212Jc:CCC, 212Jf:CCP, 212Jj:CCP, 212Jl:CCC, 212Jm:CCC, 212Jn:CCP, 212Jo:CC?, 212Ka:CCC, 212Kb:CCC, 212La:CCC, 212Lb:CCP, 212Lc:CCC, 212Mb:CCC, 212Na:CCC, 212Nb:CCC, 212Nc:CCC, 222Mc:CCC
Federal Lands: NPS (Apostle Islands, Pictured Rocks, Saint Croix, Sleeping Bear Dunes, Voyageurs); USFS (Chequamegon, Chequamegon-Nicolet, Chippewa, Hiawatha, Huron, Huron-Manistee, Manistee, Nicolet, Ottawa, Superior)

ELEMENT SOURCES

Saint Croix National Scenic Riverway Map Code: FRP
Saint Croix National Scenic Riverway Plots: SACN.4005, SACN.4009, SACN.4013, SACN.4027, SACN.4463, SACN.5058, SACN.7519.
Local Description Authors: M.J. Russo
Global Description Authors: A. Szostak, mod. D. Faber-Langendoen 04-00
References: Ahlgren 1974, Chambers et al. 1997, Chapman et al. 1989, Faber-Langendoen 2001, Farrand and Bell 1982, Frelich 1992, Greenall 1996, Grigal and Ohmann 1975, Hazlett 1986, Heinselman 1973, Hop et al. 2010a, Hop et al. 2010c, MNNHP 1993, Midwestern Ecology Working Group n.d., Ohmann and Ream 1971, Sims et al. 1989, WNHIP unpubl. Data

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White Pine - Red Oak Forest

***Pinus strobus* - *(Pinus resinosa)* - *Quercus rubra* Forest**
Eastern White Pine - (Red Pine) - Northern Red Oak Forest
Identifier: CEGL002480

NVC CLASSIFICATION

Division	Eastern North American Cool Temperate Forest (1.C.2.Na)
Macrogroup	Northern & Eastern Pine - Oak Forest & Barrens (M159)
Group	Great Lakes Pine - Oak Forest & Woodland (G025)
Association (Common name)	White Pine - Red Oak Forest

ELEMENT CONCEPT

Global Summary: This white pine - oak forest occurs in the central Great Lakes region of the United States and Canada, where it occurs on dry to dry-mesic sites with well-drained sandy loams or coarser soils, typically on morainal slopes. *Pinus strobus* (eastern white pine) is the dominant component of the overstory, often forming a supercanopy above the hardwood canopy. *Quercus rubra* (northern red oak) is an important canopy species, along with *Acer saccharum* (sugar maple), and *Quercus alba* (white oak) in central Minnesota, and, farther eastward, *Fraxinus americana* (white ash), *Quercus velutina* (black oak), and occasional *Fagus grandifolia* (American beech). Northern stands may contain *Acer rubrum* (red maple), *Betula papyrifera* (paper birch), *Pinus resinosa* (red pine), *Pinus strobus* (eastern white pine), *Populus grandidentata* (bigtooth aspen), and *Populus tremuloides* (quaking aspen), along with *Abies balsamea* (balsam fir) in the understory. The shrub and vine layer in the southern part of the range contains *Cornus foemina* (stiff dogwood), *Corylus americana* (American hazelnut), *Parthenocissus quinquefolia* (Virginia creeper), and *Vaccinium angustifolium* (lowbush blueberry), and, farther north, *Corylus cornuta* (beaked hazelnut), *Diervilla lonicera* (northern bush honeysuckle), *Gaultheria procumbens* (eastern teaberry), *Vaccinium angustifolium* (lowbush blueberry), and *Viburnum acerifolium* (mapleleaf viburnum). Typical herbs in the southern part of the range include *Amphicarpaea bracteata* (American hogpeanut), *Aralia nudicaulis* (wild sarsaparilla), *Carex pensylvanica* (Pennsylvania sedge), and *Geranium maculatum* (spotted geranium); farther north, they include *Eurybia macrophylla* (bigleaf aster), *Maianthemum canadense* (Canada mayflower), *Oryzopsis asperifolia* (roughleaf ricegrass), *Polygala paucifolia* (gaywings), *Polygonatum pubescens* (hairy Solomon's seal), *Pteridium aquilinum* (western brackenfern), and *Trientalis borealis* (starflower). Mosses include *Ptilidium pulcherrimum*.

ENVIRONMENTAL DESCRIPTION

Saint Croix National Scenic Riverway Environment: This white pine - oak forest was sampled at 13 locations in the park. Sites range from flat to somewhat steep hill slopes with mostly easterly aspects. The soil of one sampled plot is well-drained sandy loam; no other soil information was provided. The unvegetated surface (one sampled plot) is dominated by leaf litter (89% cover) with some large rocks (1%), wood (2%), bare soil (1%), and dead plant stems (7%). Evidence of disturbance includes trails, past logging, wind damage, and the presence of exotic plants.
Global Environment: Sites are found on dry-mesic to mesic sites with well-drained sandy loams or coarser soils, typically on morainal slopes and ridges.

VEGETATION DESCRIPTION

Saint Croix National Scenic Riverway Vegetation: Strata height or cover data were provided for three of the sampled plots. The sparse to dense (30-80% cover) tree canopy, 15-35 m tall, and sparse to dense (10-80%) subcanopy (5-20 m) are dominated by *Pinus strobus* (eastern white pine); additional tree species may include *Acer rubrum* (red maple), *Acer saccharum* (sugar maple), *Betula papyrifera* (paper birch), *Carpinus caroliniana* (American hornbeam), *Fraxinus americana* (white ash), *Ostrya virginiana* (hophornbeam), *Populus grandidentata* (bigtooth aspen), *Populus tremuloides* (quaking aspen), *Quercus rubra* (northern red oak), and *Tilia americana* (American basswood). The sparse (5-30%) shrub layer (1-5 m) includes *Acer rubrum* (red maple), *Acer saccharum* (sugar maple), *Corylus cornuta* (beaked hazelnut), *Ostrya virginiana* (hophornbeam), *Prunus virginiana* (chokecherry), and *Zanthoxylum americanum* (common pricklyash). The very sparse to moderate (5-60%) herbaceous layer contains *Amphicarpaea bracteata* (American hogpeanut), *Aralia racemosa* (American spikenard), *Asarum canadense* (Canadian wildginger), *Athyrium filix-femina* (common ladyfern), *Carex pensylvanica* (Pennsylvania sedge), *Carex sprengelii* (Sprengel's sedge), *Dryopteris carthusiana* (spinulose woodfern), *Equisetum scirpoides* (dwarf scouringrush), *Eurybia macrophylla* (bigleaf aster), *Galium aparine* (stickywilly), *Gymnocarpium dryopteris* (western oakfern), *Oryzopsis asperifolia* (roughleaf ricegrass), *Osmunda cinnamomea* (cinnamon fern), and *Osmunda claytoniana* (interrupted fern). In addition, this community may support Minnesota state-vulnerable *Panax quinquefolius* (American ginseng) and Wisconsin state-critically imperiled *Carex backii* (Back's sedge).
Global Vegetation: *Pinus strobus* (eastern white pine) is the dominant component of the overstory, often forming a supercanopy above the hardwood canopy. *Quercus rubra* (northern red oak) is an important canopy species, along with *Acer saccharum* (sugar maple) and *Quercus alba* (white oak) in central Minnesota, and, farther eastward, *Fraxinus americana* (white ash), *Quercus velutina* (black oak), and occasional *Fagus grandifolia* (American beech). Northern stands may contain *Acer rubrum* (red maple), *Betula papyrifera* (paper birch), *Pinus resinosa* (red pine), *Pinus strobus* (eastern white pine), *Populus grandidentata* (bigtooth aspen), and *Populus tremuloides* (quaking aspen), along with *Abies balsamea* (balsam fir) in the understory. The shrub and vine layer in the southern part of the range contains *Cornus foemina* (stiff dogwood), *Corylus americana* (American hazelnut), *Parthenocissus quinquefolia* (Virginia creeper), and *Vaccinium angustifolium* (lowbush blueberry), and, farther north, *Corylus cornuta* (beaked hazelnut), *Diervilla lonicera* (northern bush honeysuckle), *Gaultheria procumbens* (eastern teaberry), *Vaccinium angustifolium*

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(lowbush blueberry), and *Viburnum acerifolium* (mapleleaf viburnum). Typical herbs in the southern part of the range include *Amphicarpaea bracteata* (American hogpeanut), *Aralia nudicaulis* (wild sarsaparilla), *Carex pensylvanica* (Pennsylvania sedge), and *Geranium maculatum* (spotted geranium); farther north, they include *Eurybia macrophylla* (bigleaf aster), *Maianthemum canadense* (Canada mayflower), *Oryzopsis asperifolia* (roughleaf ricegrass), *Polygala paucifolia* (gaywings), *Polygonatum pubescens* (hairy Solomon's seal), *Pteridium aquilinum* (western brackenfern), and *Trientalis borealis* (starflower). Mosses include *Ptilidium pulcherrimum*, among others (Eyre 1980, MNNHP 1993, Chambers et al. 1997).

MOST ABUNDANT SPECIES

Saint Croix National Scenic Riverway

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Pinus strobus* (eastern white pine)
Tree canopy	Broad-leaved deciduous tree	*Acer rubrum* (red maple), *Acer saccharum* (sugar maple), *Populus grandidentata* (bigtooth aspen), *Populus tremuloides* (quaking aspen), *Quercus rubra* (northern red oak), *Tilia americana* (American basswood)
Tree subcanopy	Broad-leaved deciduous tree	*Ostrya virginiana* (hophornbeam)
Short shrub/sapling	Broad-leaved deciduous shrub	*Corylus cornuta* (beaked hazelnut)
Herb (field)	Forb	*Eurybia macrophylla* (bigleaf aster)
Herb (field)	Graminoid	*Carex pensylvanica* (Pennsylvania sedge)
Herb (field)	Fern or fern ally	*Gymnocarpium dryopteris* (western oakfern), *Osmunda claytoniana* (interrupted fern)

CHARACTERISTIC SPECIES

Saint Croix National Scenic Riverway: *Acer rubrum* (red maple), *Acer saccharum* (sugar maple), *Carex pensylvanica* (Pennsylvania sedge), *Corylus cornuta* (beaked hazelnut), *Eurybia macrophylla* (bigleaf aster), *Gymnocarpium dryopteris* (western oakfern), *Osmunda claytoniana* (interrupted fern), *Ostrya virginiana* (hophornbeam), *Pinus strobus* (eastern white pine), *Populus grandidentata* (bigtooth aspen), *Populus tremuloides* (quaking aspen), *Quercus rubra* (northern red oak), *Tilia americana* (American basswood)

OTHER NOTEWORTHY SPECIES

Saint Croix National Scenic Riverway: Vulnerable: *Carex backii* (Back's sedge, WI state-critically imperiled, G4), *Panax quinquefolius* (American ginseng, MN state-vulnerable, G3G4); **Exotic/Invasive**: *Galeopsis tetrahit* (brittlestem hempnettle, invasive/exotic), *Glechoma hederacea* (ground ivy, invasive/exotic, Low), *Rhamnus cathartica* (common buckthorn, invasive/exotic, High/Medium), *Taraxacum officinale* (common dandelion, invasive/exotic), *Urtica dioica* (stinging nettle, invasive/exotic)
Global: Vulnerable: *Panax quinquefolius* (American ginseng, collection pressure, G3G4)

CONSERVATION STATUS RANK

Global Rank & Reasons: G4 (13-Nov-2006). This association occurs in the Great Lake states region of the U.S. and in Ontario, Canada. More than 50 EOs are known from the U.S. portion of the range, and more are expected in Ontario. Currently the majority of reported EOs are ranked either A or B. Further review is needed of current assignment of EORANK to EOs of this type. Many stands are relatively large in size and total acreage well exceeds 10,000 acres. Both oaks and white pine have been extensively logged and cleared for agriculture throughout the range of this type. Although a number of EOs are in protected areas, little is known about the degree to which management is focused on the maintenance of this association. The type is dependent on fire disturbances and relatively dry substrates, and is dominated by oaks and white pine that are fairly resilient to both natural and anthropogenic disturbances.

CLASSIFICATION

Status: Standard
Classification Confidence: 2 - Moderate
Global Comments: Distinction between this type and *Pinus strobus - Quercus alba / (Corylus americana*, *Gaylussacia baccata)* Forest (CEGL002481), which is found on sands, needs clarification. Compare also with *Pinus strobus - Quercus (rubra*, *velutina) - Fagus grandifolia* Forest (CEGL006293) in the East. Type may have a boreal variant (see Voyageurs NP and descriptions from central Ontario (Chambers et al. 1997). If Minnesota White Pine-Hardwood Forest (especially north-central subtype) is primarily a sandplain type, all of it should be placed with CEGL002481. In Wisconsin, this type grades into the pure evergreen white pine type, *Pinus strobus / Acer spicatum - Corylus cornuta* Forest (CEGL002445).
Global Similar Associations:

- *Pinus strobus - Populus tremuloides / Corylus cornuta* Forest (CEGL002479)
- *Pinus strobus - Quercus (rubra, velutina) - Fagus grandifolia* Forest (CEGL006293) Eastern region version of same type?
- *Pinus strobus - Quercus alba / (Corylus americana, Gaylussacia baccata)* Forest (CEGL002481) This is a sandplain type in the sandplains of central MN, WI, and MI.
- *Pinus strobus / Acer spicatum - Corylus cornuta* Forest (CEGL002445)
- *Quercus rubra - Quercus alba - (Quercus velutina, Acer rubrum) / Viburnum acerifolium* Forest (CEGL002462)

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Global Related Concepts:

- Dry-Mesic Northern Forest - White Pine (Red Pine)-Oak (Chapman et al. 1989) =
- Northern Dry-Mesic Forest White Pine-Red Oak Subtype (Faber-Langendoen 2001) =
- White Pine - Hardwood Forest (North-Central Section) (MNNHP 1993) <
- White Pine - Hardwood Forest (Southeast Section) Mesic Subtype (MNNHP 1993) <
- White Pine - Northern Red Oak - Red Maple: 20 (Eyre 1980) =
- White Pine-White Birch-Red Oak-Largetooth Aspen-Bracken Fern (Chambers et al. 1997) =

ELEMENT DISTRIBUTION

Global Range: This white pine - oak forest community occurs in the central Great Lakes region of the United States and Canada, where it occurs on dry to dry-mesic sites. Stands range from Minnesota east to Michigan and Ontario.
Nations: CA, US
States/Provinces: MI:S3, MN, ON, QC:S4?, WI:S3
TNC Ecoregions: 46:C, 47:C, 48:C, 64:C
USFS Ecoregions (1994/95): 212Eb:CCC, 212Hb:CCP, 212He:CCC, 212Hi:CCC, 212Hj:CCC, 212Hl:CCC, 212Hm:CCP, 212Ho:CCC, 212Hp:CCP, 212Hq:CCP, 212Hr:CCP, 212Ht:CCP, 212Hu:CCP, 212Hv:CCC, 212Hw:CCC, 212Ja:CCP, 212Jb:CCC, 212Jc:CCP, 212Jf:CCP, 212Jj:CCP, 212Jl:CCP, 212Jm:CCC, 212Jn:CCP, 212Jr:CCC, 212Ka:CCP, 212Kb:CCC, 212Mb:CPP, 212Na:CPP, 212Nb:CPP, 212Nc:CPP, 212Oa:CCC, 212Oc:CCC, 222Jd:CCC, 222Je:CCC, 222Jg:CCC, 222Lc:CCC, 222Lf:CCC, 222Mc:CCC, 222Md:CCC
Federal Lands: NPS (Pictured Rocks, Saint Croix, Sleeping Bear Dunes); USFS (Chequamegon, Chequamegon-Nicolet, Chippewa, Huron, Huron-Manistee, Manistee, Nicolet, Ottawa)

ELEMENT SOURCES

Saint Croix National Scenic Riverway Map Code: FPO
Saint Croix National Scenic Riverway Plots: SACN.9, SACN.20, SACN.42, SACN.61, SACN.0086, SACN.0347, SACN.0490, SACN.3521, SACN.3534, SACN.4746, SACN.6447, SACN.8324, SACN.8327, SACN.8328.
Local Description Authors: M.J. Russo
Global Description Authors: D. Faber-Langendoen
References: Chambers et al. 1997, Chapman et al. 1989, Eyre 1980, Faber-Langendoen 2001, Farrand and Bell 1982, Hop et al. 2010c, MNNHP 1993, Midwestern Ecology Working Group n.d., WNHIP unpubl. data

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White Pine - Aspen - Birch Forest

***Pinus strobus - Populus tremuloides / Corylus cornuta* Forest**
Eastern White Pine - Quaking Aspen / Beaked Hazelnut Forest
Identifier: CEGL002479

NVC CLASSIFICATION

Division	Eastern North American Cool Temperate Forest (1.C.2.Na)
Macrogroup	Northern & Eastern Pine - Oak Forest & Barrens (M159)
Group	Great Lakes Pine - Oak Forest & Woodland (G025)
Association (Common name)	White Pine - Aspen - Birch Forest

ELEMENT CONCEPT

Global Summary: This white pine - hardwood forest is found in the Great Lakes region of the United States and Canada. Stands are found on a variety of slope positions on deep (>60 cm), dry-mesic to mesic, rapidly drained soils, with fine sandy to loamy soil textures. The tree canopy is mixed evergreen-deciduous. *Pinus strobus* (eastern white pine) may form a supercanopy over a mixture of other species, including *Betula papyrifera* (paper birch), *Populus tremuloides* (quaking aspen), *Picea glauca* (white spruce), and *Abies balsamea* (balsam fir). Less frequent are *Pinus resinosa* (red pine), *Populus grandidentata* (bigtooth aspen), and *Thuja occidentalis* (northern white-cedar). The subcanopy can include *Acer rubrum* (red maple) and *Acer saccharum* (sugar maple), as well as a mixture of canopy species. Tall shrubs and saplings include *Abies balsamea* (balsam fir), *Acer spicatum* (mountain maple), *Amelanchier* (serviceberry) spp. and *Corylus cornuta* (beaked hazelnut). Short shrubs include *Diervilla lonicera* (northern bush honeysuckle), *Linnaea borealis* (twinflower), *Lonicera canadensis* (American fly honeysuckle), and *Vaccinium myrtilloides* (velvetleaf huckleberry). *Viburnum nudum* var. *cassinoides* (withe-rod) may be present in the eastern part of the range. Herbs include *Aralia nudicaulis* (wild sarsaparilla), *Eurybia macrophylla* (bigleaf aster), *Clintonia borealis* (bluebead), *Cornus canadensis* (bunchberry dogwood), *Maianthemum canadense* (Canada mayflower), *Oryzopsis asperifolia* (roughleaf ricegrass), *Pteridium aquilinum* (western brackenfern), *Streptopus lanceolatus* var. *longipes* (twistedstalk), and *Trientalis borealis* (starflower). Typical mosses include *Pleurozium schreberi* (Schreber's big red stem moss), *Dicranum polysetum* (dicranum moss) and *Dicranum flagellare* (dicranum moss).

ENVIRONMENTAL DESCRIPTION

Saint Croix National Scenic Riverway Environment: This white pine - hardwood forest was sampled at seven locations in the park. Sites are on gently sloping upland flats with variable aspects. Soils are well-drained loamy sand and sandy loam. The unvegetated surface is dominated by leaf litter (88-96% cover) with some large rocks (0-5%), wood (1-8%), bare soil (0-1%) and dead plant stems (2-4%). Evidence of disturbance includes trails, downed wood, past logging fire, tip-up mounds, and the presence of trash and exotic plants.

Global Environment: Stands are found on a variety of slope positions on deep (>60 cm), dry-mesic to mesic, rapidly drained soils, with fine sandy to loamy soil textures (Sims et al. 1989, MNNHP 1993, Chambers et al. 1997).

VEGETATION DESCRIPTION

Saint Croix National Scenic Riverway Vegetation: The moderate (40-60% cover) tree canopy, 10-35 m tall, and subcanopy (10-15 m), when present (0-40%), are dominated by *Pinus strobus* (eastern white pine). Additional tree species may include *Acer rubrum* (red maple), *Betula papyrifera* (paper birch), *Picea glauca* (white spruce), *Pinus resinosa* (red pine), *Populus tremuloides* (quaking aspen), and *Quercus rubra* (northern red oak). The very sparse to moderate (5-60%) tall-shrub layer (2-5 m) and sparse (10-40%) short-shrub layer (0.5-1 m) include *Acer spicatum* (mountain maple), *Amelanchier sanguinea* (roundleaf serviceberry), *Corylus americana* (American hazelnut), *Corylus cornuta* (beaked hazelnut), *Fraxinus nigra* (black ash), *Ilex verticillata* (common winterberry), *Pinus strobus* (eastern white pine), *Prunus serotina* (black cherry), and *Rubus* (blackberry) sp. The moderate to dense (40-80%) herbaceous layer is dominated by *Eurybia macrophylla* (bigleaf aster) and may include *Amphicarpaea bracteata* (American hogpeanut), *Aralia nudicaulis* (wild sarsaparilla), *Carex pensylvanica* (Pennsylvania sedge), *Luzula acuminata* (hairy woodrush), *Osmorhiza claytonii* (Clayton's sweetroot), and *Pteridium aquilinum* (western brackenfern). In addition, this community may support Minnesota and Wisconsin state-vulnerable *Juglans cinerea* (butternut).

Global Vegetation: The tree canopy is mixed evergreen-deciduous. *Pinus strobus* (eastern white pine) may form a supercanopy over a mixture of other species, including *Betula papyrifera* (paper birch), *Populus tremuloides* (quaking aspen), *Picea glauca* (white spruce), and *Abies balsamea* (balsam fir). Less frequent are *Pinus resinosa* (red pine), *Populus grandidentata* (bigtooth aspen), and *Thuja occidentalis* (northern white-cedar). The subcanopy can include *Acer rubrum* (red maple) and *Acer saccharum* (sugar maple), as well as a mixture of canopy species. Tall shrubs and saplings include *Abies balsamea* (balsam fir), *Acer spicatum* (mountain maple), *Amelanchier* (serviceberry) spp., and *Corylus cornuta* (beaked hazelnut). Short shrubs include *Diervilla lonicera* (northern bush honeysuckle), *Linnaea borealis* (twinflower), *Lonicera canadensis* (American fly honeysuckle), and *Vaccinium myrtilloides* (velvetleaf huckleberry). *Viburnum nudum* var. *cassinoides* (withe-rod) may be present in the eastern part of the range. Herbs include *Aralia nudicaulis* (wild sarsaparilla), *Eurybia macrophylla* (bigleaf aster), *Clintonia borealis* (bluebead), *Cornus canadensis* (bunchberry dogwood), *Maianthemum canadense* (Canada mayflower), *Oryzopsis asperifolia* (roughleaf ricegrass), *Pteridium aquilinum* (western brackenfern), *Streptopus lanceolatus* (twistedstalk), and *Trientalis borealis* (starflower). Typical mosses include *Pleurozium schreberi* (Schreber's big red stem moss), *Dicranum polysetum* (dicranum moss) and *Dicranum flagellare* (dicranum moss) (Sims et al. 1989, MNNHP 1993, Chambers et al. 1997).

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MOST ABUNDANT SPECIES

Saint Croix National Scenic Riverway

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Pinus strobus* (eastern white pine)
Shrub/sapling (tall & short)	Needle-leaved shrub	*Pinus strobus* (eastern white pine)
Tall shrub/sapling	Broad-leaved deciduous shrub	*Corylus cornuta* (beaked hazelnut)
Short shrub/sapling	Broad-leaved deciduous shrub	*Prunus serotina* (black cherry)
Herb (field)	Forb	*Eurybia macrophylla* (bigleaf aster)

CHARACTERISTIC SPECIES

Saint Croix National Scenic Riverway: *Corylus cornuta* (beaked hazelnut), *Eurybia macrophylla* (bigleaf aster), *Pinus strobus* (eastern white pine), *Prunus serotina* (black cherry)

OTHER NOTEWORTHY SPECIES

Saint Croix National Scenic Riverway: Vulnerable: *Juglans cinerea* (butternut, MN & WI state-vulnerable, G4); **Exotic/Invasive**: *Cerastium fontanum* ssp. *vulgare* (big chickweed, invasive/exotic), *Glechoma hederacea* (ground ivy, invasive/exotic, Low), *Hieracium aurantiacum* (orange hawkweed, invasive/exotic, Medium/Low), *Lonicera tatarica* (Tatarian honeysuckle, invasive/exotic, High/Medium), *Poa pratensis* (Kentucky bluegrass, invasive/exotic, Medium), *Rosa rugosa* (rugosa rose, invasive/exotic, Low)

CONSERVATION STATUS RANK

Global Rank & Reasons: G4? (3-Oct-1996).

CLASSIFICATION

Status: Standard

Classification Confidence: 2 - Moderate

Global Comments: In Wisconsin and Michigan this type can originate as a result of forestry management and natural examples may be rare. In Wisconsin, this type did apparently occur prior to European settlement, but was more variable than what is described here (E. Epstein pers. comm. 1999). An aspen-birch-white pine type has also been recognized by Grigal and Ohmann (1975) [see also Heinselman (1996)], which consists of two subtypes, stands currently with a white pine overstory, and stands formerly with white pine but currently dominated by aspen-birch because of past logging and fire. Thus this type may be a relatively trivial split between pure evergreen white pine forest and pure deciduous aspen-birch types.

Global Similar Associations:

- *Picea glauca - Abies balsamea / Acer spicatum / Rubus pubescens* Forest (CEGL002446)
- *Pinus resinosa / Vaccinium* spp. Forest (CEGL002443)
- *Pinus strobus - (Pinus resinosa) - Quercus rubra* Forest (CEGL002480)
- *Pinus strobus / Acer spicatum - Corylus cornuta* Forest (CEGL002445) This is essentially the mainly evergreen equivalent.
- *Populus tremuloides - Betula papyrifera - (Acer rubrum, Populus grandidentata)* Forest (CEGL002467)

Global Related Concepts:

- Dry-Mesic Northern Forest - Red Pine-White Pine (Chapman et al. 1989) >
- Northern Dry-Mesic Forest White Pine-Aspen Subtype (Faber-Langendoen 2001) =
- Northern Hardwood - Conifer Forest (Northern Section) (MNNHP 1993) =
- White Birch-White Pine-Trembling Aspen-Beaked Hazel-Mountain Maple (V23) (Chambers et al. 1997) =
- White Pine Mixedwood (Sims et al. 1989) =

ELEMENT DISTRIBUTION

Global Range: This white pine - hardwood forest community type is found in the Great Lakes region of the United States and Canada.

Nations: CA, US

States/Provinces: MI, MN:S3, ON, QC, WI:S4S5

TNC Ecoregions: 47:C, 48:C

USFS Ecoregions (1994/95): 212Ha:CCP, 212Hb:CCP, 212He:CCP, 212Hh:CCP, 212Hi:CCC, 212Hj:CCP, 212Hk:CCP, 212Hl:CCP, 212Hm:CCP, 212Hn:CCP, 212Ho:CCC, 212Hp:CCP, 212Hq:CCP, 212Hr:CCC, 212Hs:CCP, 212Ht:CCP, 212Hu:CCP, 212Hv:CCP, 212Hw:CCC, 212Hx:CC?, 212Hy:CCP, 212Ia:CCC, 212Ja:CPP, 212Jb:CPP, 212Jc:CPP, 212Jk:CPP, 212Jl:CPP, 212Jn:CPP, 212Jo:CPP, 212Jr:CPP, 212La:CCC, 212Lb:CCC, 212Lc:CCP, 212Ld:CCP, 212Mb:CPP, 212Na:CPP, 212Nb:CPP, 212Nc:CPP

Federal Lands: NPS (Apostle Islands, Isle Royale, Pictured Rocks, Saint Croix, Sleeping Bear Dunes, Voyageurs); USFS (Chippewa, Huron, Huron-Manistee, Manistee?, Ottawa, Superior?)

ELEMENT SOURCES

Saint Croix National Scenic Riverway Map Code: FWA

Saint Croix National Scenic Riverway Plots: SACN.212, SACN.221, SACN.226, SACN.235, SACN.263, SACN.5132, SACN.7505.

Local Description Authors: M.J. Russo

Global Description Authors: D. Faber-Langendoen

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References: Chambers et al. 1997, Chapman et al. 1989, Faber-Langendoen 2001, Grigal and Ohmann 1975, Heinselman 1996, Hop et al. 2010a, Hop et al. 2010c, MNNHP 1993, Midwestern Ecology Working Group n.d., Sims et al. 1989, TNC 1999b, WNHIP unpubl. data

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White Pine / Mountain Maple Mesic Forest

***Pinus strobus / Acer spicatum - Corylus cornuta* Forest**
Eastern White Pine / Mountain Maple - Beaked Hazelnut Forest
Identifier: CEGL002445

NVC CLASSIFICATION

Division	Eastern North American Cool Temperate Forest (1.C.2.Na)
Macrogroup	Northern & Eastern Pine - Oak Forest & Barrens (M159)
Group	Great Lakes Pine - Oak Forest & Woodland (G025)
Association (Common name)	White Pine / Mountain Maple Mesic Forest

ELEMENT CONCEPT

Global Summary: This white pine forest type is found in the northern parts of the midwestern United States and in adjacent parts of Canada. Stands occur on moderately deep to deep (>60 cm) sandy or gravelly loam soil. The canopy is dominated by *Pinus strobus* (eastern white pine), often mixed with *Pinus resinosa* (red pine). The lower layer of the canopy consists mainly of *Abies balsamea* (balsam fir) trees and saplings. Other trees that may be found in this layer include *Acer rubrum* (red maple), *Betula papyrifera* (paper birch), *Betula alleghaniensis* (yellow birch), *Picea glauca* (white spruce), and *Thuja occidentalis* (northern white-cedar). The tall-shrub/sapling layer is moderately to well-developed and consists of *Abies balsamea* (balsam fir), *Acer spicatum* (mountain maple), *Corylus cornuta* (beaked hazelnut), and, less frequently, *Amelanchier* (serviceberry) spp. The low-shrub layer is not well-developed and is dominated by *Diervilla lonicera* (northern bush honeysuckle), *Linnaea borealis* (twinflower), *Vaccinium myrtilloides* (velvetleaf huckleberry) and *Vaccinium angustifolium* (lowbush blueberry). The herb stratum is often sparse. Prevalent herbs include *Aralia nudicaulis* (wild sarsaparilla), *Eurybia macrophylla* (bigleaf aster), *Cornus canadensis* (bunchberry dogwood), *Maianthemum canadense* (Canada mayflower), *Polypodium virginianum* (rock polypody), and *Pteridium aquilinum* (western brackenfern). Moss species include *Dicranum polysetum* (dicranum moss) and *Pleurozium schreberi* (Schreber's big red stem moss). The forest floor is generally characterized by a deep layer of pine needle litter. Diagnostic features include dominance by *Pinus strobus* (eastern white pine), a well-developed tall-shrub layer with *Acer spicatum* (mountain maple) and *Corylus cornuta* (beaked hazelnut), and a sparse herb layer.

ENVIRONMENTAL DESCRIPTION

Global Environment: This community is found on Precambrian Shield bedrock, overlaid with sandy loam soils that are moderately well-drained and deep (>60 cm). In northeastern Minnesota it occurs on northeast- and south-facing slopes, that are moderate to steep (slope ranges between 4-45%) (Ohmann and Ream 1971). The climate is highly variable, with temperature extremes between -46.7 degrees C and 38.7 degrees C and 58-91 cm precipitation.

VEGETATION DESCRIPTION

Global Vegetation: This community is dominated by *Pinus strobus* (eastern white pine). It is often distinguished by a supercanopy of large, old *Pinus strobus* (eastern white pine) and scattered *Pinus resinosa* (red pine). The lower layer of the canopy consists mainly of *Abies balsamea* (balsam fir) trees and saplings (Ohmann and Ream 1971). Other trees that may be found in this layer include *Betula alleghaniensis* (yellow birch), *Picea glauca* (white spruce), *Thuja occidentalis* (northern white-cedar), *Acer rubrum* (red maple), *Acer spicatum* (mountain maple), and other trees common to boreal forest landscapes. The tall-shrub layer is moderately to well-developed and consists of *Abies balsamea* (balsam fir), *Acer spicatum* (mountain maple), *Corylus cornuta* (beaked hazelnut), and, less frequently, *Amelanchier* (serviceberry) spp. (Ohmann and Ream 1971, Sims et al. 1989). The low-shrub layer is not well-developed and dominated by *Diervilla lonicera* (northern bush honeysuckle), *Linnaea borealis* (twinflower), *Vaccinium myrtilloides* (velvetleaf huckleberry), and *Vaccinium angustifolium* (lowbush blueberry). The herb stratum is also not well-developed. The deep layer of undecomposed needles that formed the mor humus are not conducive to herb growth (Martin 1959a). Prevalent herbs include *Aralia nudicaulis* (wild sarsaparilla), *Eurybia macrophylla* (bigleaf aster), *Cornus canadensis* (bunchberry dogwood), *Maianthemum canadense* (Canada mayflower), *Polypodium virginianum* (rock polypody), and *Pteridium aquilinum* (western brackenfern). Moss species include *Dicranum polysetum* (dicranum moss) and *Pleurozium schreberi* (Schreber's big red stem moss).

MOST ABUNDANT SPECIES

Global Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Abies balsamea* (balsam fir), *Pinus strobus* (eastern white pine)
Tree subcanopy	Needle-leaved tree	*Abies balsamea* (balsam fir), *Pinus strobus* (eastern white pine)
Tall shrub/sapling	Broad-leaved deciduous tree	*Acer spicatum* (mountain maple)
Tall shrub/sapling	Broad-leaved deciduous shrub	*Corylus cornuta* (beaked hazelnut), *Diervilla lonicera* (northern bush honeysuckle)
Short shrub/sapling	Dwarf-shrub	*Vaccinium angustifolium* (lowbush blueberry), *Vaccinium myrtilloides* (velvetleaf huckleberry)
Herb (field)	Forb	*Eurybia macrophylla* (bigleaf aster)

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CHARACTERISTIC SPECIES

Global: *Abies balsamea* (balsam fir), *Diervilla lonicera* (northern bush honeysuckle), *Eurybia macrophylla* (bigleaf aster), *Pinus strobus* (eastern white pine)

CONSERVATION STATUS RANK

Global Rank & Reasons: G3G4 (22-Jun-1998). There are fewer than 100 occurrences of this community rangewide, but Ontario ranks are unknown. Currently there are 45 occurrences documented from Minnesota (where it is ranked S3), Michigan (S?), and Wisconsin (S?); it is also reported from Ontario (S?). There are probably fewer than 10,000 acres of this community rangewide. Currently 2075 acres have been documented from 32 occurrences in Minnesota, Michigan, and Wisconsin. Many stands are reported to be of post-fire origin; infrequent catastrophic fires may be important for maintenance of this community. Many, perhaps, most sites have been degraded by logging. Some sites may be disturbed by fire suppression, and they may be succeeding to other forest types.

CLASSIFICATION

Status: Standard
Classification Confidence: 1 - Strong
Global Comments: The type allows for *Pinus strobus* (eastern white pine)-dominated stands or mixed *Pinus strobus* (eastern white pine)-conifers, including *Pinus resinosa* (red pine). The type concept is not well-developed in Wisconsin, where it complexes with *Pinus strobus - (Pinus resinosa) - Quercus rubra* Forest (CEGL002480). The limits of the type farther eastward, where it overlaps with *Pinus strobus - Pinus resinosa / Cornus canadensis* Forest (CEGL006253), are also not clear. In some stands *Juniperus communis* (common juniper) may be present.
Global Similar Associations:
- *Pinus resinosa / Vaccinium* spp. Forest (CEGL002443)
- *Pinus strobus - (Pinus resinosa) - Quercus rubra* Forest (CEGL002480)
- *Pinus strobus - Pinus resinosa / Cornus canadensis* Forest (CEGL006253) northeastern U.S. version?
- *Pinus strobus - Populus tremuloides / Corylus cornuta* Forest (CEGL002479)
- *Pinus strobus / Vaccinium* spp. Forest (CEGL002444)

Global Related Concepts:
- Northern Dry-Mesic Forest White Pine / Mountain Maple Subtype (Faber-Langendoen 2001) =
- White Pine (Ohmann and Ream 1971) =
- White Pine Conifer (V26) (Sims et al. 1989) =
- White Pine Forest (Northeast Section) (MNNHP 1993) =
- White Pine-Red Pine-Beaked Hazel-Bracken Fern-Bush Honeysuckle (V29) (Chambers et al. 1997) =

ELEMENT DISTRIBUTION

Global Range: This white pine forest type is found in the northern parts of the midwestern United States and in adjacent parts of Canada, ranging from Minnesota and Ontario east to Wisconsin and Michigan.
Nations: CA, US
States/Provinces: MI?, MN:S3, ON, QC, WI
TNC Ecoregions: 47:C, 48:C, 64:C
USFS Ecoregions (1994/95): 212Ea:CCP, 212Eb:CCP, 212Ec:CCC, 212Ha:CCC, 212Ia:CCC, 212Ja:CCP, 212Jb:CCC, 212Jc:CCC, 212Je:CCC, 212Jl:CCC, 212Jm:CCC, 212Ka:CCC, 212La:CCC, 212Lb:CCC, 212Lc:CCC, 212Ld:CC?, 212Ma:CCC, 212Mb:CCC, 212Nb:CCC
Federal Lands: NPS (Apostle Islands, Grand Portage, Saint Croix, Voyageurs); USFS (Chequamegon-Nicolet, Chequamegon?, Nicolet, Superior)

ELEMENT SOURCES

Saint Croix National Scenic Riverway Map Code: FWM
Local Description Authors:
Global Description Authors: D. Faber-Langendoen
References: Chambers et al. 1997, Faber-Langendoen 2001, Frelich 1992, Grigal and Ohmann 1975, Heinselman 1973, Hop et al. 2010a, Hop et al. 2010b, Judziewicz and Koch 1993, MNNHP 1993, Martin 1959a, Midwestern Ecology Working Group n.d., Ohmann and Ream 1971, Sims et al. 1989, WNHIP unpubl. data

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Northern Pin Oak - (Bur Oak) Forest

***Quercus ellipsoidalis - (Quercus macrocarpa)* Forest**
Northern Pin Oak - (Bur Oak) Forest
Identifier: CEGL002077

NVC CLASSIFICATION

Division	Eastern North American Cool Temperate Forest (1.C.2.Na)
Macrogroup	Northern & Eastern Pine - Oak Forest & Barrens (M159)
Group	Great Lakes Pine - Oak Forest & Woodland (G025)
Association (Common name)	Northern Pin Oak - (Bur Oak) Forest

ELEMENT CONCEPT

Global Summary: This northern pin oak - bur oak forest community is found in the upper midwestern United States. Stands are found on sandy, well-drained to excessively well-drained soils. These develop from glacial outwash, glaciofluvial deposits, or alluvial sediments. The soils are relatively infertile and acidic. The tree canopy is moderately closed. In Minnesota, it is typically 70-80%. The more open stands tend to have well-developed shrub layers while closed-canopy stands have fewer shrubs. Some stands, especially those in which fire has been excluded for long periods, can have tree densities up to several hundred trees per hectare. *Quercus ellipsoidalis* (northern pin oak) is the dominant tree species and makes up the great majority of the canopy in most stands. Other common tree species include *Pinus banksiana* (jack pine) (especially in Wisconsin), *Populus tremuloides* (quaking aspen), and sometimes *Acer rubrum* (red maple), *Quercus alba* (white oak), *Quercus rubra* (northern red oak), *Quercus velutina* (black oak), *Quercus macrocarpa* (bur oak), and *Prunus serotina* (black cherry). Shrubs such as *Cornus racemosa* (gray dogwood), *Corylus cornuta* (beaked hazelnut), *Juniperus communis* (common juniper), and *Vaccinium* (blueberry) spp. are typical. The ground layer contains species such as *Amphicarpaea bracteata* (American hogpeanut), Asteraceae spp., *Carex pensylvanica* (Pennsylvania sedge), *Geranium maculatum* (spotted geranium), *Maianthemum racemosum* (feathery false lily of the valley), and *Pteridium aquilinum* (western brackenfern).

ENVIRONMENTAL DESCRIPTION

Saint Croix National Scenic Riverway Environment: This common northern pin oak - bur oak forest was sampled at 16 locations in the park. Sites range from flat uplands to gentle slopes and bluffs. Aspect may be northeast, east, southeast, southwest, or west. Reported soil types are rapidly drained sand and well-drained loamy sand. The unvegetated surface, where reported, is dominated by leaf litter (81-91% cover) with some large rocks (0-2%), small rocks (0-2%), wood (1-4%), bare soil (1-5%) and dead plant stems (6-7%). Evidence of disturbance includes trails, past fire, past logging, some dead standing and fallen trees, and the presence of exotic plants.

Global Environment: Stands are found on sandy, well-drained to excessively well-drained soils. These develop from glacial outwash, glaciofluvial deposits, or alluvial sediments. The soils are relatively infertile and acidic (Eyre 1980). Stands can be found on flat to moderately sloping sites.

VEGETATION DESCRIPTION

Saint Croix National Scenic Riverway Vegetation: Height or cover data were collected for four of the sampled plots. The sparse to dense (40-80% cover) tree canopy, 15-20 m tall, is dominated by *Quercus ellipsoidalis* (northern pin oak) and may include *Acer rubrum* (red maple), *Populus tremuloides* (quaking aspen), *Quercus alba* (white oak), *Quercus macrocarpa* (bur oak), *Ulmus americana* (American elm), and others. The very sparse (5-20%) subcanopy (2-15 m) is made up of canopy species. The very sparse to moderate (5-40%) tall-shrub layer (2-5 m) and very sparse to moderate (5-50%) short-shrub layer (0.5-1 m) may include *Carpinus caroliniana* (American hornbeam), *Cornus sericea* ssp. *sericea* (red-osier dogwood), *Corylus americana* (American hazelnut), *Corylus cornuta* (beaked hazelnut), *Hudsonia tomentosa* (woolly beach-heather), *Ostrya virginiana* (hophornbeam), *Prunus virginiana* (chokecherry), *Sambucus racemosa* var. *racemosa* (red elderberry), and *Vaccinium angustifolium* (lowbush blueberry) (which may form a dwarf-shrub layer). The very sparse to very dense (20-90%) herbaceous layer may be dominated by *Andropogon gerardii* (big bluestem), *Carex pensylvanica* (Pennsylvania sedge), *Eurybia macrophylla* (bigleaf aster), *Osmunda cinnamomea* (cinnamon fern), and/or *Pteridium aquilinum* (western brackenfern); additional species include *Ambrosia psilostachya* (Cuman ragweed), *Amphicarpaea bracteata* (American hogpeanut), *Athyrium filix-femina* (common ladyfern), *Dalea villosa* var. *villosa*, *Desmodium glutinosum* (pointedleaf ticktrefoil), *Fragaria virginiana* (Virginia strawberry), *Hesperostipa spartea* (porcupinegrass), *Impatiens capensis* (jewelweed), *Oryzopsis asperifolia* (roughleaf ricegrass), *Thalictrum dioicum* (early meadowrue), and others. In addition, this community may support Minnesota state-vulnerable *Hudsonia tomentosa* (woolly beach-heather), *Lysimachia quadrifolia* (whorled yellow loosestrife), and *Juglans cinerea* (butternut) (also Wisconsin state-vulnerable).

Global Vegetation: The tree canopy is moderately closed, with typically 70-80% cover (MNNHP 1993). The more open stands tend to have well-developed shrub layers while closed-canopy stands have fewer shrubs. Some stands, especially those in which fire has been excluded for long periods, can have tree densities up to several hundred trees per hectare (Curtis 1959). *Quercus ellipsoidalis* (northern pin oak) is the dominant tree species and comprises the great majority of the canopy in most stands. Other common tree species include *Pinus banksiana* (jack pine) (especially in Wisconsin), *Populus tremuloides* (quaking aspen), and sometimes *Acer rubrum* (red maple), *Quercus rubra* (northern red oak), *Quercus macrocarpa* (bur oak), *Quercus velutina* (black oak), and *Prunus serotina* (black cherry). Shrubs such as *Cornus racemosa* (gray dogwood), *Corylus cornuta* (beaked hazelnut), *Juniperus communis* (common juniper), and *Vaccinium* (blueberry) spp. are typical. The ground layer contains species such as *Amphicarpaea bracteata*

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(American hogpeanut), Asteraceae spp., *Carex pensylvanica* (Pennsylvania sedge), *Geranium maculatum* (spotted geranium), *Maianthemum racemosum* (feathery false lily of the valley), and *Pteridium aquilinum* (western brackenfern).

MOST ABUNDANT SPECIES

Saint Croix National Scenic Riverway

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Quercus ellipsoidalis* (northern pin oak), *Quercus macrocarpa* (bur oak)
Tall shrub/sapling	Broad-leaved deciduous shrub	*Corylus americana* (American hazelnut), *Sambucus racemosa* var. *racemosa* (red elderberry)
Short shrub/sapling	Broad-leaved deciduous shrub	*Ostrya virginiana* (hophornbeam)
Short shrub/sapling	Dwarf-shrub	*Vaccinium angustifolium* (lowbush blueberry)
Herb (field)	Forb	*Eurybia macrophylla* (bigleaf aster)
Herb (field)	Graminoid	*Carex pensylvanica* (Pennsylvania sedge)
Herb (field)	Fern or fern ally	*Osmunda cinnamomea* (cinnamon fern), *Pteridium aquilinum* (western brackenfern)

CHARACTERISTIC SPECIES

Saint Croix National Scenic Riverway: *Carex pensylvanica* (Pennsylvania sedge), *Corylus americana* (American hazelnut), *Eurybia macrophylla* (bigleaf aster), *Osmunda cinnamomea* (cinnamon fern), *Ostrya virginiana* (hophornbeam), *Pteridium aquilinum* (western brackenfern), *Quercus ellipsoidalis* (northern pin oak), *Quercus macrocarpa* (bur oak), *Sambucus racemosa* var. *racemosa* (red elderberry), *Vaccinium angustifolium* (lowbush blueberry)

OTHER NOTEWORTHY SPECIES

Saint Croix National Scenic Riverway: Vulnerable: *Hudsonia tomentosa* (woolly beach-heather, MN state-vulnerable, G5), *Juglans cinerea* (butternut, MN & WI state-vulnerable, G4), *Lysimachia quadrifolia* (whorled yellow loosestrife, MN state-vulnerable, G5); **Exotic/Invasive**: *Arctium minus* (lesser burdock, invasive/exotic, Medium/Insignificant), *Crepis tectorum* (narrowleaf hawksbeard, invasive/exotic), *Lonicera tatarica* (Tatarian honeysuckle, invasive/exotic, High/Medium), *Poa pratensis* (Kentucky bluegrass, invasive/exotic, Medium), *Polygonum convolvulus* (black bindweed, invasive/exotic), *Rhamnus cathartica* (common buckthorn, invasive/exotic, High/Medium), *Urtica dioica* (stinging nettle, invasive/exotic)

CONSERVATION STATUS RANK

Global Rank & Reasons: G4? (3-Oct-1996).

CLASSIFICATION

Status: Standard

Classification Confidence: 2 - Moderate

Global Comments: Stands of this community typically contain at least 50% cover or basal area of *Quercus ellipsoidalis* (northern pin oak). Stands in this association may be similar to stands in the *Quercus velutina - Quercus alba - (Quercus coccinea)* Forest Alliance (A.1911). The type concept in Minnesota was developed by H. Dunevitz (pers. comm. 2000), who considers this type to be absent in subsections 222Lc and 222Lf, where soils are finer, loess-derived and more likely to retain moisture. Stands on drier slopes in these subsections are more likely to resemble dry-mesic stands that are classified as white oak - red oak forests, *Quercus alba - Quercus rubra - Carya ovata* Glaciated Forest (CEGL002068).

Global Similar Associations:

- *Quercus alba - Quercus macrocarpa - Quercus rubra / Corylus americana* Woodland (CEGL002142)
- *Quercus velutina / Carex pensylvanica* Forest (CEGL002078) is dominated by *Quercus velutina*. In Wisconsin, these two species hybridize and traditionally *Quercus velutina* is treated as occurring south of the tension zone and *Quercus ellipsoidalis* north of it. However, this type has also been reported in Iowa, Illinois and Indiana.

Global Related Concepts:

- Northern Dry Forest Northern Pin Oak Subtype (Faber-Langendoen 2001) =
- Northern Pin Oak: 14 (Eyre 1980) >
- Oak Forest (Central Section) Dry Subtype (MNNHP 1993) >

ELEMENT DISTRIBUTION

Global Range: This community, found in the upper midwestern United States, ranging from the northern parts of Indiana, Illinois, and Iowa, north to Minnesota, Wisconsin, and possibly Michigan.

Nations: US

States/Provinces: IA:SU, IN?, MI?, MN, WI:S3

TNC Ecoregions: 35:C, 46:C, 47:C, 48:C

USFS Ecoregions (1994/95): 212Hb:CPP, 212Ia:CCC, 212Ja:CPP, 212Jj:CPP, 212Jm:CPP, 212Ka:CCP, 212Kb:CCC, 212Na:CCP, 212Nb:CC?, 212Nc:CCC, 222Lc:C??, 222Lf:C??, 222Ma:CCC, 222Mc:CCC, 222Md:CCC, 251Ba:CCC

Federal Lands: NPS (Apostle Islands, Saint Croix); USFS (Chequamegon, Chequamegon-Nicolet, Chippewa, Nicolet, Ottawa?)

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ELEMENT SOURCES

Saint Croix National Scenic Riverway Map Code: FPB

Saint Croix National Scenic Riverway Plots: SACN.15, SACN.86, SACN.89, SACN.91, SACN.0368, SACN.0666, SACN.0670, SACN.0674, SACN.0676, SACN.4705, SACN.4730, SACN.4734, SACN.5497, SACN.5518, SACN.6691, SACN.7476.

Local Description Authors: M.J. Russo

Global Description Authors: D. Faber-Langendoen

References: Curtis 1959, Eyre 1980, Faber-Langendoen 2001, Hop et al. 2010a, INAI unpubl. data, MNNHP 1993, Midwestern Ecology Working Group n.d., WNHIP unpubl. data

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G160. Great Lakes Pine Barrens

Jack Pine - Red Pine Barrens

***Pinus banksiana - Pinus resinosa - (Quercus ellipsoidalis) / Carex pensylvanica* Wooded Herbaceous Vegetation**
Jack Pine - Red Pine - (Northern Pin Oak) / Pennsylvania Sedge Wooded Herbaceous Vegetation
Identifier: CEGL005124

NVC CLASSIFICATION

Division	Eastern North American Cool Temperate Forest (1.C.2.Na)
Macrogroup	Northern & Eastern Pine - Oak Forest & Barrens (M159)
Group	Great Lakes Pine Barrens (G160)
Association (Common name)	Jack Pine - Red Pine Barrens

ELEMENT CONCEPT

Global Summary: This pine savanna is found in the western and central Great Lakes region of the United States. Stands occur on dry soils on flat to moderately sloping terrain. It consists of a sparse tree layer within a matrix of herbs and short shrubs. The trees are *Pinus banksiana* (jack pine), *Pinus resinosa* (red pine), and sometimes *Quercus ellipsoidalis* (northern pin oak). The shrub layer is discontinuous. Young *Pinus banksiana* (jack pine) and *Pinus resinosa* (red pine), and grubs of *Quercus ellipsoidalis* (northern pin oak), along with *Vaccinium* (blueberry) spp. and *Corylus americana* (American hazelnut) are common constituents of the shrub layer. *Gaylussacia baccata* (black huckleberry) can be dominant in central Wisconsin stands. The cover by herbaceous plants is often reduced by the number of short shrubs, which may become thick in the absence of fire. *Euphorbia corollata* (flowering spurge), *Andropogon gerardii* (big bluestem), and *Symphyotrichum urophyllum* (white arrowleaf aster) are common herbs in Wisconsin.

ENVIRONMENTAL DESCRIPTION

Saint Croix National Scenic Riverway Environment: This jack pine savanna was sampled at four locations in the park. Sites range from upland flats to gentle, south-, west- and northwest-facing midslopes. Soils are rapidly drained to well-drained sand and loamy sand. The unvegetated surface is dominated by leaf litter (30-96% cover) with some large rocks (0-2%), small rocks (0-20%), wood (0-2%), bare sand (0-25%), bare soil (0-3%), dead plant stems (1-8%), and mosses and lichens (0-20%). Evidence of disturbance includes trails, possible past soil disturbance, and the presence of trash and exotic plants.
Global Environment: This community is found on dry soils on flat to moderately sloping terrain.

VEGETATION DESCRIPTION

Saint Croix National Scenic Riverway Vegetation: The sparse (20-30% cover) highly variable tree canopy, 2-15 m tall, is dominated by *Pinus banksiana* (jack pine) along with a small amount of *Betula papyrifera* (paper birch), as is the very sparse (0-5%) subcanopy layer (2-10 m), when present. The very sparse (5-10%) short-shrub layer (0.5-1 m) may include small amounts of *Cornus racemosa* (gray dogwood), *Cornus sericea* ssp. *sericea* (red-osier dogwood), *Corylus americana* (American hazelnut), *Crataegus punctata* (dotted hawthorn), *Ilex verticillata* (common winterberry), *Lonicera tatarica* (Tatarian honeysuckle), *Ostrya virginiana* (hophornbeam), *Picea glauca* (white spruce), *Pinus banksiana* (jack pine), *Prunus serotina* (black cherry), *Rhus glabra* (smooth sumac), and *Rubus occidentalis* (black raspberry). *Comptonia peregrina* (sweet fern), *Rosa arkansana* (prairie rose), *Rosa blanda* (smooth rose), and/or *Vaccinium angustifolium* (lowbush blueberry) may form a very sparse (10%) dwarf-shrub layer. The very sparse to dense (5-80%) herbaceous layer may be dominated by *Carex pensylvanica* (Pennsylvania sedge), *Festuca trachyphylla* (hard fescue), or *Poa compressa* (Canada bluegrass) (exotic). Additional species include *Andropogon gerardii* (big bluestem), *Carex ovalis* (eggbract sedge), *Schizachyrium scoparium* (little bluestem), and trace amounts of many others. In addition, this community has been heavily invaded by exotic species; a total of 13 exotics were recorded from four sample plots. Nonvascular species (mosses and lichens) cover 10-20% of the ground surface and include *Pleurozium schreberi* (Schreber's big red stem moss).
Global Vegetation: This community consists of a sparse tree layer in a matrix of herbs and short shrubs. The trees are *Pinus banksiana* (jack pine), *Pinus resinosa* (red pine), and sometimes *Quercus ellipsoidalis* (northern pin oak). The shrub layer is discontinuous but includes many species. Young *Pinus banksiana* (jack pine) and *Pinus resinosa* (red pine), and grubs of *Quercus ellipsoidalis* (northern pin oak), along with *Vaccinium* (blueberry) spp. and *Corylus americana* (American hazelnut) are common constituents of the shrub layer. *Gaylussacia baccata* (black huckleberry) can be dominant in central Wisconsin stands (Curtis 1959). The cover by herbaceous plants is often reduced by the number of short shrubs, which may become thick in the absence of fire. *Carex pensylvanica* (Pennsylvania sedge), *Euphorbia corollata* (flowering spurge), and *Symphyotrichum cordifolium* (common blue wood aster) are common herbs in Wisconsin (Curtis 1959, Vogl 1970).

MOST ABUNDANT SPECIES

Saint Croix National Scenic Riverway

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Pinus banksiana* (jack pine)
Herb (field)	Graminoid	*Carex pensylvanica* (Pennsylvania sedge), *Festuca trachyphylla* (hard fescue), *Poa compressa* (Canada bluegrass)
Nonvascular	Moss	*Pleurozium schreberi* (Schreber's big red stem moss)

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Global

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Pinus banksiana* (jack pine), *Pinus resinosa* (red pine)
Short shrub/sapling	Needle-leaved tree	*Pinus banksiana* (jack pine)
Short shrub/sapling	Broad-leaved deciduous tree	*Quercus ellipsoidalis* (northern pin oak)
Short shrub/sapling	Broad-leaved deciduous shrub	*Comptonia peregrina* (sweet fern)
Herb (field)	Forb	*Euphorbia corollata* (flowering spurge), *Symphyotrichum cordifolium* (common blue wood aster)
Herb (field)	Graminoid	*Carex pensylvanica* (Pennsylvania sedge)

CHARACTERISTIC SPECIES

Saint Croix National Scenic Riverway: *Andropogon gerardii* (big bluestem), *Carex pensylvanica* (Pennsylvania sedge), *Comptonia peregrina* (sweet fern), *Festuca trachyphylla* (hard fescue), *Pinus banksiana* (jack pine), *Pleurozium schreberi* (Schreber's big red stem moss), *Poa compressa* (Canada bluegrass), *Rubus occidentalis* (black raspberry), *Vaccinium angustifolium* (lowbush blueberry)

OTHER NOTEWORTHY SPECIES

Saint Croix National Scenic Riverway: Exotic/Invasive: *Berteroa incana* (hoary alyssum, invasive/exotic, Low/Insignificant), *Centaurea biebersteinii* (spotted knapweed, invasive/exotic, High/Medium), *Festuca trachyphylla* (hard fescue, invasive/exotic, Medium/Insignificant), *Hieracium caespitosum* (meadow hawkweed, invasive/exotic, Medium/Insignificant), *Leucanthemum vulgare* (oxeye daisy, invasive/exotic, Medium/Low), *Lonicera tatarica* (Tatarian honeysuckle, invasive/exotic, High/Medium), *Poa compressa* (Canada bluegrass, invasive/exotic, High/Low), *Poa pratensis* (Kentucky bluegrass, invasive/exotic, Medium), *Rumex acetosa* (garden sorrel, invasive/exotic), *Silene vulgaris* (maidenstears, invasive/exotic), *Taraxacum officinale* (common dandelion, invasive/exotic), *Tragopogon dubius* (yellow salsify, invasive/exotic, Medium/Low), *Trifolium hybridum* (alsike clover, invasive/exotic, Medium/Low), *Trifolium pratense* (red clover, invasive/exotic, Low/Insignificant)
Global: Vulnerable: *Callophrys irus* (frosted elfin, a threatened species in Wisconsin, G3), *Dendroica kirtlandii* (kirtland's warbler, Federally listed endangered; globally critically imperiled, G1); **Other**: *Tympanuchus cupido* (greater prairie-chicken, needs large tracts of open areas, as are found in this community, to maintain viable populations, G4), *Tympanuchus phasianellus* (sharp-tailed grouse, eeds large tracts of open areas, as are found in this community, to maintain viable populations, G4)

CONSERVATION STATUS RANK

Global Rank & Reasons: G3G4 (22-Jun-1998). The total number of occurrences is unknown. Eight have been documented: three in Michigan, where the community is ranked S4, and five in Wisconsin (S2).

CLASSIFICATION

Status: Standard
Classification Confidence: 2 - Moderate
Global Comments: Type contains less of a prairie flora than does the related type, *Pinus banksiana - (Quercus ellipsoidalis) / Schizachyrium scoparium* - Prairie Forbs Wooded Herbaceous Vegetation (CEGL002490). Stands at Shaky Lake, Michigan (western Upper Peninsula), may belong to this type.
Global Similar Associations:

- *Pinus banksiana - (Quercus ellipsoidalis) / Schizachyrium scoparium* - Prairie Forbs Wooded Herbaceous Vegetation (CEGL002490) can be very difficult to separate. These two communities can grade into one another in Wisconsin and they share many species. The main diagnostic feature is that CEGL002490 has understory species more typical of dry-mesic and sand prairies, while CEGL005124 has understory species with northern forest affinities as well as having more low, woody shrubs.
- *Pinus banksiana - Pinus resinosa / Quercus ellipsoidalis* Woodland (CEGL002484) can appear similar; can be distinguished by a more closed canopy and somewhat greater cover by woody shrubs. It also tends to appear on better soils.
- *Pinus banksiana / Vaccinium* spp. / *Pleurozium schreberi* Forest (CEGL002441) former stands that have been logged can appear similar. *Pinus* spp. forests that have been logged often come back as *Pinus banksiana* communities, and this can include those with very open physiognomies. These anthropogenic communities have a high proportion of exotics and weedy species in their understory.
- *Pinus resinosa / Vaccinium* spp. Forest (CEGL002443) former stands that have been logged can appear similar. *Pinus* spp. forests that have been logged often come back as *Pinus banksiana* communities, and this can include those with very open physiognomies. These anthropogenic communities have a high proportion of exotics and weedy species in their understory.
- *Pinus strobus - Quercus alba - (Quercus velutina) / Andropogon gerardii* Wooded Herbaceous Vegetation (CEGL005127)
- *Populus tremuloides - Quercus (ellipsoidalis, macrocarpa) / Andropogon gerardii* Shrubland (CEGL002197)

Global Related Concepts:

- Pine Barren (Chapman et al. 1989) >
- Pine Barrens Jack Pine-Oak/Sedge Subtype (Faber-Langendoen 2001) =

ELEMENT DISTRIBUTION

Global Range: This pine savanna is found in the western and central Great Lakes region of the United States, occurring in Wisconsin and Michigan. In Michigan it occurs in both the High Plains of central lower Michigan and in scattered areas of the Upper Peninsula.
Nations: US
States/Provinces: MI, MN?, WI:S2

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TNC Ecoregions: 47:C, 48:C

USFS Ecoregions (1994/95): 212Hb:CPP, 212He:CPP, 212Hk:CPP, 212Hm:CPP, 212Hp:CPP, 212Hq:CPP, 212Hr:CPP, 212Hs:CPP, 212Hu:CPP, 212Hv:CPP, 212Jb:CC?, 212Jc:CCP, 212Jk:CCC, 212Jl:CC?, 212Jm:CCC, 212Jn:CC?, 212Jr:CCP, 212Ka:CCC, 212Ob:CCC

Federal Lands: NPS (Saint Croix); USFS (Chequamegon, Chequamegon-Nicolet, Hiawatha, Huron, Huron-Manistee, Manistee, Nicolet?)

ELEMENT SOURCES

Saint Croix National Scenic Riverway Map Code: Not mapped separately.

Saint Croix National Scenic Riverway Plots: SACN.117, SACN.213, SACN.215, SACN.244.

Local Description Authors: M.J. Russo

Global Description Authors: J. Drake

References: Chapman et al. 1989, Curtis 1959, Faber-Langendoen 2001, Midwestern Ecology Working Group n.d., Vogl 1961, Vogl 1970, Vora 1993, WNHIP unpubl. data, Whitney 1986, Whitney 1987, Zimmerman 1956

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Jack Pine - Red Pine / Scrub Oak Woodland

***Pinus banksiana - Pinus resinosa / Quercus ellipsoidalis* Woodland**
Jack Pine - Red Pine / Northern Pin Oak Woodland
Identifier: CEGL002484

NVC CLASSIFICATION

Division	Eastern North American Cool Temperate Forest (1.C.2.Na)
Macrogroup	Northern & Eastern Pine - Oak Forest & Barrens (M159)
Group	Great Lakes Pine Barrens (G160)
Association (Common name)	Jack Pine - Red Pine / Scrub Oak Woodland

ELEMENT CONCEPT

Global Summary: This pine barrens community type is typically found in the sand plain regions of the upper midwestern United States. Stands are located on outwash plains, on sandy to sandy loam soils. The canopy is open, and dominated by *Pinus banksiana* (jack pine), with large *Pinus resinosa* (red pine) occasionally codominant or forming a supercanopy. *Quercus macrocarpa* (bur oak) and *Quercus ellipsoidalis* (northern pin oak) oak grubs and young *Populus tremuloides* (quaking aspen) may occur in the understory. The shrub layer is tall, dense, and continuous; dominants include *Amelanchier* (serviceberry) spp., *Corylus americana* (American hazelnut), *Salix humilis* (prairie willow), and *Viburnum rafinesquianum* (downy arrow-wood). The herbaceous layer is generally sparse and is composed of dry woodland and prairie species (in parts of the range) capable of persisting in partial shade.

ENVIRONMENTAL DESCRIPTION

Saint Croix National Scenic Riverway Environment: This jack pine / scrub oak woodland was sampled at 10 locations in the park. The sites range from flat uplands to gentle and moderate hill slopes. Soils range from rapidly drained to well-drained sand to moderately well-drained loamy sand. The ground surface is dominated by either leaf litter or mosses with some wood, bare soil, and dead plant stems. Evidence of disturbance includes trails and the presence of exotic plants.
Global Environment: Stands are located on outwash plains, on sandy to sandy loam prairie soils (MNNHP 1993).

VEGETATION DESCRIPTION

Saint Croix National Scenic Riverway Vegetation: The sparse to moderate (30-50% cover) tree canopy, 5-20 m tall, is dominated by *Pinus banksiana* (jack pine), as is the sparse (10-20%) subcanopy (10-15 m), when present. Additional tree species may include *Pinus resinosa* (red pine), *Populus grandidentata* (bigtooth aspen), *Populus tremuloides* (quaking aspen), *Quercus ellipsoidalis* (northern pin oak), *Quercus macrocarpa* (bur oak), and *Quercus rubra* (northern red oak). The very sparse to moderate (5-50%) tall-shrub layer (1-5 m) and very sparse to moderate (10-60%) short-shrub layer (0.5-2 m), when present, is dominated by *Corylus americana* (American hazelnut) and may include *Acer rubrum* (red maple), *Corylus cornuta* (beaked hazelnut), *Diervilla lonicera* (northern bush honeysuckle), *Gaylussacia baccata* (black huckleberry), *Prunus* (plum) spp., and *Rubus* (blackberry) spp. *Vaccinium angustifolium* (lowbush blueberry) may form a sparse (15%) dwarf-shrub layer. The very sparse to moderate (5-40%) herbaceous layer includes *Andropogon gerardii* (big bluestem), *Carex pensylvanica* (Pennsylvania sedge), *Danthonia spicata* (poverty oatgrass), *Oryzopsis asperifolia* (roughleaf ricegrass), *Pteridium aquilinum* (western brackenfern), *Schizachyrium scoparium* (little bluestem), and *Uvularia sessilifolia* (sessileleaf bellwort). Nonvascular species (mosses and lichens) cover 5-80% of the ground surface and may include species of *Dicranum* (dicranum moss), *Lichenochora*, *Sphagnum* (sphagnum), and *Pleurozium schreberi* (Schreber's big red stem moss). In addition, this community may support Wisconsin state-vulnerable *Cypripedium parviflorum* (lesser yellow lady's slipper).
Global Vegetation: The canopy is open and dominated by *Pinus banksiana* (jack pine), with large *Pinus resinosa* (red pine) occasionally codominant or forming a supercanopy. *Quercus macrocarpa* (bur oak) and *Quercus ellipsoidalis* (northern pin oak) oak grubs and young *Populus tremuloides* (quaking aspen) may occur in the understory. The shrub layer is tall, dense, and continuous; dominants include *Amelanchier* (serviceberry) spp., *Corylus americana* (American hazelnut), *Salix humilis* (prairie willow), and *Viburnum rafinesquianum* (downy arrow-wood). The herbaceous layer is generally sparse and is composed of dry woodland and prairie species (in parts of the range) capable of persisting in partial shade (MNNHP 1993).

MOST ABUNDANT SPECIES

Saint Croix National Scenic Riverway

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Pinus banksiana* (jack pine)
Tree canopy	Broad-leaved deciduous tree	*Quercus ellipsoidalis* (northern pin oak)
Tall shrub/sapling	Broad-leaved deciduous shrub	*Corylus americana* (American hazelnut)
Short shrub/sapling	Broad-leaved deciduous shrub	*Gaylussacia baccata* (black huckleberry)
Shrot shrub/sapling	Dwarf-shrub	*Vaccinium angustifolium* (lowbush blueberry)
Herb (field)	Graminoid	*Andropogon gerardii* (big bluestem), *Carex pensylvanica* (Pennsylvania sedge), *Danthonia spicata* (poverty oatgrass)
Herb (field)	Fern or fern ally	*Pteridium aquilinum* (western brackenfern)
Nonvascular	Moss	*Pleurozium schreberi* (Schreber's big red stem moss)

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CHARACTERISTIC SPECIES

Saint Croix National Scenic Riverway: *Andropogon gerardii* (big bluestem), *Carex pensylvanica* (Pennsylvania sedge), *Corylus americana* (American hazelnut), *Danthonia spicata* (poverty oatgrass), *Gaylussacia baccata* (black huckleberry), *Pinus banksiana* (jack pine), *Pleurozium schreberi* (Schreber's big red stem moss), *Pteridium aquilinum* (western brackenfern), *Quercus ellipsoidalis* (northern pin oak), *Vaccinium angustifolium* (lowbush blueberry)

OTHER NOTEWORTHY SPECIES

Saint Croix National Scenic Riverway: Vulnerable: *Cypripedium parviflorum* (lesser yellow lady's slipper, WI state-vulnerable, G5); **Exotic/Invasive**: *Convolvulus arvensis* (field bindweed, invasive/exotic, Medium/Low), *Elymus repens* (quackgrass, invasive/exotic, High/Medium), *Hieracium aurantiacum* (orange hawkweed, invasive/exotic, Medium/Low), *Poa pratensis* (Kentucky bluegrass, invasive/exotic, Medium), *Taraxacum officinale* (common dandelion, invasive/exotic)

CONSERVATION STATUS RANK

Global Rank & Reasons: G3G4 (24-Oct-2002). This pine barrens type is typically found in the sand plain regions of the upper midwestern United States. It has not been well described in Michigan and Wisconsin, where a "woodland phase" is generally combined with the "savanna phase." In Minnesota, where it is restricted to the prairie-forest border region, the type is ranked S1. Stands require some type of fire management to persist in a partially open condition. The savanna phases that are related to this type are not common. Further review of this type is needed.

CLASSIFICATION

Status: Standard

Classification Confidence: 2 - Moderate

Global Comments: This type has not been well described in Michigan and Wisconsin, where a "woodland phase" is generally combined with the "savanna phase," so that the tree canopy can range from 10-60%, and the shrub layer also varies from open to closed. This may well make sense floristically. From a management perspective, a woodland category may be helpful in emphasizing the variability of canopy structure in the pine barrens landscape.

Global Similar Associations:

- *Pinus banksiana - (Pinus resinosa) / Corylus cornuta* Forest (CEGL002442) This is the somewhat more rich jack pine forest with a tall-shrub layer.
- *Pinus banksiana - (Quercus ellipsoidalis) / Schizachyrium scoparium* - Prairie Forbs Wooded Herbaceous Vegetation (CEGL002490) This is the more savanna-like pine barrens with a prairie understory.
- *Pinus banksiana - Pinus resinosa - (Quercus ellipsoidalis) / Carex pensylvanica* Wooded Herbaceous Vegetation (CEGL005124) This is the more savanna-like pine barrens, with a more northern understory.
- *Pinus banksiana / Vaccinium* spp. / *Pleurozium schreberi* Forest (CEGL002441) This is the more nutrient-poor jack pine forest with a dwarf-shrub and feathermoss understory.

Global Related Concepts:

- Jack Pine Woodland (MNNHP 1993) =
- Northern Dry Woodland Jack Pine-Red Pine Subtype (Faber-Langendoen 2001) =
- Pine Barren (Chapman et al. 1989) >

ELEMENT DISTRIBUTION

Global Range: This pine barrens community type is typical found in the sand plain regions of the upper midwestern United States, ranging from Minnesota to Michigan.

Nations: US

States/Provinces: MI, MN:S1, WI:S2

TNC Ecoregions: 47:C, 48:C

USFS Ecoregions (1994/95): 212Hb:CPP, 212He:CPP, 212Hi:CPP, 212Hp:CPP, 212Hq:CPP, 212Hr:CPP, 212Hs:CPP, 212Ht:CPP, 212Hu:CPP, 212Hv:CPP, 212Hw:CPP, 212Hy:CPP, 212Ja:CPP, 212Jc:CPP, 212Jf:CPP, 212Jm:CPP, 212Jn:CPP, 212Ka:CPP, 212Nc:C??

Federal Lands: NPS (Saint Croix); USFS (Chequamegon, Chequamegon-Nicolet, Hiawatha, Huron, Huron-Manistee, Manistee, Nicolet, Ottawa)

ELEMENT SOURCES

Saint Croix National Scenic Riverway Map Code: WJO

Saint Croix National Scenic Riverway Plots: SACN.4464, SACN.4465, SACN.4469, SACN.4470, SACN.4472, SACN.4475, SACN.7478, SACN.7503, SACN.7513, SACN.7522.

Local Description Authors: M.J. Russo

Global Description Authors: D. Faber-Langendoen

References: Chapman et al. 1989, Faber-Langendoen 2001, MNNHP 1993, Midwestern Ecology Working Group n.d., WNHIP unpubl. data

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M151. Northern Great Plains Woodland

G146. Eastern Great Plains Tallgrass Aspen Parkland

Aspen / American Hazel Forest

***Populus tremuloides / Corylus americana* Forest**
Quaking Aspen / American Hazelnut Forest
Identifier: CEGL002063

NVC CLASSIFICATION

Division	Eastern North American Cool Temperate Forest (1.C.2.Na)
Macrogroup	Northern Great Plains Woodland (M151)
Group	Eastern Great Plains Tallgrass Aspen Parkland (G146)
Association (Common name)	Aspen / American Hazel Forest

ELEMENT CONCEPT

Global Summary: This aspen / hazelnut forest type is found along the northern tallgrass prairie-forest border in the United States and Canada. Stands occur on gently rolling, poorly drained topography with a high water table. The mature trees in this community form an open to closed canopy. The canopies of individual trees usually touch, but because of the growth form of the dominant species, *Populus tremuloides* (quaking aspen), significant light penetrates the canopy. *Betula papyrifera* (paper birch), *Fraxinus pennsylvanica* (green ash), *Quercus macrocarpa* (bur oak), *Quercus ellipsoidalis* (northern pin oak), and *Tilia americana* (American basswood) are minor constituents of the canopy. The understory is dominated by shrubs, especially *Corylus americana* (American hazelnut), *Viburnum rafinesquianum* (downy arrow-wood), and *Amelanchier* (serviceberry) spp. The other species that make up the shrub layer vary with site factors such as soil moisture. The herbaceous layer is composed of species that can survive in the shade cast by the taller strata. Among these are *Aralia nudicaulis* (wild sarsaparilla), *Carex pensylvanica* (Pennsylvania sedge), *Maianthemum canadense* (Canada mayflower), *Oryzopsis asperifolia* (roughleaf ricegrass), and *Schizachne purpurascens* (false melic).

ENVIRONMENTAL DESCRIPTION

Global Environment: Grimm (1984) reported that aspen forest occurs on gently rolling, poorly drained topography in Minnesota's prairie-forest border region. The water table is usually high but not high enough to affect the composition of the ground layer or to allow peat formation (MNNHP 1993).

VEGETATION DESCRIPTION

Global Vegetation: The mature trees in this community form an open to closed canopy. The canopies of individual trees usually touch, but because of the growth form of the dominant species, *Populus tremuloides* (quaking aspen), significant light penetrates the canopy. *Betula papyrifera* (paper birch), *Fraxinus pennsylvanica* (green ash), *Quercus macrocarpa* (bur oak), *Quercus ellipsoidalis* (northern pin oak), and *Tilia americana* (American basswood) are minor constituents of the canopy in this community. The understory is dominated by shrubs, especially *Corylus americana* (American hazelnut), *Viburnum rafinesquianum* (downy arrow-wood), and *Amelanchier* (serviceberry) spp. Other species that make up the shrub layer vary with site factors such as soil moisture. The herbaceous layer is composed of species that can survive in the shade cast by the taller strata. Among these are *Aralia nudicaulis* (wild sarsaparilla), *Carex pensylvanica* (Pennsylvania sedge), *Maianthemum canadense* (Canada mayflower), *Oryzopsis asperifolia* (roughleaf ricegrass), and *Schizachne purpurascens* (false melic).

CONSERVATION STATUS RANK

Global Rank & Reasons: G5 (3-Oct-1996).

CLASSIFICATION

Status: Standard
Classification Confidence: 2 - Moderate
Global Comments: In Wisconsin stands of this description usually are a result of type conversion, especially of *Pinus banksiana* (jack pine), *Quercus velutina* (black oak), or *Quercus ellipsoidalis* (northern pin oak) forest stands and are not usually tracked for conservation purposes, but natural stands may occur around the margins of glacial Lake Wisconsin in the central sand plains region (E. Epstein pers. comm. 1999). This type is restricted to the prairie-forest border transition and does not occur in the northern hardwood-conifer region where *Betula papyrifera* (paper birch) is more typically an associate. This type may be the type expected in eastern North Dakota at Pembina Gorge and in the Sheyenne Delta. See also *Populus tremuloides - Quercus macrocarpa / Aralia nudicaulis* Forest (CEGL002065).
Global Similar Associations:
- *Populus tremuloides - Quercus macrocarpa / Aralia nudicaulis* Forest (CEGL002065)
- *Populus tremuloides / Corylus* spp. / *Andropogon gerardii* Woodland (CEGL005205)
- *Populus tremuloides / Prunus virginiana* Woodland (CEGL002130)

Global Related Concepts:
- Aspen Forest (MNNHP 1993) >
- Northern Dry-Mesic Forest Aspen Subtype (Faber-Langendoen 2001) =

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ELEMENT DISTRIBUTION

Global Range: This aspen / hazelnut forest type is found along the tallgrass prairie-forest border in the United States and Canada, extending from northern Iowa and Wisconsin to Manitoba.
Nations: US
States/Provinces: MN, WI, WY
TNC Ecoregions: 35:C, 46:C, 47:C
USFS Ecoregions (1994/95): 212Hb:CPP, 212Ja:CPP, 212Jb:CPP, 212Jc:CPP, 212Je:CPP, 212Jf:CPP, 212Jj:CPP, 212Jk:CPP, 212Jl:CPP, 212Jm:CPP, 212Ka:CPP, 212Nc:CCC, 222Md:CCC, 222Na:CCC
Federal Lands: NPS (Saint Croix); USFS (Chequamegon, Chequamegon-Nicolet, Nicolet?)

ELEMENT SOURCES

Saint Croix National Scenic Riverway Map Code: FQA
Local Description Authors:
Global Description Authors: J. Drake
References: Faber-Langendoen 2001, Greenall 1996, Grimm 1984, INAI unpubl. data, MNNHP 1993, Midwestern Ecology Working Group n.d., NDNHI unpubl. data, WNHIP unpubl. data

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G329. Great Plains Oak Woodland

North-Central Dry-Mesic Oak Woodland

***Quercus alba - Quercus macrocarpa - Quercus rubra / Corylus americana* Woodland**
White Oak - Bur Oak - Northern Red Oak / American Hazelnut Woodland
Identifier: CEGL002142

NVC CLASSIFICATION

Division	Eastern North American Cool Temperate Forest (1.C.2.Na)
Macrogroup	Northern Great Plains Woodland (M151)
Group	Great Plains Oak Woodland (G329)
Association (Common name)	North-central Dry-Mesic Oak Woodland

ELEMENT CONCEPT

Global Summary: This white oak - bur oak woodland is found in the northern prairie-forest border of the midwestern United States. Stands occur on flat, gently rolling or hilly landscapes subject to fires of low frequency and variable intensity. Canopy cover ranges from 30-80%. The tree layer is dominated by *Quercus alba* (white oak) and *Quercus macrocarpa* (bur oak) on drier soils (or even *Quercus ellipsoidalis* (northern pin oak) or *Quercus velutina* (black oak)) and occasionally codominated by *Quercus rubra* (northern red oak) on more mesic soils. The ground layer is codominated by shrubs and tree grubs, forbs and graminoids. Shrub cover is usually high (30-50%) with some stands forming impenetrable thickets. Typical shrubs include *Corylus americana* (American hazelnut) and *Cornus foemina* (stiff dogwood). Dominant herbs include *Andropogon gerardii* (big bluestem), *Carex pensylvanica* (Pennsylvania sedge), *Desmodium glutinosum* (pointedleaf ticktrefoil), and *Geranium maculatum* (spotted geranium). This community is maintained by a fire regime that is frequent enough to prevent full canopy closure and sapling establishment of fire-sensitive tree species, but infrequent enough to allow saplings of fire-tolerant tree species to reach fire-resistant size.

ENVIRONMENTAL DESCRIPTION

Saint Croix National Scenic Riverway Environment: This bur oak - northern red oak woodland was sampled at 11 locations in the park. Sites range from upland flats to gentle to somewhat steep hill midslopes. Soils are rapidly drained to moderately well-drained sandy loam and loamy sand. The unvegetated surface is dominated by leaf litter (32-96% cover) with some large rocks (0-1%), wood (0-4%), bare soil (0-60%), and dead plant stems (2-10%). Evidence of disturbance includes the presence of exotic plants.
Global Environment: Stands occur on level to rolling topography on well-drained outwash plains and coarse-textured end moraines, as well as on moderately fire-protected slopes in the Driftless Area. The pH varies from 6.1-7.3. Soils are excessively to moderately well-drained (dry to dry-mesic). Texture ranges range from loams to sandy loams, and include silt loams (loess-derived) close to bedrock in the Driftless Area. This community may develop on a slope of any aspect so long as the topography encourages infrequent but occasional fire. On shallow-to-bedrock slopes, a lower fire frequency is required to maintain Oak Woodland on south-facing slopes. This is because the combination of shallow soils and high evapotranspiration slows the rate of canopy closure by slowing the rate at which trees grow to canopy size.

VEGETATION DESCRIPTION

Saint Croix National Scenic Riverway Vegetation: The moderate to dense (40-80% cover) tree canopy, 10-20 m tall, is dominated by *Quercus macrocarpa* (bur oak) and *Quercus rubra* (northern red oak), and the very sparse to dense (5-80%) subcanopy (5-15 m) is dominated by *Ostrya virginiana* (hophornbeam). Additional tree species include *Carpinus caroliniana* (American hornbeam), *Fraxinus pennsylvanica* (green ash), *Populus tremuloides* (quaking aspen), and *Tilia americana* (American basswood). The very sparse to moderate (5-50%) tall-shrub (1-5 m) and very sparse to moderate (5-60%) short-shrub (0.5-1 m) layers may include *Carpinus caroliniana* (American hornbeam) and *Corylus cornuta* (beaked hazelnut), along with *Acer rubrum* (red maple), *Cornus racemosa* (gray dogwood), *Gaultheria procumbens* (eastern teaberry), *Rubus* (blackberry) spp., and *Zanthoxylum americanum* (common pricklyash). *Vaccinium angustifolium* (lowbush blueberry) forms a very sparse (5-30%) dwarf-shrub layer. The very sparse to dense (60%) herbaceous layer includes *Athyrium filix-femina* ssp. *angustum* (subarctic ladyfern), *Carex pensylvanica* (Pennsylvania sedge), *Desmodium glutinosum* (pointedleaf ticktrefoil), *Eurybia macrophylla* (bigleaf aster), *Matteuccia struthiopteris* (ostrich fern), *Pteridium aquilinum* (western brackenfern), *Schizachne purpurascens* (false melic), and *Solidago juncea* (early goldenrod). Nonvascular species (mosses) cover 5-10% of the ground surface.

Global Vegetation: There are three main structural layers - tree canopy, tall-shrub and herbaceous. Tree densities for stems greater than 10 cm dbh may historically have been between 50-200 stems per hectare (Bowles et al. 1994). The tree layer is composed predominantly of *Quercus alba* (white oak) and *Quercus macrocarpa* (bur oak), with *Quercus ellipsoidalis* (northern pin oak) or *Quercus velutina* (black oak) more common on dry sites, and occasional codominance by *Quercus rubra* (northern red oak), *Carya* (hickory) spp., and *Populus* (cottonwood) spp. (MNNHP 1993). *Sassafras albidum* (sassafras) can become an important tree layer component in the eastern end of the oak woodland range.

This community may include portions of stands also described as brushland (Grimm 1984, MNNHP 1993) or barrens (Bowles and McBride 1994, White 1994a). Shrub cover is usually high (30-50%) with some stands forming impenetrable thickets. Typical shrubs include *Corylus americana* (American hazelnut) and *Cornus foemina* (stiff dogwood). Throughout the range of the type, dominant

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herbs include *Andropogon gerardii* (big bluestem), *Carex pensylvanica* (Pennsylvania sedge), *Desmodium glutinosum* (pointedleaf ticktrefoil), *Geranium maculatum* (spotted geranium), and many others. These brushlands are dominated by woody species capable of reaching overstory size, but nearly all woody individuals are found in a shrubby state because intense fires are frequent enough to preclude them from reaching overstory size. Other barrens have been described to have scattered woody individuals of canopy size (White 1994a).

This community may also include stands described as "closed savanna" or "closed woodland" (Packard 1988, Swink and Wilhelm 1994). These stands experience low-intensity but moderately frequent fires that preclude the establishment of fire-sensitive tree saplings of species such as *Acer saccharum* (sugar maple), *Tilia americana* (American basswood) and *Fagus grandifolia* (American beech), but allow the establishment and growth to canopy size of moderately fire-tolerant tree saplings such as *Quercus rubra* (northern red oak) and even *Acer nigrum* (black maple). Shrub cover is quite low in this subtype due to the high frequency of low-intensity fire. Fuel loads for fires in this community are provided by several cool-season sedges and grasses such as *Carex rosea* (rosy sedge), *Carex pensylvanica* (Pennsylvania sedge), *Elymus villosus* (hairy wildrye), and *Elymus hystrix* (eastern bottlebrush grass) (Wilhelm 1991).

MOST ABUNDANT SPECIES

Saint Croix National Scenic Riverway

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Quercus macrocarpa* (bur oak), *Quercus rubra* (northern red oak)
Tree subcanopy	Broad-leaved deciduous tree	*Ostrya virginiana* (hophornbeam)
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Carpinus caroliniana* (American hornbeam)
Tall shrub/sapling	Broad-leaved deciduous shrub	*Corylus americana* (American hazelnut), *Corylus cornuta* (beaked hazelnut)
Short shrub/sapling	Dwarf-shrub	*Vaccinium angustifolium* (lowbush blueberry)
Herb (field)	Forb	*Eurybia macrophylla* (bigleaf aster)
Herb (field)	Graminoid	*Carex pensylvanica* (Pennsylvania sedge)
Herb (field)	Fern or fern ally	*Athyrium filix-femina* ssp. *angustum* (subarctic ladyfern), *Pteridium aquilinum* (western brackenfern)

CHARACTERISTIC SPECIES

Saint Croix National Scenic Riverway: *Athyrium filix-femina* ssp. *angustum* (subarctic ladyfern), *Carex pensylvanica* (Pennsylvania sedge), *Carpinus caroliniana* (American hornbeam), *Corylus americana* (American hazelnut), *Corylus cornuta* (beaked hazelnut), *Eurybia macrophylla* (bigleaf aster), *Ostrya virginiana* (hophornbeam), *Pteridium aquilinum* (western brackenfern), *Quercus macrocarpa* (bur oak), *Quercus rubra* (northern red oak), *Vaccinium angustifolium* (lowbush blueberry)

OTHER NOTEWORTHY SPECIES

Saint Croix National Scenic Riverway: Exotic/Invasive: *Humulus lupulus* (common hop, invasive/exotic), *Lonicera tatarica* (Tatarian honeysuckle, invasive/exotic, High/Medium), *Poa compressa* (Canada bluegrass, invasive/exotic, High/Low), *Poa pratensis* (Kentucky bluegrass, invasive/exotic, Medium), *Rhamnus cathartica* (common buckthorn, invasive/exotic, High/Medium), *Trifolium pratense* (red clover, invasive/exotic, Low/Insignificant), *Trifolium repens* (white clover, invasive/exotic, Medium/Low), *Urtica dioica* (stinging nettle, invasive/exotic), *Verbascum thapsus* (common mullein, invasive/exotic, Medium)
Global: Vulnerable: *Rubus hispidoides* (bog dewberry, globally imperiled, G2?Q)

CONSERVATION STATUS RANK

Global Rank & Reasons: G3G4 (22-Jun-1998). Most former examples of this community have been eliminated by cultivation, grazing, or conversion to forest due to fire suppression (Curtis 1959, Grimm 1984). Most of the remaining examples are relatively small. Minnesota appears to have the most acreage left.

CLASSIFICATION

Status: Standard
Classification Confidence: 2 - Moderate
Global Comments: This type typically covers dry to dry-mesic stands, but some mesic stands could also be placed here. Traditionally, partially canopied communities with a canopy cover of 10-50% have been classified as savanna, while communities with greater than 50% canopy cover have been classified as forest (Curtis 1959). Recent studies (Pruka 1994, Faber-Langendoen et al. unpubl.) suggest that there is enough turnover in understory composition along this broad canopy continuum to merit the subdivision of partially canopied communities into two communities: savanna (10-30% canopy) and woodland (30-80% canopy) (Anderson 1991, MNNHP 1993, Packard 1993, Pruka 1994). Forest communities in this region generally have >80% canopy cover. This distinction, however, is not clean. For example, in the Driftless area, drier oak forests on loess are typically treated as part of the dry-mesic white oak - red oak forest, *Quercus alba - Quercus rubra - Carya ovata* Glaciated Forest (CEGL002068) because of the finer soils that, despite slope and aspect, are more nutrient rich and moist. The driest stands would have been maintained by fire and best fit into this woodland type (H. Dunevitz pers. comm. 2000). This type may occur in Missouri and southern Iowa. Stands in southern Iowa and northern Missouri are currently placed in *Quercus alba - (Carya ovata) / Carex pensylvanica* Glaciated Woodland (CEGL002134).

Global Similar Associations:

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- *Quercus alba - (Carya ovata) / Carex pensylvanica* Glaciated Woodland (CEGL002134) is a similar type but found in southern Iowa, central Illinois and northern Missouri.
- *Quercus alba - Quercus velutina - Quercus palustris / Carex pensylvanica* Woodland (CEGL005054) Oak woodlands in southeastern Michigan and southwestern Ontario are currently treated as a separate, more eastern woodland type found on the Great Lakes Lakeplain. More information is needed on this distribution.
- *Quercus ellipsoidalis - (Quercus macrocarpa)* Forest (CEGL002077) a northern oak forest has a more-or-less closed canopy (canopy >80%). It is found on nutrient-poor, drought-prone soils that preclude establishment of more nutrient-demanding trees like *Acer saccharum*. Northern Oak Forests occur on sites protected from intense fires; otherwise they would be converted to Oak Woodland or *Corylus americana* Shrubland. Even though the canopy is generally closed, the canopy architecture of oaks allows enough sunlight to penetrate to the Oak Forest understory such that Oak Forests and Oak Woodlands share many understory species in common. Oak Forests are dominated by shrubs that are taller, since the shrubs are not consumed by intense fires. These taller shrubs produce enough shade to reduce the herbaceous component of Oak Forests in comparison to Oak Woodlands. Some understory species common in Oak Woodlands appear unable to compete with the shade of shrubs and saplings in Oak Forests.
- *Quercus macrocarpa - (Quercus alba, Quercus velutina) / Andropogon gerardii* Wooded Herbaceous Vegetation (CEGL002020)
- *Quercus macrocarpa - (Quercus ellipsoidalis) / Schizachyrium scoparium - Koeleria macrantha* Wooded Herbaceous Vegetation (CEGL002160) northern oak barrens has a wider canopy cover range (10-80%) and is found on sites where fire is more frequent. *Quercus macrocarpa* is of greater importance, shrub cover is generally lower, and graminoid cover is much higher. Understory species shared with Dry-mesic Oak Woodlands but more common in Oak Openings tend to be those that are less shade tolerant or more drought tolerant.
- *Quercus macrocarpa / Corylus americana - Amelanchier alnifolia* Woodland (CEGL000556) dry oak woodland is somewhat related. Both communities have canopies of 30-80%, but opening woodlands are found on loamier soils and dominated by *Quercus alba*, *Q. macrocarpa*, and *Q. rubra* (*Q. rubra* reaching dominance on more mesic stands only). Dry Oak Woodlands are found on droughty, sandy soils and are dominated by *Quercus ellipsoidalis*, *Quercus velutina* and *Q. alba*. Their highly droughty, low-fertility soils lead to low fuel loads that often allow for only low intensity fires. Woody individuals which survive the sapling stage generally reach canopy size as the intensities of fire in this community are rarely high enough to kill overstory trees (Anderson 1991).

Many understory species are shared in common between Dry-mesic Oak Woodlands and Dry Oak Woodlands. Understory species that are either unique to or more common in Dry Oak Woodlands are those that compete well only in acidic, low-nutrient sandy soils or those that compete well only under more droughty conditions. Conversely, species unique to or more common in Dry-mesic Oak Woodlands tend to be more competitive under lower moisture stress conditions and/or prefer more alkaline conditions.

- *Quercus velutina / Carex pensylvanica* Forest (CEGL002078) a northern oak forest has a more-or-less closed canopy (canopy >80%). It is found on nutrient-poor, drought-prone soils that preclude establishment of more nutrient-demanding trees like *Acer saccharum*. Northern Oak Forests occur on sites protected from intense fires; otherwise they would be converted to Oak Woodland or *Corylus americana* Shrubland. Even though the canopy is generally closed, the canopy architecture of oaks allows enough sunlight to penetrate to the Oak Forest understory such that Oak Forests and Oak Woodlands share many understory species in common. Oak Forests are dominated by shrubs that are taller, since the shrubs are not consumed by intense fires. These taller shrubs produce enough shade to reduce the herbaceous component of Oak Forests in comparison to Oak Woodlands. Some understory species common in Oak Woodlands appear unable to compete with the shade of shrubs and saplings in Oak Forests.

Global Related Concepts:

- Oak Woodland-Brushland (Big Woods Section) (MNNHP 1993) <
- Oak Woodland-Brushland (Southeast Section) (MNNHP 1993) <
- Southern Mesic Woodland White Oak-Bur Oak Subtype (Faber-Langendoen 2001) =

ELEMENT DISTRIBUTION

Global Range: This white oak - bur oak woodland is found in the northern prairie-forest border of the midwestern United States, ranging from central Minnesota and Wisconsin south to northeastern Iowa and northern Illinois, and possibly further east in the prairie peninsula.

Nations: US

States/Provinces: IA, IL, IN, MN, WI:S1

TNC Ecoregions: 35:C, 36:?, 46:C, 47:C, 48:C

USFS Ecoregions (1994/95): 212Je:P??, 212Jf:P??, 222Jj:CCC, 222Kf:CCC, 222Kg:CCC, 222Lc:CCC, 222Lf:CCC, 222Mb:CCC, 222Md:CCC, 222Me:CCC, 251Aa:C??, 251Ci:CCC

Federal Lands: NPS (Indiana Dunes, Saint Croix)

ELEMENT SOURCES

Saint Croix National Scenic Riverway Map Code: WBO

Saint Croix National Scenic Riverway Plots: SACN.7, SACN.47, SACN.60, SACN.132, SACN.205, SACN.252, SACN.284, SACN.3532, SACN.4466, SACN.5114, SACN.7507.

Local Description Authors: M.J. Russo

Global Description Authors: B.W. Pruka, J. Drake and D. Faber-Langendoen

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References: Anderson 1983, Anderson 1991, Bowles and McBride 1994, Bowles et al. 1994, Chapman 1984, Chapman et al. 1994, Curtis 1959, Faber-Langendoen 2001, Faber-Langendoen et al. n.d., Grimm 1984, Hop et al. 2009, INAI unpubl. data, Kline and Cottam 1979, Leitner et al. 1991, MNNHP 1993, Midwestern Ecology Working Group n.d., Nowacki et al. 1990, Packard 1988, Packard 1993, Pfannmuller 1991, Pruka 1994, Schwegman and McClain 1985, Swink and Wilhelm 1994, WNHIP unpubl. data, White 1994a, Wilhelm 1991

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M014. Northern Mesic Hardwood & Conifer Forest

G163. Northern Hardwood - Hemlock - White Pine Forest

Maple - Yellow Birch Northern Hardwoods Forest

***Acer saccharum - Betula alleghaniensis - (Tilia americana)* Forest**
Sugar Maple - Yellow Birch - (American Basswood) Forest
Identifier: CEGL002457

NVC CLASSIFICATION

Division	Eastern North American Cool Temperate Forest (1.C.2.Na)
Macrogroup	Northern Mesic Hardwood & Conifer Forest (M014)
Group	Northern Hardwood - Hemlock - White Pine Forest (G163)
Association (Common name)	Maple - Yellow Birch Northern Hardwoods Forest

ELEMENT CONCEPT

Global Summary: This northern hardwoods community type occurs in the western and central Great Lakes area of the United States and Canada. Stands are found on moderate to deep (60->150 cm) sandy loam, clay loam, or loamy sand soils. The soils are typically slightly acidic to circumneutral, dry-mesic to wet-mesic and moderately nutrient rich. Most stands develop on flat to moderate slopes over glacial till. The community is dominated by deciduous trees with scattered conifers in some stands. *Acer saccharum* (sugar maple) is a dominant throughout the range of this community. It may form nearly pure stands. Other common canopy trees include *Acer rubrum* (red maple), *Betula alleghaniensis* (yellow birch), *Fraxinus americana* (white ash), and *Tilia americana* (American basswood). Conifers such as *Abies balsamea* (balsam fir), *Picea glauca* (white spruce), *Pinus strobus* (eastern white pine), *Thuja occidentalis* (northern white-cedar), and *Tsuga canadensis* (eastern hemlock) can be found in some stands. The shrub layer is typically sparse; however, it can be moderately developed where the tree canopy is not fully closed. Typical shrubs include *Acer spicatum* (mountain maple), *Corylus cornuta* (beaked hazelnut), *Lonicera canadensis* (American fly honeysuckle), and *Taxus canadensis* (Canada yew). The herbaceous stratum includes *Clintonia borealis* (bluebead), *Dryopteris carthusiana* (spinulose woodfern), *Lycopodium* (clubmoss) spp., *Maianthemum canadense* (Canada mayflower), *Maianthemum racemosum* (feathery false lily of the valley), *Osmorhiza claytonii* (Clayton's sweetroot), *Polygonatum pubescens* (hairy Solomon's seal), *Streptopus lanceolatus* var. *longipes* (twistedstalk), and *Viola* (violet) spp. Diagnostic features include the deciduous hardwood dominance, the lack of *Fagus grandifolia* (American beech), and the presence of a sub-boreal ground layer.

ENVIRONMENTAL DESCRIPTION

Saint Croix National Scenic Riverway Environment: This sugar maple - yellow birch forest was sampled at four locations in the park. Sites are located on moderate to somewhat steep, west- and northwest-facing seepage slopes and bluffs. Soils range from moderately well- to well-drained sandy loam to somewhat poorly to poorly drained peat or muck. The unvegetated surface is dominated by leaf litter (20-81% cover) with some large rocks (0-2%), small rocks (0-1%), wood (0-5%), standing water (0-3%), bare soil (8-70%), and dead plant stems (6-12%). Evidence of disturbance includes dead standing and fallen trees, tip-up mounds and erosion.

Global Environment: This community is found on moderate to deep (60-150 cm) sandy loam, clay loam, or loamy sand soils (Coffman and Willis 1977, Pregitzer and Barnes 1984). The soils are typically slightly acidic to circumneutral, mesic to wet-mesic and nutrient rich (Kotar and Burger 1989). Most stands develop on flat to moderate slopes over glacial till.

VEGETATION DESCRIPTION

Saint Croix National Scenic Riverway Vegetation: The moderate to very dense (40-90% cover) tree canopy, 15-20 m tall, is dominated by *Betula alleghaniensis* (yellow birch) and may include lesser amounts of *Acer rubrum* (red maple), *Acer saccharum* (sugar maple), *Fraxinus nigra* (black ash), *Fraxinus pennsylvanica* (green ash), *Quercus alba* (white oak), *Quercus ellipsoidalis X rubra*, and *Quercus rubra* (northern red oak). The sparse to dense (10-80%) subcanopy (5-15 m) may be dominated by *Acer rubrum* (red maple) or *Acer saccharum* (sugar maple) and includes other canopy species as well as *Ostrya virginiana* (hophornbeam) and *Tilia americana* (American basswood). The very sparse to moderate (5-40%) tall-shrub layer (1-5 m) is made up of saplings of the tree species. The very sparse (5-20%) short-shrub layer (0.5-1 m) includes *Amelanchier laevis* (Allegheny serviceberry), *Cornus alternifolia* (alternateleaf dogwood), *Corylus cornuta* (beaked hazelnut), *Ilex verticillata* (common winterberry), *Lonicera canadensis* (American fly honeysuckle), *Prunus virginiana* (chokecherry), *Rubus occidentalis* (black raspberry), *Rubus pubescens* (dwarf red blackberry), and others. The sparse to moderately dense (30-70%) herbaceous layer is dominated by ferns and fern-allies, including *Adiantum pedatum* (northern maidenhair), *Athyrium filix-femina* ssp. *angustum* (subarctic ladyfern), *Chrysosplenium americanum* (American golden saxifrage), *Dryopteris carthusiana* (spinulose woodfern), *Equisetum arvense* (field horsetail), *Equisetum hyemale* (scouringrush horsetail), *Equisetum sylvaticum* (woodland horsetail), *Gymnocarpium dryopteris* (western oakfern), *Osmunda cinnamomea* (cinnamon fern), *Osmunda claytoniana* (interrupted fern), *Phegopteris connectilis* (long beechfern), and others. Typical forbs include *Amphicarpaea bracteata* (American hogpeanut), *Aralia nudicaulis* (wild sarsaparilla), *Arisaema triphyllum* (Jack in the pulpit), *Circaea alpina* (small enchanter's nightshade), *Clintonia borealis* (bluebead), *Eurybia macrophylla* (bigleaf aster), *Galium triflorum* (fragrant bedstraw), *Impatiens capensis* (jewelweed), *Maianthemum canadense* (Canada mayflower), *Osmorhiza claytonii* (Clayton's sweetroot), *Ranunculus recurvatus* (blisterwort), *Scutellaria lateriflora* (blue skullcap), *Solidago flexicaulis* (zigzag

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goldenrod), *Symphyotrichum lateriflorum* (calico aster), *Symplocarpus foetidus* (skunk-cabbage), *Thalictrum dioicum* (early meadowrue), *Trientalis borealis* (starflower), *Trillium grandiflorum* (white trillium), and *Uvularia sessilifolia* (sessileleaf bellwort); typical graminoids include *Carex blanda* (eastern woodland sedge), *Carex intumescens* (greater bladder sedge), *Carex pedunculata* (longstalk sedge), *Cinna latifolia* (drooping woodreed), and *Elymus hystrix* (eastern bottlebrush grass). In addition, this community may support Minnesota and Wisconsin state-vulnerable *Juglans cinerea* (butternut).

Global Vegetation: This forest community is dominated by deciduous trees with scattered conifers in some stands. *Acer saccharum* (sugar maple) is a dominant throughout the range of this community. It may form nearly pure stands (Flaccus and Ohmann 1964, Hansen et al. 1973). Other common canopy trees include *Acer rubrum* (red maple), *Betula alleghaniensis* (yellow birch), *Fraxinus americana* (white ash), and *Tilia americana* (American basswood). Conifers, such as *Abies balsamea* (balsam fir), *Picea glauca* (white spruce), *Pinus strobus* (eastern white pine), *Thuja occidentalis* (northern white-cedar), and *Tsuga canadensis* (eastern hemlock), can be found in some stands. The shrub layer is sparse; however, it can be moderately developed where the tree canopy is not fully closed. Typical shrubs include *Acer spicatum* (mountain maple), *Corylus cornuta* (beaked hazelnut), *Lonicera canadensis* (American fly honeysuckle), and *Taxus canadensis* (Canada yew). The herbaceous stratum includes *Clintonia borealis* (bluebead), *Lycopodium* (clubmoss) spp., *Maianthemum canadense* (Canada mayflower), *Osmorhiza claytonii* (Clayton's sweetroot), *Streptopus lanceolatus* (twistedstalk), and *Viola* (violet) spp. (Chambers et al. 1997).

MOST ABUNDANT SPECIES

Saint Croix National Scenic Riverway

Stratum	Lifeform	Species
Tree (canopy & subcanopy)	Broad-leaved deciduous tree	*Acer rubrum* (red maple)
Tree canopy	Broad-leaved deciduous tree	*Betula alleghaniensis* (yellow birch)
Tree subcanopy	Broad-leaved deciduous tree	*Ostrya virginiana* (hophornbeam)
Short shrub/sapling	Broad-leaved deciduous shrub	*Corylus cornuta* (beaked hazelnut)
Herb (field)	Forb	*Symplocarpus foetidus* (skunk-cabbage)
Herb (field)	Fern or fern ally	*Athyrium filix-femina* ssp. *angustum* (subarctic ladyfern), *Osmunda cinnamomea* (cinnamon fern)

CHARACTERISTIC SPECIES

Saint Croix National Scenic Riverway: *Acer rubrum* (red maple), *Acer saccharum* (sugar maple), *Athyrium filix-femina* ssp. *angustum* (subarctic ladyfern), *Betula alleghaniensis* (yellow birch), *Corylus cornuta* (beaked hazelnut), *Equisetum arvense* (field horsetail), *Maianthemum canadense* (Canada mayflower), *Osmunda cinnamomea* (cinnamon fern), *Ostrya virginiana* (hophornbeam), *Symplocarpus foetidus* (skunk-cabbage)

OTHER NOTEWORTHY SPECIES

Saint Croix National Scenic Riverway: Vulnerable: *Juglans cinerea* (butternut, MN & WI state-vulnerable, G4)

CONSERVATION STATUS RANK

Global Rank & Reasons: G3G4 (22-Jun-1998). There are probably over 100 occurrences rangewide. Ninety have been documented: 77 in Minnesota (where the community is ranked S2), 10 in Wisconsin (S4), and 3 in Michigan (S4). Although no other occurrences have been documented, the community is also reported from Ontario. The 90 occurrences total 13,401 acres (5360 ha). The type has been extensively cleared for development or harvested for timber in the past (between 50 and 90% of its former extent), but degree of conversion versus second-growth status is not well-understood. Few old-growth stands remained by the late 1980s.

CLASSIFICATION

Status: Standard

Classification Confidence: 2 - Moderate

Global Comments: This community has a sub-boreal herbaceous layer. This may be a useful feature to differentiate this community from the similar *Acer saccharum - Fraxinus americana - Tilia americana / Acer spicatum / Caulophyllum thalictroides* Forest (CEGL005008). Some stands can have a scattered supercanopy of *Pinus strobus* (eastern white pine) (less than 25% cover), and although floristically such stands are very similar to this type, there may be some value in recognizing a separate type, *Acer saccharum - Pinus strobus / Acer pensylvanicum* Forest (CEGL005005). Further review of this issue is needed.

Global Similar Associations:

- *Acer saccharum - Fagus grandifolia - Betula* spp. / *Maianthemum canadense* Forest (CEGL005004)
- *Acer saccharum - Fraxinus americana - Tilia americana / Acer spicatum / Caulophyllum thalictroides* Forest (CEGL005008) This community lacks the sub-boreal herbaceous layer.
- *Acer saccharum - Pinus strobus / Acer pensylvanicum* Forest (CEGL005005)
- *Acer saccharum - Tilia americana / Ostrya virginiana / Lonicera canadensis* Forest (CEGL002458)
- *Betula alleghaniensis - (Acer saccharum, Picea glauca)* Forest [Provisional] (CEGL005245)

Global Related Concepts:

- *Acer / Hydrophyllum* Habitat Type (Kotar and Burger 1989) =
- *Acer saccharum - Viola pennsylvanica - Osmorhiza claytonii* Association (Coffman and Willis 1977) =
- Mesic Northern Forest - Sugar Maple-Yellow Birch-(Balsam Fir) (Chapman et al. 1989) >
- Northern Hardwood Forest (Northern Section) (MNNHP 1993) =
- Northern Mesic Forest Sugar Maple-Yellow Birch Subtype (Faber-Langendoen 2001) =

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- Site Unit 11 (Pregitzer and Barnes 1984) <
- Site Unit 2 (Pregitzer and Barnes 1984) <
- Site Unit 4 (Pregitzer and Barnes 1984) <
- Site Unit 5 (Pregitzer and Barnes 1984) <
- Sugar Maple-Yellow Birch-Spinulose Wood Fern (V10) (Chambers et al. 1997) =
- Yellow Birch - Sugar Maple (Hansen et al. 1973) =

ELEMENT DISTRIBUTION

Global Range: This northern hardwoods community occurs in the western and central Great Lakes area of the United States and Canada, ranging from Minnesota and Ontario east to Michigan.
Nations: CA, US
States/Provinces: MI, MN:S2, ON, QC, WI:S3
TNC Ecoregions: 47:C, 48:C, 64:C
USFS Ecoregions (1994/95): 212Hb:CC?, 212Hi:CCC, 212Hj:CCP, 212Hs:CCC, 212Hv:CCP, 212Ia:CCC, 212Ib:CCC, 212Ja:CCC, 212Jb:CCC, 212Jc:CCC, 212Je:CCC, 212Jf:CCP, 212Jj:CCC, 212Jl:CCC, 212Jm:CCC, 212Jn:CCP, 212Jo:CCP, 212Jr:CCC, 212Js:CCC, 212Kb:CCC, 212La:CC?, 212Lb:CCC, 212Mb:C??, 212Na:CCC, 212Nb:CCC, 212Nc:CCC, 212Nd:CCC
Federal Lands: NPS (Apostle Islands, Isle Royale, Pictured Rocks, Saint Croix); USFS (Chequamegon, Chequamegon-Nicolet, Chippewa, Hiawatha?, Huron-Manistee, Huron?, Manistee, Nicolet, Ottawa, Superior?)

ELEMENT SOURCES

Saint Croix National Scenic Riverway Map Code: Not mapped separately.
Saint Croix National Scenic Riverway Plots: SACN.8, SACN.63, SACN.92, SACN.116.
Local Description Authors: M.J. Russo
Global Description Authors: J. Drake
References: Chambers et al. 1997, Chapman et al. 1989, Coffman and Willis 1977, Faber-Langendoen 2001, Farrand and Bell 1982, Flaccus and Ohmann 1964, Frelich 1995, Hansen et al. 1973, Hop et al. 2010a, Hop et al. 2010c, Kotar and Burger 1989, MNNHP 1993, Midwestern Ecology Working Group n.d., Pregitzer and Barnes 1984, TNC 1999b, WNHIP unpubl. data

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Northern Maple - Basswood Forest

***Acer saccharum - Tilia americana / Ostrya virginiana / Lonicera canadensis* Forest**
Sugar Maple - American Basswood / Hophornbeam / Fly Honeysuckle Forest
Identifier: CEGL002458

NVC CLASSIFICATION

Division	Eastern North American Cool Temperate Forest (1.C.2.Na)
Macrogroup	Northern Mesic Hardwood & Conifer Forest (M014)
Group	Northern Hardwood - Hemlock - White Pine Forest (G163)
Association (Common name)	Northern Maple - Basswood Forest

ELEMENT CONCEPT

Global Summary: This maple-basswood forest community type is found in northern Great Lakes region of the United States and Canada. Stands occur on deep, well-drained soils formed from glacial deposits, usually till. Soils are nutrient-rich loam, silt loam, or sandy loam. Slopes are generally gentle to moderate, but can sometimes be steep. The canopy contains a closed, deciduous tree layer that casts dense shade in summer and limits the growth of understory species. This results in a sparse shrub layer 1-2 m tall and the presence of many spring ephemerals in the herbaceous layer. *Acer saccharum* (sugar maple) and *Tilia americana* (American basswood) are the most abundant trees, and together make up virtually the entire canopy in many stands. Other trees that may be found include *Fraxinus pennsylvanica* (green ash), *Ostrya virginiana* (hophornbeam), *Quercus rubra* (northern red oak), *Ulmus americana* (American elm), and, in more eastern stands, *Fagus grandifolia* (American beech). Typical shrubs are *Acer spicatum* (mountain maple), *Corylus americana* (American hazelnut), *Dirca palustris* (eastern leatherwood), *Hamamelis virginiana* (American witch-hazel), *Lonicera canadensis* (American fly honeysuckle), and *Viburnum acerifolium* (mapleleaf viburnum). The herbaceous stratum contains species such as *Adiantum pedatum* (northern maidenhair), *Aralia nudicaulis* (wild sarsaparilla), *Eurybia macrophylla* (bigleaf aster), *Carex pensylvanica* (Pennsylvania sedge), *Desmodium cuspidatum* var. *cuspidatum* (largebract ticktrefoil), *Epipactis helleborine* (broadleaf helleborine), *Galium triflorum* (fragrant bedstraw), *Hepatica nobilis* (hepatica), *Laportea canadensis* (Canadian woodnettle), *Maianthemum canadense* (Canada mayflower), *Oryzopsis asperifolia* (roughleaf ricegrass), *Trillium grandiflorum* (white trillium), and *Uvularia grandiflora* (largeflower bellwort).

ENVIRONMENTAL DESCRIPTION

Saint Croix National Scenic Riverway Environment: This very common maple-basswood forest was sampled at 66 locations in the park over a wide range of topographic situations. Sites range from flat uplands to steep slopes of hills and cliffs with nearly any aspect. Soils include moderately well- to well-drained loam, loamy sand, sandy loam, silt loam and loam. The unvegetated surface is dominated by leaf litter (80-93% cover) with some exposed bedrock (0-2%), large rocks (0-10%), small rocks (0-2%), wood (2-4%), bare soil (0-8%), and dead plant stems (2-9%). Evidence of disturbance includes past fire, erosion, grazing, possible past logging, trails, fallen trees, and the presence of exotic plants.
Global Environment: This community is usually found on gentle to moderate slopes but can sometimes be found on steep slopes. Stands occur on deep, well-drained soils formed from glacial deposits, usually till. Soils are nutrient-rich loam, silt loam, or sandy loam. The water table is rarely within the tree-rooting zone (MNNHP 1993).

VEGETATION DESCRIPTION

Saint Croix National Scenic Riverway Vegetation: The sparse to very dense (30-90% cover) tree canopy, 15-35 m tall, is codominated by *Acer saccharum* (sugar maple) and *Tilia americana* (American basswood) and may also include *Acer rubrum* (red maple), *Betula alleghaniensis* (yellow birch), *Betula papyrifera* (paper birch), *Carpinus caroliniana* (American hornbeam), *Fraxinus pennsylvanica* (green ash), *Ostrya virginiana* (hophornbeam), *Populus grandidentata* (bigtooth aspen), *Populus tremuloides* (quaking aspen), *Quercus alba* (white oak), *Quercus macrocarpa* (bur oak), *Quercus rubra* (northern red oak), *Ulmus rubra* (slippery elm), and others. The very sparse to sparse (5-40%) subcanopy (5-15 m) is made up of canopy species. The tall-shrub layer (1-5 m), when present (0-80%), may include *Acer saccharum* (sugar maple), *Corylus cornuta* (beaked hazelnut), *Ostrya virginiana* (hophornbeam), *Rubus* (blackberry) sp., and *Zanthoxylum americanum* (common pricklyash). The short-shrub layer (0.5-2 m), when present (0-20 %), includes tall-shrub species. The highly variable (5-90%) herbaceous layer is often dominated by *Acer saccharum* (sugar maple) seedlings but may also include significant amounts of *Adiantum pedatum* (northern maidenhair), *Amphicarpaea bracteata* (American hogpeanut), *Aralia nudicaulis* (wild sarsaparilla), *Athyrium filix-femina* (common ladyfern), *Carex pensylvanica* (Pennsylvania sedge), *Desmodium glutinosum* (pointedleaf ticktrefoil), *Eurybia macrophylla* (bigleaf aster), *Oryzopsis asperifolia* (roughleaf ricegrass), *Osmunda claytoniana* (interrupted fern), *Trillium grandiflorum* (white trillium), *Uvularia sessilifolia* (sessileleaf bellwort), and others. In addition, this community may support Minnesota state-critically imperiled *Botrychium oneidense* (bluntlobe grapefern) and state-vulnerable *Desmodium nudiflorum* (nakedflower ticktrefoil), *Dryopteris goldiana* (Goldie's woodfern), *Juglans cinerea* (butternut), and *Panax quinquefolius* (American ginseng), as well as Wisconsin state-critically imperiled *Carex backii* (Back's sedge) and *Dryopteris filix-mas* (male fern), state-imperiled *Botrychium oneidense* (bluntlobe grapefern), and state-vulnerable *Aplectrum hyemale* (Adam and Eve), *Botrychium lanceolatum* var. *angustisegmentum* (lanceleaf grapefern), *Cypripedium reginae* (showy lady's slipper), *Thelypteris simulata* (bog fern), and *Juglans cinerea* (butternut), which were all recorded from sampled plots.
Global Vegetation: The canopy contains a closed, deciduous tree layer that casts dense shade in summer and limits the growth of understory species. This results in a sparse shrub layer 1-2 m tall and the presence of many spring ephemerals in the herbaceous layer. *Acer saccharum* (sugar maple) and *Tilia americana* (American basswood) are the most abundant trees and together make up virtually

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the entire canopy in many stands. Other trees that may be found include *Fraxinus pennsylvanica* (green ash), *Ostrya virginiana* (hophornbeam), *Quercus rubra* (northern red oak), *Ulmus americana* (American elm), and, in more eastern stands, *Fagus grandifolia* (American beech). Typical shrubs are *Acer spicatum* (mountain maple), *Corylus americana* (American hazelnut), *Dirca palustris* (eastern leatherwood), *Hamamelis virginiana* (American witch-hazel), *Lonicera canadensis* (American fly honeysuckle), and *Viburnum acerifolium* (mapleleaf viburnum). The herbaceous stratum contains species such as *Adiantum pedatum* (northern maidenhair), *Aralia nudicaulis* (wild sarsaparilla), *Eurybia macrophylla* (bigleaf aster), *Carex pensylvanica* (Pennsylvania sedge), *Desmodium cuspidatum* var. *cuspidatum* (largebract ticktrefoil), *Epipactis helleborine* (broadleaf helleborine), *Galium triflorum* (fragrant bedstraw), *Hepatica nobilis* var. *acuta* (sharplobe hepatica), *Laportea canadensis* (Canadian woodnettle), *Maianthemum canadense* (Canada mayflower), *Oryzopsis asperifolia* (roughleaf ricegrass), *Trillium grandiflorum* (white trillium), and *Uvularia grandiflora* (largeflower bellwort) (Buell and Bormann 1955, Curtis 1959, MNNHP 1993, Chambers et al. 1997).

MOST ABUNDANT SPECIES

Saint Croix National Scenic Riverway

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Acer rubrum* (red maple), *Acer saccharum* (sugar maple), *Betula alleghaniensis* (yellow birch), *Betula papyrifera* (paper birch), *Carpinus caroliniana* (American hornbeam), *Fraxinus pennsylvanica* (green ash), *Ostrya virginiana* (hophornbeam), *Quercus rubra* (northern red oak), *Tilia americana* (American basswood)
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Zanthoxylum americanum* (common pricklyash)
Tall shrub/sapling	Broad-leaved deciduous shrub	*Acer saccharum* (sugar maple), *Viburnum rafinesquianum* (downy arrow-wood), *Corylus cornuta* (beaked hazelnut)
Short shrub/sapling	Needle-leaved shrub	*Taxus canadensis* (Canada yew)
Herb (field)	Forb	*Amphicarpaea bracteata* (American hogpeanut), *Aralia nudicaulis* (wild sarsaparilla), *Desmodium glutinosum* (pointedleaf ticktrefoil), *Eurybia macrophylla* (bigleaf aster), *Uvularia sessilifolia* (sessileleaf bellwort)
Herb (field)	Graminoid	*Carex pensylvanica* (Pennsylvania sedge)
Herb (field)	Fern or fern ally	*Adiantum pedatum* (northern maidenhair), *Athyrium filix-femina* (common ladyfern)
Herb (field)	Other herbaceous	*Acer saccharum* (sugar maple)

CHARACTERISTIC SPECIES

Saint Croix National Scenic Riverway: *Acer rubrum* (red maple), *Acer saccharum* (sugar maple), *Adiantum pedatum* (northern maidenhair), *Amphicarpaea bracteata* (American hogpeanut), *Aralia nudicaulis* (wild sarsaparilla), *Athyrium filix-femina* (common ladyfern), *Betula alleghaniensis* (yellow birch), *Betula papyrifera* (paper birch), *Carex pensylvanica* (Pennsylvania sedge), *Carpinus caroliniana* (American hornbeam), *Corylus cornuta* (beaked hazelnut), *Desmodium glutinosum* (pointedleaf ticktrefoil), *Eurybia macrophylla* (bigleaf aster), *Fraxinus pennsylvanica* (green ash), *Ostrya virginiana* (hophornbeam), *Quercus rubra* (northern red oak), *Taxus canadensis* (Canada yew), *Tilia americana* (American basswood), *Uvularia sessilifolia* (sessileleaf bellwort), *Viburnum rafinesquianum* (downy arrow-wood), *Zanthoxylum americanum* (common pricklyash)

OTHER NOTEWORTHY SPECIES

Saint Croix National Scenic Riverway: Vulnerable: *Aplectrum hyemale* (Adam and Eve, WI state-vulnerable, G5), *Botrychium lanceolatum* var. *angustisegmentum* (lanceleaf grapefern, WI state-vulnerable, G5TNR), *Botrychium oneidense* (bluntlobe grapefern, MN state-critically imperiled, G4), *Carex backii* (Back's sedge, WI state-critically imperiled, G4), *Cypripedium reginae* (showy lady's slipper, WI state-vulnerable, G4), *Desmodium nudiflorum* (nakedflower ticktrefoil, MN state-vulnerable, G5), *Dryopteris filix-mas* (male fern, WI state-critically imperiled, G5), *Dryopteris goldiana* (Goldie's woodfern, MN state-vulnerable, G4), *Juglans cinerea* (butternut, MN & WI state-vulnerable, G4), *Panax quinquefolius* (American ginseng, MN state-vulnerable, G3G4), *Thelypteris simulata* (bog fern, WI state-vulnerable, G4G5); **Exotic/Invasive**: *Arctium minus* (lesser burdock, invasive/exotic, Medium/Insignificant), *Calystegia sepium* ssp. *sepium* (hedge false bindweed, invasive/exotic), *Glechoma hederacea* (ground ivy, invasive/exotic, Low), *Lonicera tatarica* (Tatarian honeysuckle, invasive/exotic, High/Medium), *Rhamnus cathartica* (common buckthorn, invasive/exotic, High/Medium), *Taraxacum officinale* (common dandelion, invasive/exotic), *Urtica dioica* (stinging nettle, invasive/exotic)

Global: Vulnerable: *Panax quinquefolius* (American ginseng, collection pressure, G3G4)

CONSERVATION STATUS RANK

Global Rank & Reasons: G3? (22-Jun-1998). The total number of occurrences is unknown. Five have been documented in Wisconsin, where the community is ranked S3, and 22 in Minnesota (S3). It is found in 7 ecoregional subsections.

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CLASSIFICATION

Status: Standard
Classification Confidence: 2 - Moderate
Global Comments: Curtis' (1959) most northern maple-basswood stands belong here. This community is similar to *Acer saccharum - Tilia americana / Ostrya virginiana - Carpinus caroliniana* Forest (CEGL002062), but the canopy of this community is typically less diverse, with much less presence of some of the southern tree species found in the latter, such as *Juglans nigra* (black walnut), *Carya* (hickory) spp., and many *Quercus* (oak) spp. (Janssen 1967). This community also lacks appreciable amounts of *Betula alleghaniensis* (yellow birch) and *Tsuga canadensis* (eastern hemlock) which are found to the east and north in similar forests, such as *Acer saccharum - Betula alleghaniensis - (Tilia americana)* Forest (CEGL002457) and *Tsuga canadensis - Acer saccharum - Betula alleghaniensis* Forest (CEGL005044). In Minnesota, all stands of *Acer saccharum* (sugar maple) - northern hardwoods in the Lake Superior Highlands region are placed in CEGL002457, but it may be that the more southern stands should be placed within this type. In Ontario this type occurs in Site Region 5, but may extend into Site Region 6.
Global Similar Associations:
- *Acer saccharum - Betula alleghaniensis - (Tilia americana)* Forest (CEGL002457)
- *Acer saccharum - Fagus grandifolia - Betula* spp. / *Maianthemum canadense* Forest (CEGL005004)
- *Acer saccharum - Tilia americana / Ostrya virginiana - Carpinus caroliniana* Forest (CEGL002062)
- *Tsuga canadensis - Acer saccharum - Betula alleghaniensis* Forest (CEGL005044)

Global Related Concepts:
- *Tilio-Acerion sacchari* Alliance (Janssen 1967) =
- East Woods (Eggler 1938) <
- Hunt Hill (Eggler 1938) <
- Long Lake (Eggler 1938) <
- Maple-Basswood Forest (Northern Section) (MNNHP 1993) =
- Southern Mesic Forest Maple-Basswood Northern Subtype (Faber-Langendoen 2001) =
- Sugar Maple - Basswood Stand (Buell and Bormann 1955) =
- Sugar Maple-Red Oak-Basswood-Ironwood-Leatherwood (V5) (Chambers et al. 1997) =

ELEMENT DISTRIBUTION

Global Range: This maple - basswood forest community type is found in northern Great Lakes region of the United States and Canada, ranging from Minnesota and Wisconsin into Ontario.
Nations: CA, US
States/Provinces: MN:S3, ON, QC:S3?, WI:S2S3
TNC Ecoregions: 47:C, 48:C
USFS Ecoregions (1994/95): 212Ia:CCC, 212Ja:CCC, 212Jc:CCC, 212Jg:CCC, 212Mb:CPP, 212Na:CCC, 212Nb:CCP, 212Nc:CCC
Federal Lands: NPS (Apostle Islands, Saint Croix); USFS (Chippewa)

ELEMENT SOURCES

Saint Croix National Scenic Riverway Map Code: FMT
Saint Croix National Scenic Riverway Plots: SACN.16, SACN.28, SACN.30, SACN.65, SACN.67, SACN.75, SACN.77, SACN.88, SACN.110, SACN.216, SACN.248, SACN.265, SACN.286, SACN.287, SACN.0137, SACN.0206, SACN.0343, SACN.0365, SACN.0487, SACN.0488, SACN.0541, SACN.0659, SACN.0912, SACN.0913, SACN.3512, SACN.3513, SACN.3517, SACN.3525, SACN.3528, SACN.3531, SACN.4004, SACN.4022, SACN.4461, SACN.4474, SACN.4698, SACN.4700, SACN.4701, SACN.4707, SACN.4722, SACN.4723, SACN.4724, SACN.4727, SACN.4728, SACN.4737, SACN.4738, SACN.4830, SACN.4909, SACN.4910, SACN.4911, SACN.4912, SACN.4913, SACN.4914, SACN.4915, SACN.4916, SACN.4917, SACN.5066, SACN.5068, SACN.5124, SACN.5522, SACN.6044, SACN.6451, SACN.6559, SACN.7447, SACN.7510, SACN.7517, SACN.7518.
Local Description Authors: M.J. Russo
Global Description Authors: J. Drake, mod. D. Faber-Langendoen 06-00
References: Buell and Bormann 1955, Chambers et al. 1997, Curtis 1959, Eggler 1938, Faber-Langendoen 2001, Hop et al. 2010a, Janssen 1967, MNNHP 1993, Midwestern Ecology Working Group n.d., WNHIP unpubl. data

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Paper Birch / Sugar Maple - Mixed Hardwoods Forest

***Betula papyrifera / Acer saccharum* - Mixed Hardwoods Forest**
Paper Birch / Sugar Maple - Mixed Hardwoods Forest
Identifier: CEGL002464

NVC CLASSIFICATION

Division	Eastern North American Cool Temperate Forest (1.C.2.Na)
Macrogroup	Northern Mesic Hardwood & Conifer Forest (M014)
Group	Northern Hardwood - Hemlock - White Pine Forest (G163)
Association (Common name)	Paper Birch / Sugar Maple - Mixed Hardwoods Forest

ELEMENT CONCEPT

Global Summary: This paper birch successional forest type is found in the boreal regions of the Great Lakes of the United States and Canada and elsewhere in central Canada and the northeastern United States. Stands are often small, and found on slopes or in somewhat recently burned or otherwise disturbed areas. It has a moderately open to closed canopy dominated strongly by *Betula papyrifera* (paper birch). *Populus tremuloides* (quaking aspen), *Populus grandidentata* (bigtooth aspen), or *Acer rubrum* (red maple) may be present in smaller amounts. Tree reproduction layers are dominated by later successional deciduous trees. *Acer saccharum* (sugar maple) is often the dominant species in these layers. *Acer rubrum* (red maple), *Betula alleghaniensis* (yellow birch), *Fagus grandifolia* (American beech), and *Quercus rubra* (northern red oak) are common components in some areas. Minor amounts of conifers including *Pinus strobus* (eastern white pine) or, in the Northeast *Picea rubens* (red spruce), may be present. The shrub layer is dominated by *Acer spicatum* (mountain maple) and *Corylus cornuta* (beaked hazelnut). The understory contains species such as *Aralia nudicaulis* (wild sarsaparilla), *Eurybia macrophylla* (bigleaf aster), *Clintonia borealis* (bluebead), *Cornus canadensis* (bunchberry dogwood), *Maianthemum canadense* (Canada mayflower), *Dryopteris intermedia* (intermediate woodfern), and *Trientalis borealis* (starflower). Diagnostic features include dominance by *Betula papyrifera* (paper birch), and the presence of a variety of hardwood species in the understory, including *Acer saccharum* (sugar maple), *Acer rubrum* (red maple), *Betula alleghaniensis* (yellow birch), *Fagus grandifolia* (American beech), and *Quercus rubra* (northern red oak).

ENVIRONMENTAL DESCRIPTION

Saint Croix National Scenic Riverway Environment: This paper birch successional forest was sampled once in the park. The site is a steep, northeast-facing midslope with well-drained loamy sand soil. The unvegetated surface is dominated by leaf litter (88% cover) with some wood (6%), bare soil (3%) and dead plant stems (3%). Evidence of disturbance includes abundant downed wood.
Global Environment: Stands are often small, and found on shaded north-facing slopes or in recently burned areas (MNNHP 1993). In the northeastern United States, stands may be more extensive and are not restricted to north-facing slopes.

VEGETATION DESCRIPTION

Saint Croix National Scenic Riverway Vegetation: The moderate (60% cover) tree canopy, 10-15 m tall, is dominated by *Betula papyrifera* (paper birch) and includes small amounts of *Acer rubrum* (red maple) and *Ostrya virginiana* (hophornbeam). The sparse (30%) subcanopy (5-10 m) is dominated by *Ostrya virginiana* (hophornbeam) with small amounts of *Acer rubrum* (red maple) and *Tilia americana* (American basswood). The moderate (50%) tall-shrub layer (2-5 m) is dominated by *Corylus cornuta* (beaked hazelnut) and includes canopy species as well as *Cornus alternifolia* (alternateleaf dogwood). The very sparse (10%) short-shrub layer (0.5-1 m) includes equal amounts of *Amelanchier sanguinea* (roundleaf serviceberry), *Cornus alternifolia* (alternateleaf dogwood), *Corylus cornuta* (beaked hazelnut), *Diervilla lonicera* (northern bush honeysuckle), *Ribes cynosbati* (eastern prickly gooseberry), *Rubus allegheniensis* (Allegheny blackberry), *Rubus pubescens* (dwarf red blackberry), and *Vaccinium angustifolium* (lowbush blueberry) (dwarf-shrub). The very sparse (10%) herbaceous layer includes equal amounts of *Anemone quinquefolia* (wood anemone), *Clintonia borealis* (bluebead), *Galium circaezans* (licorice bedstraw), *Hepatica nobilis* var. *obtusa* (roundlobe hepatica), *Maianthemum canadense* (Canada mayflower), *Mitchella repens* (partridgeberry), *Orthilia secunda* (sidebells wintergreen), *Pyrola elliptica* (waxflower shinleaf), and *Thalictrum dioicum* (early meadowrue).
Global Vegetation: This type has a moderately open to closed canopy dominated strongly (>90%) by *Betula papyrifera* (paper birch). *Populus tremuloides* (quaking aspen) may be present in small amounts. Tree reproduction layers are dominated by later successional deciduous trees. *Acer saccharum* (sugar maple) is often the dominant species in these layers. *Acer rubrum* (red maple), *Betula alleghaniensis* (yellow birch), and *Quercus rubra* (northern red oak) are common components. The shrub layer is dominated by *Acer spicatum* (mountain maple) and *Corylus cornuta* (beaked hazelnut). The understory contains species such as *Aralia nudicaulis* (wild sarsaparilla), *Eurybia macrophylla* (bigleaf aster), *Clintonia borealis* (bluebead), *Cornus canadensis* (bunchberry dogwood), *Maianthemum canadense* (Canada mayflower), and *Trientalis borealis* (starflower). Diagnostic features include strong dominance by *Betula papyrifera* (paper birch), and the presence of a variety of hardwood species in the understory, including *Acer saccharum* (sugar maple), *Acer rubrum* (red maple), *Betula alleghaniensis* (yellow birch), and *Quercus rubra* (northern red oak) (Sims et al. 1989, MNNHP 1993).

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MOST ABUNDANT SPECIES

Saint Croix National Scenic Riverway

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Betula papyrifera* (paper birch)
Tree subcanopy	Broad-leaved deciduous tree	*Ostrya virginiana* (hophornbeam)
Tall shrub/sapling	Broad-leaved deciduous shrub	*Corylus cornuta* (beaked hazelnut)

CHARACTERISTIC SPECIES

Saint Croix National Scenic Riverway: *Betula papyrifera* (paper birch), *Corylus cornuta* (beaked hazelnut), *Ostrya virginiana* (hophornbeam)

CONSERVATION STATUS RANK

Global Rank & Reasons: G4? (3-Oct-1996).

CLASSIFICATION

Status: Standard

Classification Confidence: 2 - Moderate

Global Comments: This type is currently only described from northeastern Minnesota, northwestern Ontario, and northern New England. Information is needed from other parts of the range. It is very similar to, and may not be sufficiently distinctive floristically to warrant separation from, either the *Betula papyrifera / Diervilla lonicera - (Abies balsamea)* Forest (CEGL002463), which contains a boreal conifer understory, or the mixed *Populus tremuloides - Betula papyrifera / Acer saccharum* - Mixed Hardwoods Forest (CEGL002468). *Clintonia borealis* (bluebead), *Lycopodium annotinum* (stiff clubmoss), and mosses may be more common in this community, whereas *Eurybia macrophylla* (bigleaf aster) may be more common in CEGL002468, or other early successional community types dominated by both *Populus tremuloides* (quaking aspen) and *Betula papyrifera* (paper birch) (MNNHP 1993), but these suggested patterns need further study.

Global Similar Associations:

- *Betula papyrifera / Diervilla lonicera - (Abies balsamea)* Forest (CEGL002463) birch type with conifer understory.
- *Populus tremuloides - Betula papyrifera / Acer saccharum* - Mixed Hardwoods Forest (CEGL002468) the mixed aspen-birch type.

Global Related Concepts:

- Beech - Birch - Maple Forest (Gawler 2002) **>**
- Beech - Sugar Maple: 60 (Eyre 1980) **>**
- CNE mesic hardwood forest on acidic bedrock/till (Rawinski 1984) **>**
- Mesic Northern Hardwood Forest (Beech-Birch-Maple Forest) (Thompson 1996) **>**
- Paper Birch Forest Northern Hardwoods Subtype (MNNHP 1993) **=**
- Successional hardwoods (NAP pers. comm. 1998) **?**
- Sugar Maple - Beech - Yellow Birch: 25 (Eyre 1980) **>**
- Sugar Maple: 27 (Eyre 1980) **>**
- White Birch Hardwood and Mixedwood (V4) (Sims et al. 1989) **>**

ELEMENT DISTRIBUTION

Global Range: This paper birch boreal forest type is found in the boreal regions of the Great Lakes of the United States and Canada and elsewhere in central Canada and the northeastern United States.

Nations: CA, US

States/Provinces: MA, ME, MN:S4?, NH, NY, ON, QC:S4?, VT, WI?

TNC Ecoregions: 35:C, 47:C, 48:C, 61:C, 63:C

USFS Ecoregions (1994/95): 212Lb:C??, 212Mb:C??, 212Na:CPP, 212Nb:CPP, 212Nc:CPP, 221Ai:CCC, 221Al:CCC, 251Aa:CCC, M212Bb:CCC, M212Bc:CCC, M212Bd:CCP, M212Cb:CCC

Federal Lands: NPS (Saint Croix); USFS (Chippewa, Superior?); USFWS (Pondicherry)

ELEMENT SOURCES

Saint Croix National Scenic Riverway Map Code: FPH

Saint Croix National Scenic Riverway Plots: SACN.278.

Local Description Authors: M.J. Russo

Global Description Authors: J. Drake

References: Edinger et al. 2002, Eyre 1980, Gawler 2002, MNNHP 1993, Midwestern Ecology Working Group n.d., NAP pers. comm. 1998, Rawinski 1984, Sims et al. 1989, Swain and Kearsley 2001, Thompson 1996, Thompson and Sorenson 2000

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White Pine - (Red Pine) Driftless Bluff Forest

***Pinus strobus - (Pinus resinosa)* Driftless Bluff Forest**
Eastern White Pine - (Red Pine) Driftless Bluff Forest
Identifier: CEGL002378

NVC CLASSIFICATION

Division	Eastern North American Cool Temperate Forest (1.C.2.Na)
Macrogroup	Northern Mesic Hardwood & Conifer Forest (M014)
Group	Northern Hardwood - Hemlock - White Pine Forest (G163)
Association (Common name)	White Pine - (Red Pine) Driftless Bluff Forest

ELEMENT CONCEPT

Global Summary: This pine bluff forest occurs on steep sandstone or, rarely, limestone bluffs in the Driftless Area of the upper midwestern United States. Stands occur in small patches 0.1-2 ha in size. The soils are shallow, poorly developed, and often acidic. Runoff and leaching are severe due to the slope and the porous nature of the bedrock. *Pinus strobus* (eastern white pine) typically dominates the overstory, with *Pinus resinosa* (red pine) and *Tsuga canadensis* (eastern hemlock) either present or locally dominant. Other hardwood associates include *Betula papyrifera* (paper birch), *Populus tremuloides* (quaking aspen), *Quercus alba* (white oak), *Quercus velutina* (black oak), *Ostrya virginiana* (hophornbeam). The composition of the understory is variable but typically contains herbs and shrubs with more northerly distributions, such as *Diervilla lonicera* (northern bush honeysuckle), *Vaccinium myrtilloides* (velvetleaf huckleberry), *Eurybia macrophylla* (bigleaf aster), *Chimaphila umbellata* (pipsissewa), *Gaultheria procumbens* (eastern teaberry), *Lycopodium obscurum* (rare clubmoss), *Mitchella repens* (partridgeberry), *Pyrola americana* (American wintergreen), and *Trientalis borealis* (starflower), as well as some prairie species, including *Amorpha canescens* (leadplant), *Coreopsis palmata* (stiff tickseed), and *Dodecatheon meadia* (pride of Ohio). This community is a relict, thought to have existed in the Driftless Area since at least the Wisconsin glaciation.

ENVIRONMENTAL DESCRIPTION

Global Environment: This community occurs on sloping or level sandstone or, rarely, on quartzite bluffs. The sandstone is either St. Peter or Franconia. McIntosh (1950) studied 22 stands of this type and found them on all aspects except SE. Soils are sandy, shallow, usually acidic, and excessively drained. The most common site is a waterworn cliff with the undercutting stream still present at the cliff base. Considerable light penetrates to the forest floor even though the trees are close together.

VEGETATION DESCRIPTION

Global Vegetation: The vegetation is a closed to open canopy of conifer or mixed conifer-hardwood trees. The canopy is typically dominated by *Pinus strobus* (eastern white pine). Occasionally *Tsuga canadensis* (eastern hemlock) is mixed with the pine, or may dominate in certain areas, typically the most steep areas. Some of the stands examined by McIntosh (1950) had pine seedlings and saplings in the understory, while others were dominated by young hardwoods, such as *Betula papyrifera* (paper birch), *Populus tremuloides* (quaking aspen), *Quercus alba* (white oak), *Quercus velutina* (black oak), *Ostrya virginiana* (hophornbeam), or *Tilia americana* (American basswood). Less common conifer associates include *Juniperus virginiana* (eastern red-cedar) and *Pinus banksiana* (jack pine). Many of the herbs and shrubs of the northern pine forests are present in these forests. Typical shrub associates include *Diervilla lonicera* (northern bush honeysuckle) and *Vaccinium myrtilloides* (velvetleaf huckleberry). Less common shrubs include *Acer spicatum* (mountain maple), *Cornus canadensis* (bunchberry dogwood), *Corylus cornuta* (beaked hazelnut), *Prunus pensylvanica* (pin cherry), and *Prunus virginiana* (chokecherry). Typical herbs include *Maianthemum canadense* (Canada mayflower). Less common herb and dwarf-shrub associates may include *Eurybia macrophylla* (bigleaf aster), *Chimaphila umbellata* (pipsissewa), *Gaultheria procumbens* (eastern teaberry), *Lycopodium obscurum* (rare clubmoss), *Mitchella repens* (partridgeberry), *Pyrola americana* (American wintergreen), and *Trientalis borealis* (starflower). Other members of the understory are found more commonly on prairies, including *Amorpha canescens* (leadplant), *Coreopsis palmata* (stiff tickseed), and *Dodecatheon meadia* (pride of Ohio). Species typical of more southern hardwood stands include *Arisaema triphyllum* (Jack in the pulpit) and *Sanguinaria canadensis* (bloodroot). There is little chance of exchange of species between sites, and the makeup of adjacent communities can have a significant impact on understory composition. When a population of a species becomes extirpated in one site it is unlikely to reinvade due to the distance to another site (McIntosh 1950).

MOST ABUNDANT SPECIES

Global

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

CHARACTERISTIC SPECIES

Global: *Pinus resinosa* (red pine), *Pinus strobus* (eastern white pine)

OTHER NOTEWORTHY SPECIES

Global: Vulnerable: *Besseya bullii* (Bull's coraldrops, an endangered species in Minnesota; occurs on some sites in that state (Hannah Dunevitz, pers. comm.)., G3); **Other**: *Pinus banksiana* (jack pine, found on the drier portions of this community, G5)

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CONSERVATION STATUS RANK

Global Rank & Reasons: G2G3 (22-Jun-1998). This type has a naturally restricted distribution. McIntosh (1950) mentioned that some of the more accessible stands in his study had been logged.

CLASSIFICATION

Status: Standard
Classification Confidence: 2 - Moderate
Global Comments: This type should be compared to the more moist *Pinus strobus - Abies balsamea - Betula alleghaniensis* Driftless Forest (CEGL002111).
Global Similar Associations:
- *Pinus strobus - Abies balsamea - Betula alleghaniensis* Driftless Forest (CEGL002111)
- *Tsuga canadensis - Acer saccharum / (Hepatica nobilis* var. *acuta)* Driftless Forest (CEGL002597)

Global Related Concepts:
- Northern Dry-Mesic Forest White Pine-Red Pine Relict (Faber-Langendoen 2001) =
- White Pine Forest (Southeast Section) (MNNHP 1993) =

ELEMENT DISTRIBUTION

Global Range: This community occurs in many places in the Driftless Area of southwestern Wisconsin, and also in a few places in the area of Farmdale glaciation. It is also found in southeastern Minnesota and in very small occurrences in northeastern Iowa.
Nations: US
States/Provinces: IA:S1?, MN:S2, WI:S2
TNC Ecoregions: 46:C
USFS Ecoregions (1994/95): 222Lc:CCC, 222Ld:CCC, 222Le:CCC, 222Lf:CCC
Federal Lands: NPS (Saint Croix)

ELEMENT SOURCES

Saint Croix National Scenic Riverway Map Code: FPR
Local Description Authors:
Global Description Authors: J. Drake, D. Faber-Langendoen, and D. M. Ambrose
References: Cahayla-Wynne and Glenn-Lewis 1978, Curtis 1959, Faber-Langendoen 2001, INAI unpubl. data, MNNHP 1993, McIntosh 1950, Midwestern Ecology Working Group n.d., WNHIP unpubl. data

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Aspen - Birch - Red Maple Forest

***Populus tremuloides - Betula papyrifera - (Acer rubrum, Populus grandidentata)* Forest**
Quaking Aspen - Paper Birch - (Red Maple, Bigtooth Aspen) Forest
Identifier: CEGL002467

NVC CLASSIFICATION

Division	Eastern North American Cool Temperate Forest (1.C.2.Na)
Macrogroup	Northern Mesic Hardwood & Conifer Forest (M014)
Group	Northern Hardwood - Hemlock - White Pine Forest (G163)
Association (Common name)	Aspen - Birch - Red Maple Forest

ELEMENT CONCEPT

Global Summary: This aspen - birch - maple forest is found in the upper midwestern United States and southern and central Canada. Sites are on level to rolling topography, and on upper slopes or plateaus or in valley bottoms. The substrate is derived from glacial outwash, lacustrine deposits, or moraines. The soil is typically deep, sandy loam or loamy sand and well-drained. This deciduous forest community has a moderately closed canopy usually dominated by *Populus tremuloides* (quaking aspen) and *Betula papyrifera* (paper birch). *Acer rubrum* (red maple) and *Populus grandidentata* (bigtooth aspen) may be absent to dominant. Other minor components of the overstory may include *Abies balsamea* (balsam fir), *Pinus resinosa* (red pine), *Pinus strobus* (eastern white pine), *Picea glauca* (white spruce), and *Quercus rubra* (northern red oak). The shrub layer is approximately 2 m tall and often well-developed. The most abundant species are *Acer spicatum* (mountain maple), *Amelanchier* (serviceberry) spp., *Corylus cornuta* (beaked hazelnut), *Diervilla lonicera* (northern bush honeysuckle), and *Rosa acicularis* (prickly rose). Other shrubs present include *Lonicera canadensis* (American fly honeysuckle), *Rubus pubescens* (dwarf red blackberry), *Vaccinium angustifolium* (lowbush blueberry), and *Vaccinium myrtilloides* (velvetleaf huckleberry). The herbaceous layer tends to contain many species. Common species are *Aralia nudicaulis* (wild sarsaparilla), *Eurybia macrophylla* (bigleaf aster), *Clintonia borealis* (bluebead), *Maianthemum canadense* (Canada mayflower), *Trientalis borealis* (starflower), and *Viola* (violet) spp.

ENVIRONMENTAL DESCRIPTION

Saint Croix National Scenic Riverway Environment: This common aspen - birch - red maple forest was sampled 35 times in the park. Sites range from upland flats to gentle or moderate mid- and upper hillslopes and ridges of any aspect. Soils are generally moderately well- to well-drained loamy sand, sandy loam and silt loam; some sites are somewhat excessively drained and dry. The unvegetated surface is dominated by leaf litter (86-97% cover) with some large rocks (0-3%), wood (0-5%), bare soil (0-3%) and dead plant stems (2-8%). Evidence of disturbance includes past logging, erosion, downed wood, and the presence of exotic plants.
Global Environment: This community is mostly found on level to rolling topography. It can occur on upper slopes or plateaus or in valley bottoms (Ohmann and Ream 1971). The soil is typically deep, sandy loam or loamy sand (Alban et al. 1991). The sites are on glacial outwash, lacustrine deposits, or moraines (Ohmann and Ream 1971, Sims et al. 1989). Most are well-drained, however, this community can be found on somewhat poorly drained sites.

VEGETATION DESCRIPTION

Saint Croix National Scenic Riverway Vegetation: The sparse to moderately dense (30-70% cover) tree canopy, 10-35 m tall, is codominated by *Acer rubrum* (red maple), *Betula papyrifera* (paper birch), *Populus grandidentata* (bigtooth aspen), and *Populus tremuloides* (quaking aspen); additional species may include *Fraxinus pennsylvanica* (green ash), *Ostrya virginiana* (hophornbeam), *Quercus macrocarpa* (bur oak), *Quercus rubra* (northern red oak), *Tilia americana* (American basswood), and others. The very sparse to moderate (5-60%) subcanopy (5-15 m) is made up of canopy species. The very sparse to moderately sparse (5-40%) tall-shrub layer (2-5 m) and very sparse to moderate (5-70%) short-shrub layer (0.5-1 m) may include saplings of the canopy species, as well as *Amelanchier* (serviceberry) sp., *Cornus racemosa* (gray dogwood), *Cornus rugosa* (roundleaf dogwood), *Corylus americana* (American hazelnut), *Corylus cornuta* (beaked hazelnut), *Lonicera dioica* (limber honeysuckle), *Prunus serotina* (black cherry), *Prunus virginiana* (chokecherry), *Rubus* (blackberry) spp., *Viburnum rafinesquianum* (downy arrow-wood), and others. *Gaultheria procumbens* (eastern teaberry), *Vaccinium angustifolium* (lowbush blueberry), and/or *Vaccinium myrtilloides* (velvetleaf huckleberry) may form a very sparse (5-10%) dwarf-shrub layer. The sparse to dense (60%) herbaceous layer is often dominated by *Eurybia macrophylla* (bigleaf aster) and/or *Pteridium aquilinum* (western brackenfern) and may include *Amphicarpaea bracteata* (American hogpeanut), *Aralia nudicaulis* (wild sarsaparilla), *Athyrium filix-femina* (common ladyfern), *Carex gracillima* (graceful sedge), *Carex pensylvanica* (Pennsylvania sedge), *Maianthemum canadense* (Canada mayflower), *Onoclea sensibilis* (sensitive fern), *Oryzopsis asperifolia* (roughleaf ricegrass), *Osmunda claytoniana* (interrupted fern), *Viola sororia* (common blue violet), and others. In addition, this community may support Minnesota state-vulnerable *Juglans cinerea* (butternut), *Lysimachia quadrifolia* (whorled yellow loosestrife), *Pyrola minor* (snowline wintergreen) (Wisconsin state-critically imperiled), *Sanicula trifoliata* (largefruit blacksnakeroot), and *Waldsteinia fragarioides* (Appalachian barren strawberry), and Wisconsin state-vulnerable *Juglans cinerea* (butternut) and *Streptopus amplexifolius* (claspleaf twistedstalk).
Global Vegetation: This deciduous forest community has a moderately closed canopy usually dominated by *Populus tremuloides* (quaking aspen) and *Betula papyrifera* (paper birch). *Acer rubrum* (red maple) and *Populus grandidentata* (bigtooth aspen) may be absent to dominant. Other minor components of the overstory may include *Abies balsamea* (balsam fir), *Pinus resinosa* (red pine), *Pinus strobus* (eastern white pine), *Picea glauca* (white spruce), and *Quercus rubra* (northern red oak). The shrub layer is approximately 2 m tall and often well-developed (MNNHP 1993). The most abundant species are *Acer spicatum* (mountain maple),

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Amelanchier (serviceberry) spp., *Corylus cornuta* (beaked hazelnut), *Diervilla lonicera* (northern bush honeysuckle), and *Rosa acicularis* (prickly rose). Other shrubs present include *Lonicera canadensis* (American fly honeysuckle), *Rubus pubescens* (dwarf red blackberry), *Vaccinium angustifolium* (lowbush blueberry), and *Vaccinium myrtilloides* (velvetleaf huckleberry). The herbaceous layer tends to contain many species. Common species include *Aralia nudicaulis* (wild sarsaparilla), *Eurybia macrophylla* (bigleaf aster), *Clintonia borealis* (bluebead), *Maianthemum canadense* (Canada mayflower), *Trientalis borealis* (starflower), and *Viola* (violet) spp.

MOST ABUNDANT SPECIES

Saint Croix National Scenic Riverway

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Acer rubrum* (red maple), *Betula papyrifera* (paper birch), *Populus grandidentata* (bigtooth aspen), *Populus tremuloides* (quaking aspen), *Tilia americana* (American basswood)
Tall shrub/sapling	Broad-leaved deciduous shrub	*Cornus racemosa* (gray dogwood), *Corylus americana* (American hazelnut)
Herb (field)	Forb	*Eurybia macrophylla* (bigleaf aster)
Herb (field)	Fern or fern ally	*Pteridium aquilinum* (western brackenfern)

CHARACTERISTIC SPECIES

Saint Croix National Scenic Riverway: *Acer rubrum* (red maple), *Betula papyrifera* (paper birch), *Cornus racemosa* (gray dogwood), *Corylus americana* (American hazelnut), *Eurybia macrophylla* (bigleaf aster), *Populus grandidentata* (bigtooth aspen), *Populus tremuloides* (quaking aspen), *Pteridium aquilinum* (western brackenfern), *Tilia americana* (American basswood)

OTHER NOTEWORTHY SPECIES

Saint Croix National Scenic Riverway: Vulnerable: *Juglans cinerea* (butternut, MN & WI state-vulnerable, G4), *Lysimachia quadrifolia* (whorled yellow loosestrife, MN state-vulnerable, G5), *Pyrola minor* (snowline wintergreen, WI state-critically imperiled & MN state-vulnerable, G5), *Sanicula trifoliata* (largefruit blacksnakeroot, MN state-vulnerable, G4), *Streptopus amplexifolius* (claspleaf twistedstalk, WI state-vulnerable, G5), *Waldsteinia fragarioides* (Appalachian barren strawberry, MN state-vulnerable, G5); **Exotic/Invasive**: *Agrostis gigantea* (redtop, invasive/exotic, Medium/Low), *Calystegia sepium* (hedge false bindweed, invasive/exotic), *Convolvulus arvensis* (field bindweed, invasive/exotic, Medium/Low), *Hieracium aurantiacum* (orange hawkweed, invasive/exotic, Medium/Low), *Lonicera tatarica* (Tatarian honeysuckle, invasive/exotic, High/Medium), *Poa pratensis* (Kentucky bluegrass, invasive/exotic, Medium), *Rhamnus cathartica* (common buckthorn, invasive/exotic, High/Medium), *Rosa rugosa* (rugosa rose, invasive/exotic, Low), *Taraxacum officinale* (common dandelion, invasive/exotic), *Verbascum thapsus* (common mullein, invasive/exotic, Medium)
Global: Other: *Trillium chloropetalum* var. *giganteum* (giant wakerobin, G5T3?)

CONSERVATION STATUS RANK

Global Rank & Reasons: G5 (3-Oct-1996).

CLASSIFICATION

Status: Standard
Classification Confidence: 2 - Moderate
Global Comments: In Michigan, *Quercus rubra* (northern red oak) may be present. This type can result from removal of conifers by logging; e.g., Wisconsin does not track this type for conservation purposes because it most commonly establishes after logging of spruce-fir stands. Stands with understories of pines or mixed aspen-birch-pines best fit under the mixed evergreen-deciduous types (e.g., white pine - aspen - birch forest, *Pinus strobus - Populus tremuloides / Corylus cornuta* Forest (CEGL002479)).
Global Similar Associations:
- *Pinus strobus - Populus tremuloides / Corylus cornuta* Forest (CEGL002479)
- *Populus tremuloides - Betula papyrifera / (Abies balsamea, Picea glauca)* Forest (CEGL002466)
- *Populus tremuloides - Betula papyrifera / Acer saccharum* - Mixed Hardwoods Forest (CEGL002468)

Global Related Concepts:
- Aspen - Birch Forest (MNNHP 1993) =
- Aspen Hardwood (V5) (Sims et al. 1989) =
- Cloquet Site (Alban et al. 1991) =
- Dry-Mesic Northern Forest - Aspen-Birch (Chapman et al. 1989) =
- Maple (Yellow Birch) Hardwood and Mixedwood (V3.1) (Sims et al. 1997) =
- Maple - Aspen - Birch (Ohmann and Ream 1971) =
- Northern Mesic Forest Aspen-Birch-Red Maple Subtype (Faber-Langendoen 2001) =

ELEMENT DISTRIBUTION

Global Range: This aspen - birch - maple forest is found in the upper midwestern United States and southern and central Canada, ranging from Minnesota and Manitoba east to Michigan, Ontario and possibly Quebec.
Nations: CA, US
States/Provinces: MI:S5, MN:S4?, ON, QC:S5?, WI:S5
TNC Ecoregions: 46:C, 47:C, 48:C

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USFS Ecoregions (1994/95): 212Ha:CCP, 212Hb:CCP, 212He:CCP, 212Hh:CCP, 212Hi:CCC, 212Hj:CCP, 212Hk:CCP, 212Hl:CCC, 212Hn:CCP, 212Ho:CCC, 212Hp:CC?, 212Hw:CCC, 212Ia:CCC, 212Ib:CC?, 212Ja:CPP, 212Jb:CPP, 212Jc:CPP, 212Je:CPP, 212Jf:CPP, 212Jj:CPP, 212Jk:CPP, 212Jl:CPP, 212Jm:CPP, 212Jn:CPP, 212Jo:CPP, 212Jr:CPP, 212Ka:CCP, 212Kb:CCC, 212La:CCC, 212Mb:CCC, 212Na:CCP, 212Nb:CCP, 212Nc:CCC, 222Ma:CCC, 222Md:CCC

Federal Lands: NPS (Apostle Islands, Isle Royale, Saint Croix, Sleeping Bear Dunes, Voyageurs); USFS (Chequamegon, Chequamegon-Nicolet, Chippewa, Huron-Manistee?, Huron?, Manistee?, Nicolet, Ottawa, Superior)

ELEMENT SOURCES

Saint Croix National Scenic Riverway Map Code: FAM

Saint Croix National Scenic Riverway Plots: SACN.56, SACN.201, SACN.202, SACN.206, SACN.214, SACN.219, SACN.229, SACN.239, SACN.273, SACN.0362, SACN.0662, SACN.4001, SACN.4002, SACN.4003, SACN.4006, SACN.4014, SACN.4015, SACN.4019, SACN.4023, SACN.4025, SACN.5060, SACN.5113, SACN.5119, SACN.5133, SACN.5134, SACN.5135, SACN.5136, SACN.7479, SACN.7480, SACN.7481, SACN.7482, SACN.7483, SACN.7511, SACN.7515, SACN.7521.

Local Description Authors: M.J. Russo

Global Description Authors: J. Drake

References: Alban et al. 1991, Chapman et al. 1989, Faber-Langendoen 2001, Hop et al. 2010a, MNNHP 1993, Midwestern Ecology Working Group n.d., Ohmann and Ream 1971, Sims et al. 1989, Sims et al. 1997, TNC 1999b, WNHIP unpubl. data

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Aspen - Birch / Sugar Maple - Mixed Hardwoods Forest

***Populus tremuloides - Betula papyrifera / Acer saccharum* - Mixed Hardwoods Forest**
Quaking Aspen - Paper Birch / Sugar Maple - Mixed Hardwoods Forest
Identifier: CEGL002468

NVC CLASSIFICATION

Division	Eastern North American Cool Temperate Forest (1.C.2.Na)
Macrogroup	Northern Mesic Hardwood & Conifer Forest (M014)
Group	Northern Hardwood - Hemlock - White Pine Forest (G163)
Association (Common name)	Aspen - Birch / Sugar Maple - Mixed Hardwoods Forest

ELEMENT CONCEPT

Global Summary: This boreal aspen - birch forest type is found in the north-central United States and southern Canada on a variety of mesic upland locations. This community has been found on rich sites over clay or silt loam soils. Deciduous trees dominate the canopy and tree reproduction layers of this community. Conifers, when present, are widely scattered. Tree density is moderate to high, but substantial light penetrates the canopy due to the growth form of the dominant species, *Betula papyrifera* (paper birch) and *Populus tremuloides* (quaking aspen). Other northern hardwoods may be found in the canopy but are more common in the sapling layer. These include *Acer rubrum* (red maple), *Acer saccharum* (sugar maple), *Betula alleghaniensis* (yellow birch), *Fraxinus pennsylvanica* (green ash), *Ostrya virginiana* (hophornbeam), *Tilia americana* (American basswood), and *Ulmus americana* (American elm) (in more mesic sites). *Fagus grandifolia* (American beech) and *Tsuga canadensis* (eastern hemlock) become more common in eastern examples of this type. The shrub stratum is usually not well-developed due to shading from the canopy and subcanopy trees. Scattered *Acer spicatum* (mountain maple), *Corylus cornuta* (beaked hazelnut), *Diervilla lonicera* (northern bush honeysuckle) and *Rubus pubescens* (dwarf red blackberry) are typical shrubs. *Taxus canadensis* (Canada yew) and *Acer pensylvanicum* (striped maple) are present on some sites. The herbaceous layer contains species such as *Aralia nudicaulis* (wild sarsaparilla), *Eurybia macrophylla* (bigleaf aster), *Clintonia borealis* (bluebead), *Maianthemum canadense* (Canada mayflower), *Oryzopsis asperifolia* (roughleaf ricegrass), and *Streptopus lanceolatus* var. *longipes* (twistedstalk). Mosses include *Dicranum flagellare* (dicranum moss), *Dicranum montanum* (montane dicranum moss), and others.

ENVIRONMENTAL DESCRIPTION

Saint Croix National Scenic Riverway Environment: This aspen - sugar maple forest was sampled once in the park. The site is a terrace crest that slopes gently to the southeast and with pit-and-mound microtopography. The soil is comprised of boulders and pebbles covered by organic loam and sand. No evidence of disturbance was reported.
Global Environment: This community is found on a variety of rich mesic sites over clay or silt loam soils. Alban et al. (1991) identified two examples of this community in Minnesota and upper Michigan. Both sites had 6 cm of organic material over the mineral soil. One site was on clay soil and the other on silt loam.

VEGETATION DESCRIPTION

Saint Croix National Scenic Riverway Vegetation: No height data and only partial stratum differentiation were provided. The tree canopy is dominated by *Populus tremuloides* (quaking aspen) (62.5% cover) with *Acer saccharum* (sugar maple) and *Quercus rubra* (northern red oak) (both 37.5%); additional species at lesser amounts include *Carpinus caroliniana* (American hornbeam), *Fraxinus pennsylvanica* (green ash), *Ostrya virginiana* (hophornbeam), *Quercus macrocarpa* (bur oak), and *Tilia americana* (American basswood). The shrub layer is sparse and includes very small amounts of *Cornus racemosa* (gray dogwood), *Corylus cornuta* (beaked hazelnut), *Diervilla lonicera* (northern bush honeysuckle), *Dirca palustris* (eastern leatherwood), *Lonicera hirsuta* (hairy honeysuckle), *Prunus virginiana* (chokecherry), *Rubus* (blackberry) sp., and *Viburnum rafinesquianum* (downy arrow-wood). The herbaceous layer is dominated by *Eurybia macrophylla* (bigleaf aster) (62.5%) and includes lesser amounts of *Anemone quinquefolia* (wood anemone), *Carex pensylvanica* (Pennsylvania sedge), *Desmodium glutinosum* (pointedleaf ticktrefoil), *Hepatica nobilis* (hepatica), *Oryzopsis asperifolia* (roughleaf ricegrass), *Osmunda claytoniana* (interrupted fern), *Pteridium aquilinum* (western brackenfern), *Uvularia grandiflora* (largeflower bellwort), *Viola pubescens* (downy yellow violet), and others.
Global Vegetation: Deciduous trees dominate the canopy and tree reproduction layers of this community. Conifers, when present, are widely scattered. Tree density is moderate to high, but substantial light penetrates the canopy due to the growth form of the dominant species, *Betula papyrifera* (paper birch) and *Populus tremuloides* (quaking aspen). Other northern hardwoods may be found in the canopy but are more common in the sapling layer. These include *Acer rubrum* (red maple), *Acer saccharum* (sugar maple), *Betula alleghaniensis* (yellow birch), *Fraxinus pennsylvanica* (green ash), *Ostrya virginiana* (hophornbeam), *Tilia americana* (American basswood), and *Ulmus americana* (American elm) (in more mesic sites). *Fagus grandifolia* (American beech) and *Tsuga canadensis* (eastern hemlock) become more common in eastern examples of this type. The shrub stratum is usually not well-developed due to shading from the canopy and subcanopy trees. Scattered *Acer spicatum* (mountain maple), *Corylus cornuta* (beaked hazelnut), *Diervilla lonicera* (northern bush honeysuckle), and *Rubus pubescens* (dwarf red blackberry) are typical shrubs. *Taxus canadensis* (Canada yew) and *Acer pensylvanicum* (striped maple) are present on some sites. For example, Hansen et al. (1973) found *Taxus canadensis* (Canada yew) to be one of the more abundant shrubs on Isle Royale in Lake Superior. They also found this type to have the most diverse herbaceous layer of their sites. The herbaceous layer contains species such as *Aralia nudicaulis* (wild sarsaparilla), *Eurybia macrophylla* (bigleaf aster), *Clintonia borealis* (bluebead), *Maianthemum canadense* (Canada mayflower), *Oryzopsis*

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asperifolia (roughleaf ricegrass), and *Streptopus lanceolatus* (twistedstalk). Mosses include *Dicranum flagellare* (dicranum moss), *Dicranum montanum* (montane dicranum moss), and others (Chambers et al. 1997).

MOST ABUNDANT SPECIES

Saint Croix National Scenic Riverway

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Acer saccharum* (sugar maple), *Populus tremuloides* (quaking aspen), *Quercus rubra* (northern red oak)
Herb (field)	Forb	*Eurybia macrophylla* (bigleaf aster)

CHARACTERISTIC SPECIES

Saint Croix National Scenic Riverway: *Acer saccharum* (sugar maple), *Eurybia macrophylla* (bigleaf aster), *Populus tremuloides* (quaking aspen), *Quercus rubra* (northern red oak)

CONSERVATION STATUS RANK

Global Rank & Reasons: G5 (3-Oct-1996). This type is probably more extensive today than it was prior to European settlement. For example, in Wisconsin, over half of the northern mesic forests - the hemlock hardwood and sugar maple types - have been converted to this type since about 1850.

CLASSIFICATION

Status: Standard

Classification Confidence: 2 - Moderate

Global Comments: This type includes stands dominated by a mixture of *Populus tremuloides* (quaking aspen) and *Betula papyrifera* (paper birch), with as little as 10% *Populus tremuloides* (quaking aspen). Pure stands of *Betula papyrifera* (paper birch) (>90%) are classified as a pure *Betula* (birch) type, *Betula papyrifera / Acer saccharum* - Mixed Hardwoods Forest (CEGL002464).

Global Similar Associations:

- *Betula papyrifera / Acer saccharum* - Mixed Hardwoods Forest (CEGL002464) This is a pure *Betula papyrifera* type over hardwood regeneration.
- *Deschampsia caespitosa - (Sporobolus heterolepis, Schizachyrium scoparium) - Carex crawei - Packera paupercula* Herbaceous Vegetation (CEGL005110) This is an aspen-birch type that lacks a diverse hardwood or a conifer understory.
- *Populus tremuloides - Betula papyrifera - (Acer rubrum, Populus grandidentata)* Forest (CEGL002467)
- *Populus tremuloides - Betula papyrifera / (Abies balsamea, Picea glauca)* Forest (CEGL002466)

Global Related Concepts:

- Aspen - Birch Forest Northern Hardwoods Subtype (MNNHP 1993) =
- Baltimore Flats (Alban et al. 1991) <
- CNE mesic hardwood forest on acidic bedrock/till (Rawinski 1984) >
- Mesic Northern Forest - Hemlock-Sugar Maple (Chapman et al. 1989) >
- Northern Mesic Forest Aspen-Birch / Hardwoods Subtype (Faber-Langendoen 2001) =
- Paper Birch - Sugar Maple - Yellow Birch (Hansen et al. 1973) =
- Pike Bay (Alban et al. 1991) <
- Sugar Maple-White Birch-Red Maple-Fly Honeysuckle-Beaked Hazel (V13) (Chambers et al. 1997) **?**
- Sugar Maple-White Birch-Trembling Aspen-Red Maple-Balsam Fir Shrub (V12) (Chambers et al. 1997) **?**

ELEMENT DISTRIBUTION

Global Range: This boreal aspen - birch forest type is found in the north-central United States and southern Canada on a variety of mesic upland locations, ranging from Minnesota and Ontario east to Michigan.

Nations: CA, US

States/Provinces: MI, MN:S4?, ON, QC:S4S5, WI:S5

TNC Ecoregions: 47:C, 48:C

USFS Ecoregions (1994/95): 212Ha:CPP, 212Hb:CPP, 212He:CPP, 212Hh:CPP, 212Hi:CPP, 212Hj:CPP, 212Hk:CPP, 212Hm:CPP, 212Hn:CPP, 212Ho:CPP, 212Hq:CPP, 212Hr:CPP, 212Hs:CPP, 212Ht:CPP, 212Hv:CPP, 212Ia:CCC, 212Ib:CCP, 212Ja:CPP, 212Jb:CPP, 212Jc:CPP, 212Je:CPP, 212Jf:CPP, 212Jj:CPP, 212Jk:CPP, 212Jl:CPP, 212Jm:CPP, 212Jn:CPP, 212Jo:CPP, 212Jr:CPP, 212Ka:CPP, 212Lb:C??, 212Mb:CPP, 212Na:CPP, 212Nb:CPP, 212Nc:CPP

Federal Lands: NPS (Apostle Islands, Isle Royale, Saint Croix); USFS (Chequamegon, Chequamegon-Nicolet, Chippewa, Huron, Huron-Manistee, Manistee, Nicolet, Ottawa)

ELEMENT SOURCES

Saint Croix National Scenic Riverway Map Code: FAM

Saint Croix National Scenic Riverway Plots: SACN.7516.

Local Description Authors: M.J. Russo

Global Description Authors: J. Drake

References: Alban et al. 1991, Chambers et al. 1997, Chapman et al. 1989, Faber-Langendoen 2001, Hansen et al. 1973, Hop et al. 2010a, MNNHP 1993, Midwestern Ecology Working Group n.d., Rawinski 1984, TNC 1999b, WNHIP unpubl. data

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Northern Red Oak - Sugar Maple Forest

***Quercus rubra - Acer saccharum - (Betula alleghaniensis)* Forest**
Northern Red Oak - Sugar Maple - (Yellow Birch) Forest
Identifier: CEGL002461

NVC CLASSIFICATION

Division	Eastern North American Cool Temperate Forest (1.C.2.Na)
Macrogroup	Northern Mesic Hardwood & Conifer Forest (M014)
Group	Northern Hardwood - Hemlock - White Pine Forest (G163)
Association (Common name)	Northern Red Oak - Sugar Maple Forest

ELEMENT CONCEPT

Global Summary: This red oak - hardwood forest is found in the sub-boreal/mixed hardwood-conifer region of the Great Lakes, in both the United States and Canada. Stands are found on dry to mesic ridgetops and upper to midslopes, occasionally with bedrock outcrops, and on glacial outwash. Soils are moderately shallow (30-60 cm) to deep, varying from fine sands to loams and clay loams. Dominant species in the tree canopy include *Quercus rubra* (northern red oak), *Acer saccharum* (sugar maple), and *Acer rubrum* (red maple). Associates include *Betula papyrifera* (paper birch), *Betula alleghaniensis* (yellow birch), *Pinus strobus* (eastern white pine), *Populus tremuloides* (quaking aspen), *Populus grandidentata* (bigtooth aspen), and in the eastern part of its range, *Fagus grandifolia* (American beech), *Fraxinus americana* (white ash), and *Ostrya virginiana* (hophornbeam). Subcanopy species typically include the maples. Shrubs include *Amelanchier laevis* (Allegheny serviceberry), *Acer pensylvanicum* (striped maple), *Corylus cornuta* (beaked hazelnut), *Hamamelis virginiana* (American witch-hazel), and *Lonicera canadensis* (American fly honeysuckle). Herbs include *Aralia nudicaulis* (wild sarsaparilla), *Eurybia macrophylla* (bigleaf aster), *Dryopteris carthusiana* (spinulose woodfern), *Maianthemum canadense* (Canada mayflower), *Mitchella repens* (partridgeberry) (creeping semi-shrub), *Polygonatum pubescens* (hairy Solomon's seal), and *Pteridium aquilinum* (western brackenfern). Diagnostic species include *Quercus rubra* (northern red oak) along with ground layer species typical of the mixed hardwood-conifer region.

ENVIRONMENTAL DESCRIPTION

Saint Croix National Scenic Riverway Environment: This common northern red oak - sugar maple forest was sampled at 33 locations in the park. Sites include upland flats and gentle to somewhat steep hill slopes and cliffs on any aspect. Soils may be rapidly drained sand, rapidly to moderately well-drained sandy loam or well-drained loamy sand. The unvegetated surface is dominated by leaf litter (88-94% cover) with some large rocks (0-3%), wood (1-5%), bare soil (0-2%) and dead plant stems (2-7%). Evidence of disturbance includes trails, past logging, downed wood, past fire, and the presence of exotic plants.
Global Environment: Stands are found on glacial till (end and ground moraines), mesic portions of glacial outwash and glacial lakebeds, and, farther north, on dry to mesic ridgetops and upper to midslopes, occasionally with bedrock outcrops. Soils are moderately shallow (30-60 cm) to deep, varying from fine sands to loams and clay loams (Nowacki et al. 1990, Chambers et al. 1997). Site characteristics are well-described in central Ontario by Chambers et al. (1997) (ecosites 23.1 and 23.2).

VEGETATION DESCRIPTION

Saint Croix National Scenic Riverway Vegetation: The moderate to dense (60-80% cover) tree canopy, 10-35 m tall, is dominated by *Quercus rubra* (northern red oak) along with various combinations of *Acer rubrum* (red maple), *Acer saccharum* (sugar maple), *Betula papyrifera* (paper birch), *Carpinus caroliniana* (American hornbeam), *Ostrya virginiana* (hophornbeam), *Populus grandidentata* (bigtooth aspen), *Populus tremuloides* (quaking aspen), *Quercus alba* (white oak), *Quercus ellipsoidalis X rubra*, *Quercus macrocarpa* (bur oak), and *Tilia americana* (American basswood). The very sparse to moderate (5-60%) subcanopy (5-15 m) is made up of canopy species. The very sparse to sparse (5-30%) tall-shrub layer (1-5 m) and very sparse (5-20%) short-shrub layer (0.5-1 m) may include *Acer spicatum* (mountain maple), *Corylus americana* (American hazelnut), *Corylus cornuta* (beaked hazelnut), *Ostrya virginiana* (hophornbeam), *Ribes cynosbati* (eastern prickly gooseberry), and others. *Vaccinium angustifolium* (lowbush blueberry) may form a sparse (10%) dwarf-shrub layer. The very sparse to moderate (5-60%) herbaceous layer may be dominated by *Amphicarpaea bracteata* (American hogpeanut), *Carex pensylvanica* (Pennsylvania sedge), *Eurybia macrophylla* (bigleaf aster), and/or *Pteridium aquilinum* (western brackenfern); additional common herbs include *Aralia nudicaulis* (wild sarsaparilla), *Athyrium filix-femina* (common ladyfern), *Clintonia borealis* (bluebead), *Desmodium glutinosum* (pointedleaf ticktrefoil), *Oryzopsis asperifolia* (roughleaf ricegrass), *Osmunda claytoniana* (interrupted fern), *Polygonatum pubescens* (hairy Solomon's seal), *Streptopus lanceolatus* var. *longipes* (twistedstalk), and *Uvularia sessilifolia* (sessileleaf bellwort). In addition, this community may support Minnesota state-vulnerable *Desmodium nudiflorum* (nakedflower ticktrefoil), *Lysimachia quadrifolia* (whorled yellow loosestrife), and *Juglans cinerea* (butternut), and Wisconsin state-imperiled *Salix planifolia* (diamondleaf willow) and state-vulnerable *Cypripedium reginae* (showy lady's slipper) and *Juglans cinerea* (butternut).
Global Vegetation: The canopy is dominated by deciduous trees. Dominant species in the canopy include *Quercus rubra* (northern red oak), *Acer saccharum* (sugar maple), and *Acer rubrum* (red maple). Associates include *Betula papyrifera* (paper birch), *Betula alleghaniensis* (yellow birch), *Pinus strobus* (eastern white pine), *Populus tremuloides* (quaking aspen), *Populus grandidentata* (bigtooth aspen), and in the eastern part of its range, *Fagus grandifolia* (American beech), *Fraxinus americana* (white ash), and *Ostrya virginiana* (hophornbeam). Subcanopy species typically include the maples. Shrubs include *Amelanchier laevis* (Allegheny serviceberry), *Acer pensylvanicum* (striped maple), *Corylus cornuta* (beaked hazelnut), and *Lonicera canadensis* (American fly honeysuckle). Herbs include *Aralia nudicaulis* (wild sarsaparilla), *Eurybia macrophylla* (bigleaf aster), *Dryopteris carthusiana*

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(spinulose woodfern), *Maianthemum canadense* (Canada mayflower), *Mitchella repens* (partridgeberry) (creeping semi-shrub), *Polygonatum pubescens* (hairy Solomon's seal), and *Pteridium aquilinum* (western brackenfern). Diagnostic species include *Quercus rubra* (northern red oak) with ground layer species typical of the mixed hardwood/conifer region (Chambers et al. 1997).

MOST ABUNDANT SPECIES

Saint Croix National Scenic Riverway

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Acer rubrum* (red maple), *Acer saccharum* (sugar maple), *Populus grandidentata* (bigtooth aspen), *Quercus rubra* (northern red oak), *Tilia americana* (American basswood)
Tree subcanopy	Broad-leaved deciduous tree	*Ostrya virginiana* (hophornbeam)
Tall shrub/sapling	Broad-leaved deciduous shrub	*Corylus cornuta* (beaked hazelnut)
Herb (field)	Forb	*Amphicarpaea bracteata* (American hogpeanut), *Eurybia macrophylla* (bigleaf aster)
Herb (field)	Graminoid	*Carex pensylvanica* (Pennsylvania sedge)
Herb (field)	Fern or fern ally	*Pteridium aquilinum* (western brackenfern)

CHARACTERISTIC SPECIES

Saint Croix National Scenic Riverway: *Acer rubrum* (red maple), *Acer saccharum* (sugar maple), *Amphicarpaea bracteata* (American hogpeanut), *Carex pensylvanica* (Pennsylvania sedge), *Corylus cornuta* (beaked hazelnut), *Eurybia macrophylla* (bigleaf aster), *Ostrya virginiana* (hophornbeam), *Populus grandidentata* (bigtooth aspen), *Pteridium aquilinum* (western brackenfern), *Quercus rubra* (northern red oak), *Tilia americana* (American basswood), *Vaccinium angustifolium* (lowbush blueberry)

OTHER NOTEWORTHY SPECIES

Saint Croix National Scenic Riverway: Vulnerable: *Cypripedium reginae* (showy lady's slipper, WI state-vulnerable, G4), *Desmodium nudiflorum* (nakedflower ticktrefoil, MN state-vulnerable, G5), *Juglans cinerea* (butternut, MN & WI state-vulnerable, G4), *Lysimachia quadrifolia* (whorled yellow loosestrife, MN state-vulnerable, G5), *Salix planifolia* (diamondleaf willow, WI state-imperiled, G5); **Exotic/Invasive**: *Hieracium aurantiacum* (orange hawkweed, invasive/exotic, Medium/Low), *Lonicera tatarica* (Tatarian honeysuckle, invasive/exotic, High/Medium), *Poa pratensis* (Kentucky bluegrass, invasive/exotic, Medium), *Rhamnus cathartica* (common buckthorn, invasive/exotic, High/Medium), *Taraxacum officinale* (common dandelion, invasive/exotic), *Urtica dioica* (stinging nettle, invasive/exotic)

CONSERVATION STATUS RANK

Global Rank & Reasons: G4G5 (14-Aug-2009). This type often arises after logging or logging and fire, and may be as common, or more so, as it was prior to European settlement.

CLASSIFICATION

Status: Standard

Classification Confidence: 2 - Moderate

Global Comments: This association is similar to *Quercus rubra - (Acer saccharum*, *Quercus alba)* Forest (CEGL005017), which is more southerly and lacks northern trees such as *Betula alleghaniensis* (yellow birch) and possibly *Betula papyrifera* (paper birch). This association (CEGL002461) is found in Province 212 while CEGL005017 is limited to Province 222. See also *Quercus rubra - Acer saccharum - Fagus grandifolia / Viburnum acerifolium* Forest (CEGL006173) in the East. Compare with *Quercus rubra - Quercus alba - (Quercus velutina*, *Acer rubrum) / Viburnum acerifolium* Forest (CEGL002462), which is more dry. Because the type is thought to have originated through logging and burning of pine stands (at least in Minnesota), its composition is fairly generic. In the Manistee National Forest ecological land type classification, see ELTP 40, 42, 43 (Cleland et al. 1994).

Global Similar Associations:

- *Acer saccharum - Betula alleghaniensis - Quercus rubra / Viburnum acerifolium* Forest (CEGL006943) is found in the northeastern United States.
- *Acer saccharum - Fagus grandifolia - Betula* spp. / *Maianthemum canadense* Forest (CEGL005004)
- *Quercus rubra - (Acer saccharum, Quercus alba)* Forest (CEGL005017) is found south of CEGL002461 in Province 222.
- *Quercus rubra - Acer saccharum - Fagus grandifolia / Viburnum acerifolium* Forest (CEGL006173) is found in the northeastern United States.
- *Quercus rubra - Quercus alba - (Quercus velutina, Acer rubrum) / Viburnum acerifolium* Forest (CEGL002462)

Global Related Concepts:

- Mesic Northern Forest - Beech-Sugar Maple-Yellow Birch (Chapman et al. 1989) **?**
- Northern Dry-Mesic Forest Red Oak-Sugar Maple Subtype (Faber-Langendoen 2001) =
- Oak Forest (Northeast Section) (MNNHP 1993) =
- Red Oak-Sugar Maple-Ironwood-Fly Honeysuckle (V6) (Chambers et al. 1997) =

ELEMENT DISTRIBUTION

Global Range: This red oak-hardwood community is found in the sub-boreal/mixed hardwood-conifer region of the Great Lakes, in both the United States and Canada, ranging from northeastern Minnesota east to Wisconsin, Michigan, and Ontario.

Nations: CA, US

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States/Provinces: MI, MN:S3, ON, QC:S4?, WI
TNC Ecoregions: 47:C, 48:C
USFS Ecoregions (1994/95): 212Hc:CCC, 212Ho:CCC, 212Hw:CCC, 212Ia:CCC, 212Jd:CCC, 212Jj:CCC, 212Jl:CC?, 212K:CC, 212Lb:CCC, 212Na:C??, 212Nb:C??
Federal Lands: NPS (Apostle Islands, Isle Royale, Saint Croix, Sleeping Bear Dunes); USFS (Chequamegon-Nicolet?, Chequamegon?, Chippewa?, Huron-Manistee?, Huron?, Manistee?, Nicolet?)

ELEMENT SOURCES

Saint Croix National Scenic Riverway Map Code: FOM
Saint Croix National Scenic Riverway Plots: SACN.29, SACN.36, SACN.58, SACN.79, SACN.123, SACN.222, SACN.231, SACN.272, SACN.3523, SACN.3538, SACN.4007, SACN.4010, SACN.4011, SACN.4012, SACN.4016, SACN.4017, SACN.4020, SACN.4021, SACN.4026, SACN.4697, SACN.4702, SACN.4703, SACN.4706, SACN.4708, SACN.4709, SACN.4710, SACN.4712, SACN.4713, SACN.4720, SACN.4729, SACN.6558, SACN.7501, SACN.7512.
Local Description Authors: M.J. Russo
Global Description Authors: D. Faber-Langendoen, mod. J. Drake
References: Chambers et al. 1997, Chapman et al. 1989, Cleland et al. 1994, Faber-Langendoen 2001, Hop et al. 2010a, Kost et al. 2007, MNNHP 1993, Midwestern Ecology Working Group n.d., Nowacki et al. 1990, TNC 1999b, WNHIP unpubl. data

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1.C.3. Temperate Flooded & Swamp Forest

1.C.3.Na. Eastern North American Flooded & Swamp Forest

M029. Northern & Central Floodplain Forest & Scrub

G041. Eastern Cottonwood - Black Willow Flooded & Swamp

Midwestern Cottonwood - Black Willow Forest
***Populus deltoides - Salix nigra* Forest**
Eastern Cottonwood - Black Willow Forest
Identifier: CEGL002018

NVC CLASSIFICATION

Division	Eastern North American Flooded & Swamp Forest (1.C.3.Na)
Macrogroup	Northern & Central Floodplain Forest & Scrub (M029)
Group	Eastern Cottonwood - Black Willow Flooded & Swamp (G041)
Association (Common name)	Midwestern Cottonwood - Black Willow Forest

ELEMENT CONCEPT

Global Summary: This cottonwood - black willow forest is characteristic of the fronts and banks of most major rivers and streams throughout the Central Forest Region, extending into the northern forest particularly within the Mississippi, Ohio, and Missouri River systems. It develops on bare, moist soil on recently formed sand bars, front-land ridges, and well-drained flats, along with *Salix interior* (sandbar willow), *Eragrostis hypnoides* (teal lovegrass), *Leptochloa panicea* ssp. *brachiata* (mucronate sprangeltop), *Lipocarpha micrantha* (smallflower halfchaff sedge), *Rumex maritimus* (golden dock), *Potentilla paradoxa* (Paradox cinquefoil), and *Bidens* (beggarticks) spp. This natural community can also be found on abandoned fields and well-drained ridges in the first bottoms. Soils are formed in alluvium, are deep, medium-textured, and with adequate or excessive moisture available for vegetation during the growing season. The tree canopy is tall (to 30 m) and dominated by *Populus deltoides* (eastern cottonwood) and *Salix nigra* (black willow), although *Fraxinus pennsylvanica* (green ash), *Acer saccharinum* (silver maple), *Acer negundo* (box-elder), *Platanus occidentalis* (American sycamore), and *Ulmus americana* (American elm) are also commonly encountered. Tree diversity is limited due to the dynamics of flooding and resultant deposition and scouring of sediments. The subcanopy is almost exclusively *Salix nigra* (black willow). The shrub layer is conspicuously absent in many parts of the range. Herbaceous growth can be thick and lush but is often patchy and sparse due to frequent inundation. Species most often encountered in the ground layer include *Carex* (sedge) spp., *Leersia oryzoides* (rice cutgrass), *Bidens* (beggarticks) spp., and Asteraceae spp.

ENVIRONMENTAL DESCRIPTION

Global Environment: This community is quick to colonize newly deposited substrates adjacent to rivers, lakes, streams, and in frequently flooded, low, wet depressions in floodplains. Dynamic substrate availability caused by frequent flooding encourages the establishment and maintenance of this community type.

VEGETATION DESCRIPTION

Global Vegetation: This community is dominated by broadleaf deciduous trees. Canopy closure is complete, or nearly so, with few shrubs and limited tree species found in the type. The tree canopy is tall (to 30 m) and dominated by *Populus deltoides* (eastern cottonwood) and *Salix nigra* (black willow), although *Fraxinus pennsylvanica* (green ash), *Acer saccharinum* (silver maple), *Acer negundo* (box-elder), *Platanus occidentalis* (American sycamore), and *Ulmus americana* (American elm) are also commonly encountered. Tree diversity is limited due to the dynamics of flooding and deposition/scouring of sediments. The subcanopy is almost exclusively *Salix nigra* (black willow). The shrub layer is conspicuously absent in many parts of the range. Herbaceous growth can be thick and lush but is often patchy and sparse due to frequent inundation. Species most often encountered in the ground layer include *Carex* (sedge) spp., *Leersia oryzoides* (rice cutgrass), *Bidens* (beggarticks) spp., and Asteraceae spp. (TNC 1995a).

MOST ABUNDANT SPECIES

Global

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Populus deltoides* (eastern cottonwood), *Salix nigra* (black willow)
Tree subcanopy	Broad-leaved deciduous tree	*Salix nigra* (black willow)
Herb (field)	Semi-shrub	*Spermacoce glabra* (smooth false buttonweed)
Herb (field)	Forb	*Bidens aristosa* (bearded beggarticks), *Symphyotrichum lanceolatum* var. *lanceolatum* (white panicle aster), *Symphyotrichum lateriflorum* var. *lateriflorum* (calico aster)
Herb (field)	Graminoid	*Carex typhina* (cattail sedge), *Leersia oryzoides* (rice cutgrass)

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OTHER NOTEWORTHY SPECIES

Global: Vulnerable: *Macrochelys temminckii* (alligator snapping turtle, G3G4), *Vermivora bachmanii* (bachman's warbler, Federally listed endangered, GH); **Other**: *Acris gryllus* (southern cricket frog, G5), *Agkistrodon piscivorus* (cottonmouth, G5), *Aix sponsa* (wood duck, G5), *Ambystoma maculatum* (spotted salamander, G5), *Ardea alba* (great egret, G5), *Ardea herodias* (great blue heron, G5), *Buteo brachyurus* (short-tailed hawk, G4G5), *Buteo lineatus* (red-shouldered hawk, G5), *Butorides virescens* (green heron, G5), *Coccyzus americanus* (yellow-billed cuckoo, G5), *Dendroica dominica* (yellow-throated warbler, G5), *Didelphis virginiana* (virginia opossum, G5), *Egretta caerulea* (little blue heron, G5), *Euphagus carolinus* (rusty blackbird, G4), *Gallinago gallinago* (common snipe, G5), *Hyla avivoca* (bird-voiced treefrog, G5), *Hyla cinerea* (green treefrog, G5), *Ictinia mississippiensis* (mississippi kite, G5), *Limenitis archippus* (viceroy, G5), *Limnothlypis swainsonii* (swainson's warbler, G4), *Lithobates sphenocephalus* (southern leopard frog, G5), *Lontra canadensis* (north american river otter, G5), *Megaceryle alcyon* (belted kingfisher, G5), *Melanerpes carolinus* (red-bellied woodpecker, G5), *Melanerpes erythrocephalus* (red-headed woodpecker, G5), *Mniotilta varia* (black-and-white warbler, G5), *Mycteria americana* (wood stork, G4), *Myiarchus crinitus* (great crested flycatcher, G5), *Neovison vison* (american mink, G5), *Nyctanassa violacea* (yellow-crowned night-heron, G5), *Nycticorax nycticorax* (black-crowned night-heron, G5), *Nymphalis antiopa* (mourning cloak, G5), *Odocoileus virginianus* (white-tailed deer, G5), *Oryzomys palustris* (marsh oryzomys, G5), *Parula americana* (northern parula, G5), *Peromyscus gossypinus* (cotton deermouse, G5), *Phalacrocorax auritus* (double-crested cormorant, G5), *Polioptila caerulea* (blue-gray gnatcatcher, G5), *Procyon lotor* (raccoon, G5), *Quiscalus quiscula* (common grackle, G5), *Reithrodontomys humulis* (eastern harvest mouse, G5), *Scolopax minor* (american woodcock, G5), *Setophaga ruticilla* (american redstart, G5), *Sigmodon hispidus* (hispid cotton rat, G5), *Strix varia* (barred owl, G5), *Sylvilagus aquaticus* (swamp rabbit, G5), *Sylvilagus palustris* (marsh rabbit, G5), *Vireo olivaceus* (red-eyed vireo, G5)

CONSERVATION STATUS RANK

Global Rank & Reasons: G3G4 (22-Jun-1998). The current range of this community is much smaller than the presettlement range due to extensive logging, ditching, draining, and land clearing for conversion to croplands. The reduced waterflows and channelization of rivers decreases the frequency of natural floods necessary for the scouring and deposition of new substrates that favor cottonwood regeneration.

CLASSIFICATION

Status: Standard

Classification Confidence: 2 - Moderate

Global Comments: The name of the community must have an additional species added to highlight the distinction between this and *Populus deltoides - Salix nigra / Mikania scandens* Forest (CEGL007346). Kentucky occurrences are intermediate between the two. This type does not occur in Nebraska, where *Salix nigra* (black willow) is a very uncommon tree species. In fact it is thought to have been incorrectly reported as more widespread in the state because it can been confused with *Salix amygdaloides* (peachleaf willow) (G. Steinauer pers. comm. 2000).

Global Similar Associations:

- *Acer saccharinum - Ulmus americana* Forest (CEGL002586)
- *Populus deltoides - Salix nigra / Mikania scandens* Forest (CEGL007346) occurs in the southeastern United States.
- *Populus deltoides - Salix nigra* Woodland (CEGL004919)
- *Salix nigra* Forest (CEGL002103) a *Salix nigra*-dominated community.
- *Salix nigra* Temporarily Flooded Shrubland (CEGL003901) a *Salix nigra*-dominated community.

Global Related Concepts:

- *Populus deltoides - Salix nigra / Leersia* community (Voigt and Mohlenbrock 1964) =
- Black Willow: 95 (Eyre 1980) >
- Cottonwood-Dogwood Floodplain Woodland (Steinauer and Rolfsmeier 2000) =
- Cottonwood: 63 (Eyre 1980) >
- Eastern Broadleaf Forests: 98: Northern Floodplain Forest (*Populus-Salix-Ulmus*) (Kuchler 1964) >
- Eastern Broadleaf and Needleleaf Forests (Kuchler 1964) >
- Floodplain Forest (MNNHP 1993) >
- Floodplain Forest Cottonwood-Willow Subtype (Faber-Langendoen 2001) =
- Palustrine: Palustrine Forested Wetland (Cowardin et al. 1979) <
- Terrestrial: Forest: Hardwood (TNC 1985) >
- UNESCO FORMATION CODE: I.B.3d (UNESCO 1973) >
- Wet Bottomland Forest (Nelson 1985) >

ELEMENT DISTRIBUTION

Global Range: This cottonwood - black willow forest is characteristic of the fronts and banks of most major rivers and streams throughout the Central Forest Region, extending into the northern forest particularly within the Mississippi, Ohio, and Missouri River systems, extending from Ohio west to Minnesota, southward to Oklahoma, and east to Kentucky.

Nations: US

States/Provinces: AR?, IA:SU, IL, IN, KS:SU, KY, MN, MO, NE:S2, OH, OK, WI:S3, WY

TNC Ecoregions: 35:C, 36:C, 37:C, 38:P, 39:?, 42:C, 43:C, 44:C, 46:C, 48:C, 49:C

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USFS Ecoregions (1994/95): 221Fa:CCC, 222Ad:CP?, 222Ae:CP?, 222C:CP, 222D:CP, 222E:CP, 222F:CP, 222G:CP, 222H:CP, 222I:CP, 222Jj:CCC, 222K:CC, 222Lf:CCC, 222Mb:CCC, 222Me:CCC, 231A:PP, 231B:PP, 231E:PP, 231F:PP, 231G:PP, 232B:PP, 232C:PP, 234A:PP, 251Ba:CCC, 251Bb:CCC, 251Cd:CC?, 251Cg:CCC, 251D:CP

Federal Lands: NPS (Cuyahoga Valley, Effigy Mounds?, Fort Larned, Indiana Dunes, Saint Croix); USFS (St. Francis?)

ELEMENT SOURCES

Saint Croix National Scenic Riverway Map Code: FHF

Local Description Authors:

Global Description Authors: M. Guetersloh, mod. D. Faber-Langendoen

References: Braun 1950, Bruner 1931, Cogan 2007b, Collins et al. 1981, Cowardin et al. 1979, Evans 1991, Eyre 1980, Faber-Langendoen 2001, Galloway 1963, Galloway 1964, Hefley 1937, Hoagland 2000, Hop et al. 2009, INAI unpubl. data, Kuchler 1964, Lauver et al. 1999, MNNHP 1993, Midwestern Ecology Working Group n.d., Nelson 1985, Rogers 1953, SAF 1967, Steinauer and Rolfsmeier 2000, TNC 1985, TNC 1995a, UNESCO 1973, Voigt and Mohlenbrock 1964, WNHIP unpubl. data, Ware and Penfound 1949, White and Madany 1978, Zanoni et al. 1979

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G040. Silver Maple - Green Ash - Sycamore Floodplain

Silver Maple - Elm Forest

***Acer saccharinum - Ulmus americana* Forest**
Silver Maple - American Elm Forest
Identifier: CEGL002586

NVC CLASSIFICATION

Division	Eastern North American Flooded & Swamp Forest (1.C.3.Na)
Macrogroup	Northern & Central Floodplain Forest & Scrub (M029)
Group	Silver Maple - Green Ash - Sycamore Floodplain (G040)
Association (Common name)	Silver Maple - Elm Forest

ELEMENT CONCEPT

Global Summary: This silver maple - elm - cottonwood forest is found throughout the midwestern United States and parts of the eastern United States. Stands occur on large, regularly flooded floodplains. The canopy cover is more-or-less closed and dominated by *Acer saccharinum* (silver maple). Codominants may include *Platanus occidentalis* (American sycamore), *Betula nigra* (river birch), and rarely *Acer saccharum* (sugar maple). Associated species may include *Ulmus americana* (American elm), *Ulmus rubra* (slippery elm), *Acer negundo* (box-elder), *Salix nigra* (black willow), *Celtis occidentalis* (common hackberry), *Carya cordiformis* (bitternut hickory), *Juglans nigra* (black walnut), and *Fraxinus pennsylvanica* (green ash). The shrub and sapling layer is often open (<25% cover). Species that may be present include *Sambucus canadensis* (common elderberry), *Rubus occidentalis* (black raspberry), or *Lindera benzoin* (northern spicebush). Woody and herbaceous vines can be prominent, including among the woody vines *Parthenocissus quinquefolia* (Virginia creeper), *Toxicodendron radicans* (eastern poison-ivy), and *Vitis riparia* (riverbank grape). Herbaceous vine species include *Apios americana* (groundnut), *Amphicarpaea bracteata* (American hogpeanut), and *Echinocystis lobata* (wild cucumber). Herbaceous grasses, forbs, and ferns dominate the ground layer, including *Symphyotrichum lateriflorum* (calico aster), *Boehmeria cylindrica* (small-spike false nettle), *Erythronium americanum* (dogtooth violet), *Solidago gigantea* (giant goldenrod), *Cinna arundinacea* (sweet woodreed), *Leersia virginica* (whitegrass), *Elymus virginicus* (Virginia wildrye), *Impatiens pallida* (pale touch-me-not), *Laportea canadensis* (Canadian woodnettle), *Matteuccia struthiopteris* (ostrich fern), *Onoclea sensibilis* (sensitive fern), *Pilea pumila* (Canadian clearweed), *Urtica dioica* (stinging nettle), and others. A variety of exotics may be present, including *Lysimachia* (yellow loosestrife) spp., *Microstegium vimineum* (Nepalese browntop), *Polygonum cuspidatum* (Japanese knotweed), *Rosa multiflora* (multiflora rose), and *Lonicera japonica* (Japanese honeysuckle).

ENVIRONMENTAL DESCRIPTION

Saint Croix National Scenic Riverway Environment: This common silver maple forest was sampled at 14 locations in the park. Sites are flat to gently sloping floodplains many of which likely flood seasonally or intermittently. Soils for two of the plots are moderately well-drained silt loam and loamy sand. The unvegetated surface (reported from two plots) is dominated by leaf litter (83-92% cover) with some wood (4-6%), bare soil (0-10%) and dead plant stems (2-3%). Evidence of disturbance includes flooding and the presence of many invasive exotic plants.

Global Environment: This community occurs on temporarily flooded soils along major rivers and smaller perennial streams. Soils may be well-drained and sandy, more loamy on infrequently flooded bottomlands and levees, or deep silts on stabilized sites along larger rivers. It appears to be favored by deposition of deep sandy sediments by low-energy floodwaters. The community may form small linear patches among other floodplain associations or be locally extensive. The structure and composition of the type is influenced by the flooding regime. Floods leave river-deposited debris on the forest floor, ice scars on trees, and abandoned channels that retain water at or above the level of the main river channel.

VEGETATION DESCRIPTION

Saint Croix National Scenic Riverway Vegetation: Height or strata cover data were provided for only two of the sampled plots. The moderately dense (70% cover) tree canopy, 10-15 m tall, dominates this community. There is little or no woody understory, but there is a moderately dense (60-70%) herbaceous layer. One plot also has 30% cover by nonvascular species (mosses) and 20% cover the hemi-parasitic vine *Cuscuta gronovii* (scaldweed). The tree canopy is dominated, almost to the exclusion of all else, by *Acer saccharinum* (silver maple); additional species may include *Fraxinus nigra* (black ash), *Fraxinus pennsylvanica* (green ash), and *Tilia americana* (American basswood). Shrubs may include very small amounts of *Corylus americana* (American hazelnut), *Lonicera dioica* (limber honeysuckle), *Prunus virginiana* (chokecherry), *Sambucus canadensis* (common elderberry), *Viburnum lentago* (nannyberry), *Zanthoxylum americanum* (common pricklyash), and others. Dominant and/or common herbs include *Boehmeria cylindrica* (small-spike false nettle), *Carex crawfordii* (Crawford's sedge), *Carex lupulina* (hop sedge), *Carex tuckermanii* (Tuckerman's sedge), *Dactylis glomerata* (orchardgrass), *Doellingeria umbellata* (parasol whitetop), *Elymus virginicus* (Virginia wildrye), *Laportea canadensis* (Canadian woodnettle), *Leersia virginica* (whitegrass), *Lysimachia ciliata* (fringed loosestrife), *Matteuccia struthiopteris* (ostrich fern), *Onoclea sensibilis* (sensitive fern), *Phalaris arundinacea* (reed canarygrass), *Polygonum virginianum* (jumpseed), *Ranunculus hispidus* (bristly buttercup), *Rudbeckia laciniata* (cutleaf coneflower), *Spartina pectinata* (prairie cordgrass), and *Symphyotrichum lateriflorum* (calico aster). Additional vines include *Parthenocissus quinquefolia* (Virginia creeper) and *Vitis riparia* (riverbank grape). In addition, this community may support Minnesota state-vulnerable *Carex typhina* (cattail sedge)

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and *Hydrocotyle americana* (American marshpennywort), and Wisconsin state-imperiled *Geum macrophllum* var. *perincisum* (largeleaf avens) and state-vulnerable *Carex assiniboinensis* (Assiniboia sedge) and *Geum macrophllum* (largeleaf avens).

Global Vegetation: The canopy cover is more-or-less closed and dominated by *Acer saccharinum* (silver maple). Codominants may include *Platanus occidentalis* (American sycamore), *Betula nigra* (river birch), and rarely *Acer saccharum* (sugar maple). Associated species may include *Ulmus americana* (American elm), *Ulmus rubra* (slippery elm), *Acer negundo* (box-elder), *Salix nigra* (black willow), *Celtis occidentalis* (common hackberry), *Carya cordiformis* (bitternut hickory), *Juglans nigra* (black walnut), *Fraxinus pennsylvanica* (green ash), and occasionally *Halesia tetraptera* (mountain silverbell). The shrub and sapling layer is often open (<25% cover). Species that may be present include *Sambucus canadensis* (common elderberry), *Rubus occidentalis* (black raspberry), or *Lindera benzoin* (northern spicebush). Woody and herbaceous vines can be prominent, including among the woody vines *Parthenocissus quinquefolia* (Virginia creeper), *Toxicodendron radicans* (eastern poison-ivy), and *Vitis riparia* (riverbank grape). Herbaceous vine species include *Apios americana* (groundnut), *Amphicarpaea bracteata* (American hogpeanut), and *Echinocystis lobata* (wild cucumber). Grasses, forbs, and ferns dominate the ground layer, including various combinations of *Symphyotrichum lateriflorum* (calico aster), *Boehmeria cylindrica* (small-spike false nettle), *Chasmanthium latifolium* (Indian woodoats), *Cryptotaenia canadensis* (Canadian honewort), *Erythronium americanum* (dogtooth violet), *Solidago gigantea* (giant goldenrod), *Cinna arundinacea* (sweet woodreed), *Leersia virginica* (whitegrass), *Elymus virginicus* (Virginia wildrye), *Helianthus* (sunflower) sp., *Impatiens capensis* (jewelweed), *Impatiens pallida* (pale touch-me-not), *Laportea canadensis* (Canadian woodnettle), *Matteuccia struthiopteris* (ostrich fern), *Menispermum canadense* (common moonseed), *Onoclea sensibilis* (sensitive fern), *Pilea pumila* (Canadian clearweed), *Polygonum virginianum* (jumpseed), *Rudbeckia laciniata* (cutleaf coneflower), *Verbesina alternifolia* (wingstem), *Urtica dioica* (stinging nettle), and others. A variety of exotics may be present, including *Lysimachia* (yellow loosestrife) spp., *Microstegium vimineum* (Nepalese browntop), *Glechoma hederacea* (ground ivy), *Polygonum cuspidatum* (Japanese knotweed), *Rosa multiflora* (multiflora rose), and *Lonicera japonica* (Japanese honeysuckle).

MOST ABUNDANT SPECIES

Saint Croix National Scenic Riverway

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Acer saccharinum* (silver maple)
Herb (field)	Forb	*Boehmeria cylindrica* (small-spike false nettle), *Cuscuta gronovii* (scaldweed), *Laportea canadensis* (Canadian woodnettle), *Matteuccia struthiopteris* (ostrich fern), *Polygonum virginianum* (jumpseed)
Herb (field)	Graminoid	*Carex crawfordii* (Crawford's sedge), *Carex tuckermanii* (Tuckerman's sedge), *Elymus virginicus* (Virginia wildrye), *Spartina pectinata* (prairie cordgrass)

Global

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Acer saccharinum* (silver maple)
Herb (field)	Vine/Liana	*Parthenocissus quinquefolia* (Virginia creeper), *Toxicodendron radicans* (eastern poison-ivy)
Herb (field)	Graminoid	*Leersia virginica* (whitegrass)

CHARACTERISTIC SPECIES

Saint Croix National Scenic Riverway: *Acer saccharinum* (silver maple), *Boehmeria cylindrica* (small-spike false nettle), *Carex crawfordii* (Crawford's sedge), *Carex tuckermanii* (Tuckerman's sedge), *Cuscuta gronovii* (scaldweed), *Elymus virginicus* (Virginia wildrye), *Laportea canadensis* (Canadian woodnettle), *Matteuccia struthiopteris* (ostrich fern), *Polygonum virginianum* (jumpseed), *Spartina pectinata* (prairie cordgrass)

Global: *Acer negundo* (box-elder), *Acer saccharinum* (silver maple), *Alliaria petiolata* (garlic mustard), *Conium maculatum* (poison hemlock), *Elymus virginicus* (Virginia wildrye), *Glechoma hederacea* (ground ivy), *Humulus japonicus* (Japanese hop), *Populus deltoides* (eastern cottonwood), *Urtica dioica* ssp. *gracilis* (California nettle)

OTHER NOTEWORTHY SPECIES

Saint Croix National Scenic Riverway: Vulnerable: *Carex assiniboinensis* (Assiniboia sedge, WI state-vulnerable, G4G5), *Carex typhina* (cattail sedge, MN state-vulnerable, G5), *Geum macrophllum* (largeleaf avens, WI state-vulnerable, G5), *Geum macrophllum* var. *perincisum* (largeleaf avens, WI state-imperiled, G5T5), *Hydrocotyle americana* (American marshpennywort, MN state-vulnerable, G5); **Exotic/Invasive**: *Agrostis gigantea* (redtop, invasive/exotic, Medium/Low), *Barbarea vulgaris* (garden yellowrocket, invasive/exotic, Low/Insignificant), *Dactylis glomerata* (orchardgrass, invasive/exotic, Medium/Insignificant), *Echinochloa muricata* (rough barnyardgrass, invasive/exotic), *Frangula alnus* (glossy buckthorn, invasive/exotic, High/Medium), *Glechoma hederacea* (ground ivy, invasive/exotic, Low), *Linaria vulgaris* (butter and eggs, invasive/exotic, High/Low), *Lythrum salicaria* (purple loosestrife, invasive/exotic, High), *Medicago lupulina* (black medick, invasive/exotic, Medium/Insignificant), *Myosoton aquaticum* (giantchickweed, invasive/exotic), *Polygonum convolvulus* (black bindweed, invasive/exotic), *Rhamnus cathartica* (common buckthorn, invasive/exotic, High/Medium), *Stellaria media* (common chickweed, invasive/exotic, Low), *Taraxacum officinale* (common dandelion, invasive/exotic), *Urtica dioica* (stinging nettle, invasive/exotic), *Verbascum thapsus* (common mullein, invasive/exotic, Medium)

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Global: Exotic/Invasive: *Glechoma hederacea* (ground ivy, invasive exotic, Low), *Lonicera japonica* (Japanese honeysuckle, invasive exotic, High/Medium), *Microstegium vimineum* (Nepalese browntop, invasive exotic, High/Medium), *Polygonum cuspidatum* (Japanese knotweed, invasive exotic, High/Medium), *Rosa multiflora* (multiflora rose, invasive exotic, Medium/Low)

CONSERVATION STATUS RANK

Global Rank & Reasons: G4? (3-Oct-1996). There has been significant conversion of stands to agriculture, hydrologic modifications due to river dams, etc., and siltation caused by modified flooding regimes.

CLASSIFICATION

Status: Standard

Classification Confidence: 2 - Moderate

Global Comments: This type includes stands where *Acer saccharinum* (silver maple) represents the majority of trees (>50% cover or basal area?). This type is most clearly expressed on larger rivers. To some degree this type is more northern, separable from the more southern type *Acer saccharinum - Celtis laevigata - Carya illinoinensis* Forest (CEGL002431), but this distinction is not yet well resolved. In the southern parts of its range, this type may overlap with *Platanus occidentalis - Acer saccharinum - Juglans nigra - Ulmus rubra* Forest (CEGL007334), but that type is generally a higher terrace, small stream type. Compare this type with SAF cover type 62 (Eyre 1980). In Minnesota stands with less than either 50% cottonwood or silver maple and not in northwestern Minnesota tend to occur here (i.e., a mixed floodplain forest), as do silver maple stands with a supercanopy of cottonwoods. In southwestern Minnesota, stands with only some swamp white oak go here. If swamp white oak is dominant the stands probably belong with either an association in the *Quercus palustris - (Quercus bicolor)* Seasonally Flooded Forest Alliance (A.329), or *Quercus macrocarpa - Quercus bicolor - Carya laciniosa / Leersia* spp. - *Cinna* (woodreed) spp. Forest (CEGL002098), at least in the Midwest. *Fraxinus pennsylvanica* (green ash) is a typical codominant in this type. In Wisconsin, this type may better be named *Acer saccharinum - Fraxinus pennsylvanica - Betula nigra* Forest (E. Epstein pers. comm. 1999).

Global Similar Associations:

- *Acer (rubrum, saccharinum) - Fraxinus* spp. - *Ulmus americana* Forest (CEGL005038) grades into this community in backwater swamps.
- *Acer saccharinum - (Populus deltoides) / Matteuccia struthiopteris - Laportea canadensis* Forest (CEGL006147) is somewhat more northern, lacking *Platanus* and *Betula nigra*.
- *Acer saccharinum - Acer negundo / Ageratina altissima - Laportea canadensis - (Elymus virginicus)* Forest (CEGL006217)
- *Acer saccharinum - Betula nigra / Cephalanthus occidentalis* Forest (CEGL007810)
- *Acer saccharinum - Celtis laevigata - Carya illinoinensis* Forest (CEGL002431) is more southern.
- *Acer saccharinum* Temporarily Flooded Forest [Placeholder] (CEGL007304)
- *Fagus grandifolia - Quercus* spp. - *Acer rubrum - Juglans nigra* Forest (CEGL005014) in the eastern part of its range on the mesic side.
- *Fraxinus pennsylvanica - Ulmus americana - (Acer negundo, Tilia americana)* Northern Forest (CEGL002089) in the western part of its range on the mesic side.
- *Fraxinus pennsylvanica - Ulmus* spp. - *Celtis occidentalis* Forest (CEGL002014)
- *Platanus occidentalis - Acer saccharinum - Juglans nigra - Ulmus rubra* Forest (CEGL007334) may overlap in southern parts of the range of CEGL002586.
- *Populus deltoides - Salix nigra* Forest (CEGL002018) grades into this community on the wetter side.
- *Quercus macrocarpa - Quercus bicolor - Carya laciniosa / Leersia* spp. - *Cinna* spp. Forest (CEGL002098)

Global Related Concepts:

- Floodplain Forest Silver Maple Subtype (MNNHP 1993) **<**
- Floodplain Forest Silver Maple Subtype (Faber-Langendoen 2001) **=**
- Floodplain Forest Swamp White Oak Subtype (MNNHP 1993) **<**
- Silver Maple - American Elm: 62 (Eyre 1980) **>**
- Silver maple-American elm-cottonwood floodplain forest (CAP pers. comm. 1998) **?**
- Southern Floodplain Forest (Chapman et al. 1989) **>**
- Wet Bottomland Forest (Nelson 1985) **>**

ELEMENT DISTRIBUTION

Global Range: This association is found throughout the midwestern United States and in the mid-Atlantic region of the eastern United States, ranging from Delaware, New Jersey, and Pennsylvania west to Minnesota, and south to Arkansas.

Nations: CA, US

States/Provinces: AR, DE, IA:SU, IL, IN, KY, MI, MN, MO, NJ, NY, OH, ON, PA, QC, TN, WI:S3, WV:S3S4

TNC Ecoregions: 35:C, 36:C, 37:C, 38:C, 40:?, 42:C, 43:P, 44:C, 45:C, 46:C, 47:C, 48:C, 49:C, 50:C, 60:C, 61:C, 62:C

USFS Ecoregions (1994/95): 212Fc:CCC, 212Hb:CCC, 212He:CCC, 212Hm:CCC, 212Ht:CCP, 212Hv:CCC, 212Hw:CCP, 212Hx:CCP, 212Hy:CCP, 212Ja:CCC, 212Je:CCC, 212Jf:CCC, 212Jj:CC?, 212Jl:CCC, 212Js:CCC, 212Ka:CC?, 212Kb:CCC, 212Mb:CPP, 212Na:CC?, 212Nb:CCP, 212Nc:CCC, 212Nd:CCC, 221Bd:CCC, 221Da:CCC, 221Db:CCC, 221Ea:CCC, 221Ec:CCC, 221Ed:CCC, 221Ef:CCC, 221Fa:CCC, 222Aj:CCC, 222An:CCC, 222Ap:CCC, 222Aq:CCC, 222Ch:CCC, 222Db:CCC, 222Dc:CCP, 222De:CCC, 222Df:CCP, 222Ei:CPP, 222Ek:CPP, 222El:CPP, 222Em:CPP, 222Fa:CCP, 222Fb:CCC, 222Fc:CCP, 222Fd:CCP, 222Fe:CCP, 222Ff:CCP, 222Ga:CCC, 222Gb:CCC, 222Gc:CCC, 222Gd:CCP, 222Ge:CCC, 222Ha:CCC, 222Hb:CCC, 222Hc:CCC, 222Hf:CCC, 222If:CCC, 222Jb:CCC, 222Jh:CCC, 222Ji:CCC, 222Jj:CCC, 222Ka:CCC, 222Kb:CCC, 222Kd:CCC, 222Kf:CCC,

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222Kg:CCC, 222Kh:CCC, 222Kj:CCP, 222Lc:CCC, 222Ld:CCC, 222Lf:CCC, 222Ma:CCC, 222Mb:CCC, 222Mc:CCC, 222Md:CCC, 222Me:CCC, 232Ac:CCC, 234Aa:CC?, 234Am:CCC, 234An:CCC, 251Ba:CCC, 251Be:CCC, 251Cc:CCC, 251Cd:CCC, 251Cf:CCC, 251Dd:CCP, 251De:CCC, 251Df:CCC, 251Dg:CCC, 251Dh:CCC, 251Eb:CCC, M221Cb:CCC

Federal Lands: NPS (Buffalo River, Cuyahoga Valley, Delaware Water Gap, Effigy Mounds, Indiana Dunes, New River Gorge, Saint Croix, Upper Delaware); USFS (Chequamegon, Chequamegon-Nicolet, Chippewa, Huron-Manistee, Huron?, Manistee, Nicolet?, Ozark?, Wayne); USFWS (Erie)

ELEMENT SOURCES

Saint Croix National Scenic Riverway Map Code: FHF

Saint Croix National Scenic Riverway Plots: SACN.267, SACN.282, SACN.0165, SACN.3530, SACN.3535, SACN.4732, SACN.4742, SACN.5055, SACN.5056, SACN.5117, SACN.5126, SACN.7514, SACN.8368, SACN.8369.

Local Description Authors: M.J. Russo

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

References: Anderson 1996, CAP pers. comm. 1998, Chapman et al. 1989, Eyre 1980, Faber-Langendoen 2001, Fike 1999, Hop et al. 2005, Hop et al. 2009, INAI unpubl. data, MNNHP 1993, Midwestern Ecology Working Group n.d., Nelson 1985, Perles et al. 2007, Perles et al. 2008, Podniesinski and Wagner 2002, TDNH unpubl. data, Vanderhorst et al. 2007, WNHIP unpubl. data, WPC and TNC 2002, Walton et al. 1996

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Ash - Elm - Mixed Lowland Hardwood Forest

***Fraxinus pennsylvanica - Celtis occidentalis - Tilia americana - (Quercus macrocarpa)* Forest**
Green Ash - Common Hackberry - American Basswood - (Bur Oak) Forest
Identifier: CEGL002081

NVC CLASSIFICATION

Division	Eastern North American Flooded & Swamp Forest (1.C.3.Na)
Macrogroup	Northern & Central Floodplain Forest & Scrub (M029)
Group	Silver Maple - Green Ash - Sycamore Floodplain (G040)
Association (Common name)	Ash - Elm - Mixed Lowland Hardwood Forest

ELEMENT CONCEPT

Global Summary: This ash - elm lowland hardwood forest community type is found in the northern tallgrass region of the midwestern United States and Canada. Stands occur in stream and river valleys, on low plateaus, and along lake margins. The sites have seasonally high (within the rooting zone) water tables but do not flood regularly. The mineral soils are deep, fertile, and moderately well-drained to poorly drained. This community is dominated by deciduous trees that can tolerate the saturated soil conditions. The tree canopy is typically closed, and often has a mixture of several tree species. Among the most abundant are *Celtis occidentalis* (common hackberry), *Fraxinus pennsylvanica* (green ash), and *Tilia americana* (American basswood). *Quercus macrocarpa* (bur oak) is often abundant in the prairie-forest border region. Other common tree species include *Acer negundo* (box-elder), *Ulmus americana* (American elm), *Betula papyrifera* (paper birch), and *Populus tremuloides* (quaking aspen). The shrub layer is patchy and composed of both upland and lowland shrubs. The herbaceous layer contains a variety of herbs.

ENVIRONMENTAL DESCRIPTION

Saint Croix National Scenic Riverway Environment: This ash - elm lowland hardwood forest was sampled at nine locations in the park. Sites are flat to gently sloping lowlands with moderately well- to well-drained sandy loam, silt loam and loamy sand soils. The unvegetated surface is dominated by leaf litter (70-98% cover) with some large rocks (0-1%), wood (1-3%), bare soil (0-20%) and dead plant stems (3-9%). Evidence of disturbance includes past logging and burning, tip-up mounds, downed wood, and the presence of exotic plants.

Global Environment: This community is found in stream and river valleys, on low plateaus, and along lake margins. The sites have seasonally high (within the rooting zone) water tables but do not flood regularly. The mineral soils are deep, fertile, and moderately well-drained to poorly drained (Kurmis et al. 1986, MNNHP 1993).

VEGETATION DESCRIPTION

Saint Croix National Scenic Riverway Vegetation: The sparse to dense (30-80% cover) tree canopy, 15-20 m tall, and moderate (40-60%) subcanopy (5-10 m) are dominated by *Fraxinus pennsylvanica* (green ash), *Quercus macrocarpa* (bur oak), and *Tilia americana* (American basswood). Additional tree species include *Acer rubrum* (red maple), *Carpinus caroliniana* (American hornbeam), *Carya cordiformis* (bitternut hickory), *Fraxinus nigra* (black ash), *Ostrya virginiana* (hophornbeam), *Populus tremuloides* (quaking aspen), *Quercus rubra* (northern red oak), and *Ulmus rubra* (slippery elm). The very sparse to moderate (5-40%) tall-shrub layer (1-5 m) and very sparse to moderate (5-40%) short-shrub layer (0.5-1 m) may include *Carpinus caroliniana* (American hornbeam), *Cornus racemosa* (gray dogwood), *Corylus americana* (American hazelnut), *Corylus cornuta* (beaked hazelnut), *Diervilla lonicera* (northern bush honeysuckle), *Ostrya virginiana* (hophornbeam), *Viburnum lentago* (nannyberry), *Viburnum rafinesquianum* (downy arrow-wood), and *Zanthoxylum americanum* (common pricklyash). The moderate to complete (50-100%) herbaceous layer may be dominated by *Amphicarpaea bracteata* (American hogpeanut), *Carex pensylvanica* (Pennsylvania sedge), *Eurybia macrophylla* (bigleaf aster), *Geranium maculatum* (spotted geranium), *Osmunda claytoniana* (interrupted fern), and/or *Pteridium aquilinum* (western brackenfern) and include *Adiantum pedatum* (northern maidenhair), *Ageratina altissima* (white snakeroot), *Aralia nudicaulis* (wild sarsaparilla), *Asarum canadense* (Canadian wildginger), *Athyrium filix-femina* (common ladyfern), *Carex cryptolepis* (northeastern sedge), *Carex deweyana* (Dewey sedge), *Carex gracillima* (graceful sedge), *Desmodium glutinosum* (pointedleaf ticktrefoil), *Oryzopsis asperifolia* (roughleaf ricegrass), and *Thalictrum dioicum* (early meadowrue), among others. In addition, this community may support Wisconsin state-vulnerable *Carex assiniboinensis* (Assiniboia sedge).

Global Vegetation: This community is dominated by deciduous trees that can tolerate the saturated soil conditions. The tree canopy is typically closed and often has a mixture of several tree species. Among the most abundant are *Celtis occidentalis* (common hackberry), *Fraxinus pennsylvanica* (green ash), and *Tilia americana* (American basswood). *Quercus macrocarpa* (bur oak) is often abundant in the prairie-forest border region. Other common tree species include *Acer negundo* (box-elder), *Ulmus americana* (American elm), *Betula papyrifera* (paper birch), and *Populus tremuloides* (quaking aspen). The shrub layer is patchy and composed of both upland and lowland shrubs. The herbaceous layer contains a variety of upland herbs. (MNNHP 1993).

MOST ABUNDANT SPECIES

Saint Croix National Scenic Riverway

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Fraxinus pennsylvanica* (green ash), *Tilia americana* (American basswood)
Tree subcanopy	Broad-leaved deciduous tree	*Quercus macrocarpa* (bur oak)

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Tall shrub/sapling	Broad-leaved deciduous shrub	*Carpinus caroliniana* (American hornbeam), *Corylus americana* (American hazelnut), *Ostrya virginiana* (hophornbeam), *Viburnum lentago* (nannyberry)
Short shrub/sapling	Broad-leaved deciduous shrub	*Zanthoxylum americanum* (common pricklyash)
Herb (field)	Forb	*Amphicarpaea bracteata* (American hogpeanut), *Eurybia macrophylla* (bigleaf aster)
Herb (field)	Graminoid	*Carex pensylvanica* (Pennsylvania sedge)
Herb (field)	Fern or fern ally	*Osmunda claytoniana* (interrupted fern), *Pteridium aquilinum* (western brackenfern)

CHARACTERISTIC SPECIES

Saint Croix National Scenic Riverway: *Amphicarpaea bracteata* (American hogpeanut), *Carex pensylvanica* (Pennsylvania sedge), *Carpinus caroliniana* (American hornbeam), *Corylus americana* (American hazelnut), *Eurybia macrophylla* (bigleaf aster), *Fraxinus pennsylvanica* (green ash), *Osmunda claytoniana* (interrupted fern), *Ostrya virginiana* (hophornbeam), *Pteridium aquilinum* (western brackenfern), *Quercus macrocarpa* (bur oak), *Tilia americana* (American basswood), *Viburnum lentago* (nannyberry), *Zanthoxylum americanum* (common pricklyash)

OTHER NOTEWORTHY SPECIES

Saint Croix National Scenic Riverway: Vulnerable: *Carex assiniboinensis* (Assiniboia sedge, WI state-vulnerable, G4G5); **Exotic/Invasive**: *Arctium minus* (lesser burdock, invasive/exotic, Medium/Insignificant), *Elymus repens* (quackgrass, invasive/exotic, High/Medium), *Galeopsis tetrahit* (brittlestem hempnettle, invasive/exotic), *Poa pratensis* (Kentucky bluegrass, invasive/exotic, Medium), *Rhamnus cathartica* (common buckthorn, invasive/exotic, High/Medium), *Taraxacum officinale* (common dandelion, invasive/exotic), *Urtica dioica* (stinging nettle, invasive/exotic)

CONSERVATION STATUS RANK

Global Rank & Reasons: G4? (3-Oct-1996).

CLASSIFICATION

Status: Standard
Classification Confidence: 2 - Moderate
Global Comments: Ground layer composition of this type needs better characterization. In the northern tallgrass prairie region, this type concept overlaps with *Tilia americana - (Quercus macrocarpa) / Ostrya virginiana* Forest (CEGL002012), but, unlike that type, this type is generally found in bottomlands that are outside of the floodplain. A similar type is defined for stands in Missouri (*Fraxinus pennsylvanica - Celtis* spp. - *Quercus* (oak) spp. - *Platanus occidentalis* (American sycamore) Bottomland Forest (CEGL002410)).
Global Similar Associations:
- *Fraxinus pennsylvanica - Celtis* spp. - *Quercus* spp. - *Platanus occidentalis* Bottomland Forest (CEGL002410)
- *Fraxinus pennsylvanica - Ulmus americana - (Acer negundo, Tilia americana)* Northern Forest (CEGL002089)
- *Platanus occidentalis - Fraxinus pennsylvanica - Ulmus americana / Cornus sericea* Forest (CEGL006901)
- *Tilia americana - (Quercus macrocarpa) / Ostrya virginiana* Forest (CEGL002012)

Global Related Concepts:
- Ash-Elm-Trillium (Kurmis et al. 1986) =
- Lowland Hardwood Forest (MNNHP 1993) =

ELEMENT DISTRIBUTION

Global Range: This ash-elm lowland hardwood forest community type is found in the northern tallgrass region of the midwestern United States and Canada.
Nations: CA, US
States/Provinces: MN:S4, ND:S3, ON, QC:S3?, WI?, WY
TNC Ecoregions: 35:C, 46:C, 47:C
USFS Ecoregions (1994/95): 212Kb:CCC, 212Mb:CCC, 212Na:CCC, 212Nb:CCP, 212Nc:CCC, 222Lc:CCC, 222Lf:CCC, 222Ma:CCC, 222Mb:CCC, 222Mc:CCC, 222Me:CCC, 222Na:CCC, 251Aa:CCC, 251Ab:CCC, 251Ba:CCC, 251Bb:CCC
Federal Lands: NPS (Saint Croix); USFS (Chippewa)

ELEMENT SOURCES

Saint Croix National Scenic Riverway Map Code: FAL, FBL, FQL
Saint Croix National Scenic Riverway Plots: SACN.35, SACN.41, SACN.64, SACN.87, SACN.271, SACN.3511, SACN.4467, SACN.6537, SACN.7477.
Local Description Authors: M.J. Russo
Global Description Authors: J. Drake
References: Ewing 1924, Kurmis et al. 1986, MNNHP 1993, Midwestern Ecology Working Group n.d., NDNHI unpubl. data

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Northern Ash - Elm Floodplain Forest

***Fraxinus pennsylvanica - Ulmus americana - (Acer negundo, Tilia americana)* Northern Forest**
Green Ash - American Elm - (Box-elder, American Basswood) Northern Forest
Identifier: CEGL002089

NVC CLASSIFICATION

Division	Eastern North American Flooded & Swamp Forest (1.C.3.Na)
Macrogroup	Northern & Central Floodplain Forest & Scrub (M029)
Group	Silver Maple - Green Ash - Sycamore Floodplain (G040)
Association (Common name)	Northern Ash - Elm Floodplain Forest

ELEMENT CONCEPT

Global Summary: This ash - elm floodplain forest is found in the northern midwestern United States and adjacent southern Canada. Stands occur primarily along higher terraces of river bottoms and floodplains and beside lakes and larger streams, where flooding is relatively brief. Soils are well-drained and moist. They are both organic and medium-textured to fine-textured mineral soils. The overstory is dominated by *Fraxinus pennsylvanica* (green ash) and, at least prior to Dutch elm disease, *Ulmus americana* (American elm). Associates in parts of its range include *Acer negundo* (box-elder), *Acer saccharinum* (silver maple), *Acer rubrum* (red maple), *Celtis occidentalis* (common hackberry) (rarely), and *Tilia americana* (American basswood). The shrub/sapling layer, which is variable in structure and composition, may include *Cornus alternifolia* (alternateleaf dogwood), *Carpinus caroliniana* (American hornbeam), *Cornus sericea* (red-osier dogwood), and *Salix* (willow) spp. The herbaceous ground cover contains *Asclepias incarnata* (swamp milkweed), *Carex* (sedge) spp., *Elymus virginicus* (Virginia wildrye), *Eupatorium maculatum* (spotted joepyeweed), *Eupatorium perfoliatum* (common boneset), *Impatiens capensis* (jewelweed), *Laportea canadensis* (Canadian woodnettle), *Rudbeckia laciniata* (cutleaf coneflower), *Toxicodendron radicans* (eastern poison-ivy), and a variety of ferns, including *Matteuccia struthiopteris* (ostrich fern), *Osmunda claytoniana* (interrupted fern), and *Osmunda cinnamomea* (cinnamon fern). Diagnostic features include the dominance of *Fraxinus pennsylvanica* (green ash) and *Ulmus americana* (American elm), lack of more southern herb and tree species (e.g., *Carya cordiformis* (bitternut hickory), *Platanus occidentalis* (American sycamore), *Juglans cinerea* (butternut), *Juglans nigra* (black walnut), *Quercus bicolor* (swamp white oak)), the infrequent and short flooding, and the presence of both upland and floodplain associates.

ENVIRONMENTAL DESCRIPTION

Saint Croix National Scenic Riverway Environment: This ash - elm - basswood forest was sampled at 14 locations in the park. Sites range from flat lowland floodplains to gently to moderately sloping hills. Soils range from moderately well-drained loam, loamy sand, sandy loam to well-drained silt to rapidly drained sand. The unvegetated surface is dominated by leaf litter (42-93% cover) with some large rocks (0-3%), wood (1-5%), bare soil (0-46%) and dead plant stems (3-12%). Evidence of disturbance includes periodic flooding, downed wood, and the presence of exotic plants.
Global Environment: This community occurs primarily along higher terraces of river bottoms and floodplains and beside lakes and larger streams, where flooding is relatively brief. Soils are well-drained and moist. They are both organic and medium-textured to fine-textured mineral soils. Rarely, soils are clays and gravels (Eyre 1980, Chapman et al. 1989).

VEGETATION DESCRIPTION

Saint Croix National Scenic Riverway Vegetation: The moderate to dense (60-80% cover) tree canopy, 15-20 m tall, is dominated by *Fraxinus pennsylvanica* (green ash), *Quercus macrocarpa* (bur oak), and *Tilia americana* (American basswood); additional species may include *Acer negundo* (box-elder), *Acer rubrum* (red maple), *Acer saccharinum* (silver maple), *Carpinus caroliniana* (American hornbeam), *Celtis occidentalis* (common hackberry), *Fraxinus nigra* (black ash), *Quercus rubra* (northern red oak), *Ulmus americana* (American elm), and others. The very sparse to moderate (5-40%) subcanopy (5-15 m) is made up of canopy species. The very sparse (5-30%) tall-shrub layer (2-5 m) and very sparse to moderate (5-40%) short-shrub layer (0.5-1 m) may include *Corylus americana* (American hazelnut), *Corylus cornuta* (beaked hazelnut), *Ilex verticillata* (common winterberry), *Rhamnus cathartica* (common buckthorn) (exotic), *Viburnum lentago* (nannyberry), and *Zanthoxylum americanum* (common pricklyash) (which may dominate). The moderate to complete (40-100%) herbaceous layer may be dominated by *Ageratina altissima* (white snakeroot), *Amphicarpaea bracteata* (American hogpeanut), *Carex bromoides* (bromelike sedge), *Carex pensylvanica* (Pennsylvania sedge), *Glechoma hederacea* (ground ivy) (exotic), *Laportea canadensis* (Canadian woodnettle), and/or *Matteuccia struthiopteris* (ostrich fern); additional herbs include *Asarum canadense* (Canadian wildginger), *Athyrium filix-femina* (common ladyfern), *Carex pedunculata* (longstalk sedge), *Carex tuckermanii* (Tuckerman's sedge), *Desmodium glutinosum* (pointedleaf ticktrefoil), *Hydrophyllum virginianum* (eastern waterleaf), *Onoclea sensibilis* (sensitive fern), *Parthenocissus quinquefolia* (Virginia creeper), *Polymnia canadensis* (whiteflower leafcup), and *Rudbeckia laciniata* (cutleaf coneflower). Nonvascular species (mosses) may cover up to 30% of the ground surface. In addition, this community may support Minnesota state-vulnerable *Carex assiniboinensis* (Assiniboia sedge) and *Juglans cinerea* (butternut) (also Wisconsin state-vulnerable).
Global Vegetation: The overstory is dominated by *Fraxinus pennsylvanica* (green ash) and, at least prior to Dutch elm disease, *Ulmus americana* (American elm). Associates in parts of its range include *Acer negundo* (box-elder), *Acer saccharinum* (silver maple), *Acer rubrum* (red maple), *Celtis occidentalis* (common hackberry) (rarely), and *Tilia americana* (American basswood). The shrub/sapling layer, which is variable in structure and composition, may include *Cornus alternifolia* (alternateleaf dogwood), *Carpinus caroliniana* (American hornbeam), *Cornus sericea* (red-osier dogwood), and *Salix* (willow) spp. The herbaceous ground

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cover contains *Asclepias incarnata* (swamp milkweed), *Carex* (sedge) spp., *Elymus virginicus* (Virginia wildrye), *Eupatorium maculatum* (spotted joepyeweed), *Eupatorium perfoliatum* (common boneset), *Impatiens capensis* (jewelweed), *Laportea canadensis* (Canadian woodnettle), *Rudbeckia laciniata* (cutleaf coneflower), *Toxicodendron radicans* (eastern poison-ivy), and a variety of ferns, including *Matteuccia struthiopteris* (ostrich fern), *Osmunda claytoniana* (interrupted fern), and *Osmunda cinnamomea* (cinnamon fern) (Eyre 1980, Chapman et al. 1989, E. Epstein pers. comm. 1999).

MOST ABUNDANT SPECIES

Saint Croix National Scenic Riverway

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Fraxinus pennsylvanica* (green ash), *Quercus macrocarpa* (bur oak), *Tilia americana* (American basswood), *Ulmus americana* (American elm)
Tree subcanopy	Broad-leaved deciduous tree	*Celtis occidentalis* (common hackberry)
Tall shrub/sapling	Broad-leaved deciduous shrub	*Corylus americana* (American hazelnut), *Zanthoxylum americanum* (common pricklyash), *Corylus cornuta* (beaked hazelnut)
Herb (field)	Forb	*Ageratina altissima* var. *altissima* (white snakeroot), *Amphicarpaea bracteata* (American hogpeanut), *Laportea canadensis* (Canadian woodnettle), *Matteuccia struthiopteris* (ostrich fern)
Herb (field)	Graminoid	*Carex bromoides* (bromelike sedge), *Carex pensylvanica* (Pennsylvania sedge)

Global

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Celtis occidentalis* (common hackberry), *Fraxinus pennsylvanica* (green ash), *Ulmus americana* (American elm)

CHARACTERISTIC SPECIES

Saint Croix National Scenic Riverway: *Ageratina altissima* var. *altissima* (white snakeroot), *Amphicarpaea bracteata* (American hogpeanut), *Carex bromoides* (bromelike sedge), *Carex pensylvanica* (Pennsylvania sedge), *Celtis occidentalis* (common hackberry), *Corylus americana* (American hazelnut), *Corylus cornuta* (beaked hazelnut), *Fraxinus pennsylvanica* (green ash), *Laportea canadensis* (Canadian woodnettle), *Matteuccia struthiopteris* (ostrich fern), *Quercus macrocarpa* (bur oak), *Tilia americana* (American basswood), *Ulmus americana* (American elm), *Zanthoxylum americanum* (common pricklyash)

OTHER NOTEWORTHY SPECIES

Saint Croix National Scenic Riverway: Vulnerable: *Carex assiniboinensis* (Assiniboia sedge, WI state-vulnerable, G4G5), *Juglans cinerea* (butternut, MN & WI state-vulnerable, G4); **Exotic/Invasive**: *Arctium minus* (lesser burdock, invasive/exotic, Medium/Insignificant), *Glechoma hederacea* (ground ivy, invasive/exotic, Low), *Lactuca serriola* (prickly lettuce, invasive/exotic, Low/Insignificant), *Leonurus cardiaca* (common motherwort, invasive/exotic), *Myosoton aquaticum* (giantchickweed, invasive/exotic), *Ranunculus acris* (tall buttercup, invasive/exotic), *Rhamnus cathartica* (common buckthorn, invasive/exotic, High/Medium), *Taraxacum officinale* (common dandelion, invasive/exotic), *Urtica dioica* (stinging nettle, invasive/exotic)

CONSERVATION STATUS RANK

Global Rank & Reasons: G3G4 (25-Feb-2000). Stands are relatively uncommon throughout the range of the type, but its relation to other similar floodplain types is still somewhat unclear.

CLASSIFICATION

Status: Standard

Classification Confidence: 3 - Weak

Global Comments: This type is intended as a more species-poor and more northern version of *Fraxinus pennsylvanica - Ulmus* spp. - *Celtis occidentalis* (common hackberry) Forest (CEGL002014) in the Great Lakes states, and it also occurs in the northern Great Plains states. These Great Plains stands may fit better with CEGL002014, but they are not likely to be species-rich. In Ontario, this type extends to the Ottawa River. Type is usually on the second terrace of floodplain. In Wisconsin, this type could be considered simply a more northern depauperate version of *Acer saccharinum - Ulmus americana* Forest (CEGL002586). This community description was modified from the Society of American Foresters' silver maple-American elm (62) forest cover type (Eyre 1980).

Global Similar Associations:

- *Acer negundo* Forest (CEGL005033)
- *Acer saccharinum - Ulmus americana* Forest (CEGL002586) This type may overlap considerably with CEGL002089, but is more wet and regularly flooded.
- *Fraxinus pennsylvanica - (Ulmus americana) / Symphoricarpos occidentalis* Forest (CEGL002088) a Great Plains type, but not found in the northern tallgrass prairie region, but perhaps in the western and southern parts.
- *Fraxinus pennsylvanica - Celtis occidentalis - Tilia americana - (Quercus macrocarpa)* Forest (CEGL002081) a non-floodplain, wet-mesic depression (lowland hardwood) type.

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- *Fraxinus pennsylvanica* - *Ulmus* spp. - *Celtis occidentalis* Forest (CEGL002014) central Midwest region including parts of the prairie forest border region. Tree layer somewhat more diverse.
- *Fraxinus pennsylvanica* / Mixed Herbs Forest (CEGL002469) a type proposed by Manitoba for herb-rich sites.

Global Related Concepts:

- Floodplain Forest (MNNHP 1993) >
- Floodplain Forest Green Ash-Elm Subtype (Faber-Langendoen 2001) =
- Southern Floodplain Forest (Chapman et al. 1989) >

ELEMENT DISTRIBUTION

Global Range: This ash - elm floodplain forest is found in the northern midwestern United States and adjacent southern Canada, ranging from central and northern Michigan and Wisconsin to southern Manitoba.
Nations: CA, US
States/Provinces: MB:S2, MI, MN, ND:S1S2, ON, QC:S2?, SD, WI, WY
TNC Ecoregions: 35:C, 46:C, 47:C, 48:C
USFS Ecoregions (1994/95): 212Hb:CC?, 212He:CCP, 212Hm:CCP, 212Hq:CCC, 212Hr:CCP, 212Hs:CCP, 212Ht:CCP, 212Hu:CCP, 212Hx:CCP, 212Hy:CCP, 212Ja:CPP, 212Jb:CPP, 212Jc:CPP, 212Jl:CPP, 212Jm:CPP, 212Jn:CPP, 212Jo:CPP, 212Nd:CCC, 222If:CCC, 222Jb:CCC, 222Jc:CCC, 222Md:CCC, 222Na:CCC, 251Aa:CCC, 251Ab:CCC, 251Ba:CCC
Federal Lands: NPS (Saint Croix); USFS (Huron-Manistee, Manistee, Ottawa)

ELEMENT SOURCES

Saint Croix National Scenic Riverway Map Code: FHF
Saint Croix National Scenic Riverway Plots: SACN.51, SACN.68, SACN.76, SACN.82, SACN.114, SACN.260, SACN.289, SACN.293, SACN.3542, SACN.4721, SACN.4741, SACN.5121, SACN.5127, SACN.7509.
Local Description Authors: M.J. Russo
Global Description Authors: D. Faber-Langendoen
References: Chapman et al. 1989, Epstein pers. comm., Eyre 1980, Faber-Langendoen 2001, Greenall 1996, MNNHP 1993, Midwestern Ecology Working Group n.d., NDNHI unpubl. data, WNHIP unpubl. data

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M030. Northern & Central Swamp Forest

G046. Northern & Central Conifer & Hardwood Alkaline Swamp

Red Maple - Ash - Birch Swamp Forest

***Acer rubrum - Fraxinus* spp. - *Betula papyrifera / Cornus canadensis* Forest**
Red Maple - Ash species - Paper Birch / Bunchberry Dogwood Forest
Identifier: CEGL002071

NVC CLASSIFICATION

Division	Eastern North American Flooded & Swamp Forest (1.C.3.Na)
Macrogroup	Northern & Central Swamp Forest (M030)
Group	Northern & Central Conifer & Hardwood Alkaline Swamp (G046)
Association (Common name)	Red Maple - Ash - Birch Swamp Forest

ELEMENT CONCEPT

Global Summary: This red maple swamp forest type is found in the northern parts of the Great Lakes region of the United States and in adjacent Canada. Stands are typically found on muck and shallow peat on lakeplains and floodplains. The canopy structure is variable, with cover ranging from open (25-60%) to closed (60-100%). Common canopy dominants include *Acer rubrum* (red maple), *Betula alleghaniensis* (yellow birch), *Betula papyrifera* (paper birch), *Fraxinus nigra* (black ash), *Fraxinus pennsylvanica* (green ash), and occasional *Larix laricina* (tamarack), *Pinus strobus* (eastern white pine), and *Ulmus americana* (American elm) (at least historically). *Pinus strobus* (eastern white pine) may form a patchy supercanopy above the hardwood canopy. Common shrubs include *Alnus incana* (gray alder). *Toxicodendron vernix* (poison-sumac) may be common in parts of the range. Other associates include *Ilex verticillata* (common winterberry), *Ribes* (currant) spp., and *Rubus idaeus* ssp. *strigosus* (grayleaf red raspberry). The herbaceous layer contains *Carex stipata* (awlfruit sedge), *Impatiens capensis* (jewelweed), *Mitella nuda* (naked miterwort), *Onoclea sensibilis* (sensitive fern), *Osmunda cinnamomea* (cinnamon fern), *Osmunda claytoniana* (interrupted fern), *Saxifraga pensylvanica* (eastern swamp saxifrage), and others. A seepage swamp subtype can occur where steep sandy slopes and gravelly slopes merge with a river or stream terrace. The ground layer can be exceptionally diverse, with characteristic seepage species including *Angelica atropurpurea* (purplestem angelica), *Carex bromoides* (bromelike sedge), *Hydrocotyle americana* (American marshpennywort), *Poa paludigena* (bog bluegrass), *Saxifraga pensylvanica* (eastern swamp saxifrage), and *Symplocarpus foetidus* (skunk-cabbage).

ENVIRONMENTAL DESCRIPTION

Saint Croix National Scenic Riverway Environment: This common red maple - ash - birch swamp forest was sampled at 17 locations in the park. Sites are on flat to gently sloping floodplains and swamps. Soils are wet, somewhat poorly to poorly drained peat and muck. The unvegetated surface of one plot is dominated by leaf litter (93% cover) with some wood (2%), bare soil (2%) and dead plant stems (3%). Evidence of disturbance includes the presence of exotic plants.
Global Environment: Stands are typically found on muck and shallow peat on lakeplains and floodplains (MNNHP 1993).

VEGETATION DESCRIPTION

Saint Croix National Scenic Riverway Vegetation: Stratum height or cover data were recorded for only one of the sample plots. It has a sparse (30% cover) tree canopy, 10-15 m tall, moderately sparse (40%) tall-shrub layer (1-2 m), very sparse (5%) short-shrub layer (0.5-1 m), moderately dense (70%) herbaceous layer and moderate (50%) nonvascular layer. The dominant tree species are *Acer rubrum* (red maple), *Betula alleghaniensis* (yellow birch), and *Fraxinus nigra* (black ash); additional species may include *Abies balsamea* (balsam fir), *Betula papyrifera* (paper birch), *Fraxinus pennsylvanica* (green ash), *Larix laricina* (tamarack), *Ostrya virginiana* (hophornbeam), *Pinus strobus* (eastern white pine), *Populus tremuloides* (quaking aspen), *Quercus rubra* (northern red oak), *Tilia americana* (American basswood), *Ulmus americana* (American elm), and *Ulmus rubra* (slippery elm). Shrubs include *Acer spicatum* (mountain maple), *Alnus incana* (gray alder), *Cornus alternifolia* (alternateleaf dogwood), *Corylus cornuta* (beaked hazelnut), *Ilex verticillata* (common winterberry), *Rubus* (blackberry) spp., *Toxicodendron radicans* (eastern poison-ivy), and *Zanthoxylum americanum* (common pricklyash). Dominant and/or common herbs include *Amphicarpaea bracteata* (American hogpeanut), *Aralia nudicaulis* (wild sarsaparilla), *Arisaema triphyllum* (Jack in the pulpit), *Athyrium filix-femina* (common ladyfern), *Carex bromoides* (bromelike sedge), *Carex pedunculata* (longstalk sedge), *Carex pensylvanica* (Pennsylvania sedge), *Circaea lutetiana* (broadleaf enchanter's nightshade), *Clintonia borealis* (bluebead), *Dryopteris cristata* (crested woodfern), *Equisetum pratense* (meadow horsetail), *Gymnocarpium dryopteris* (western oakfern), *Laportea canadensis* (Canadian woodnettle), *Maianthemum canadense* (Canada mayflower), *Matteuccia struthiopteris* (ostrich fern), *Osmunda cinnamomea* (cinnamon fern), *Osmunda claytoniana* (interrupted fern), *Symplocarpus foetidus* (skunk-cabbage), *Thelypteris palustris* (eastern marsh fern), and many others. Mosses include species of *Brachythecium* (brachythecium moss), *Plagiomnium* (plagiomnium moss), *Sphagnum* (sphagnum), and *Taxiphyllum deplanatum*. In addition, this community may support Minnesota state-imperiled *Poa paludigena* (bog bluegrass) and state-vulnerable *Hydrocotyle americana* (American marshpennywort), *Juglans cinerea* (butternut), and *Malaxis brachypoda* (white adder's-mouth orchid), and Wisconsin state-imperiled *Equisetum palustre* (marsh horsetail) and *Geum macrophyllum* var. *perincisum* (largeleaf avens) and state-vulnerable *Carex gynocrates* (northern bog sedge), *Malaxis brachypoda* (white adder's-mouth orchid), *Poa paludigena* (bog bluegrass), *Isopterygium tenerum* (isopterygium moss), and *Juglans cinerea* (butternut).

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Global Vegetation: The canopy structure is variable, with cover ranging from open (25-60%) to closed (60-100%). Common canopy dominants include *Acer rubrum* (red maple), *Betula alleghaniensis* (yellow birch), *Betula papyrifera* (paper birch), *Fraxinus nigra* (black ash), *Fraxinus pennsylvanica* (green ash), and occasional *Larix laricina* (tamarack), *Pinus strobus* (eastern white pine), and *Ulmus americana* (American elm) (at least historically). *Pinus strobus* (eastern white pine) may form a patchy supercanopy above the hardwood canopy. Common shrubs include *Alnus incana* (gray alder), and *Toxicodendron vernix* (poison-sumac) may be common in parts of the range. Other associates include *Ilex verticillata* (common winterberry), *Ribes* (currant) spp., and *Rubus idaeus* ssp. *strigosus* (grayleaf red raspberry). The herbaceous layer contains *Carex stipata* (awlfruit sedge), *Impatiens capensis* (jewelweed), *Mitella nuda* (naked miterwort), *Onoclea sensibilis* (sensitive fern), *Osmunda cinnamomea* (cinnamon fern), *Osmunda claytoniana* (interrupted fern), *Saxifraga pensylvanica* (eastern swamp saxifrage), and others (MNNHP 1993, Wovcha et al. 1995). A seepage swamp subtype can occur where steep sandy slopes and gravelly slopes merge with a river or stream terrace. The ground layer can be exceptionally diverse, with characteristic seepage species including *Angelica atropurpurea* (purplestem angelica), *Carex bromoides* (bromelike sedge), *Hydrocotyle americana* (American marshpennywort), *Poa paludigena* (bog bluegrass), *Saxifraga pensylvanica* (eastern swamp saxifrage), and *Symplocarpus foetidus* (skunk-cabbage) (MNNHP 1993, Wovcha et al. 1995).

MOST ABUNDANT SPECIES

Saint Croix National Scenic Riverway

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Acer rubrum* (red maple), *Betula alleghaniensis* (yellow birch), *Fraxinus nigra* (black ash)
Tall shrub/sapling	Broad-leaved deciduous shrub	*Acer spicatum* (mountain maple), *Ilex verticillata* (common winterberry)
Herb (field)	Forb	*Symplocarpus foetidus* (skunk-cabbage)
Herb (field)	Graminoid	*Carex bromoides* (bromelike sedge)
Herb (field)	Fern or fern ally	*Athyrium filix-femina* (common ladyfern), *Osmunda cinnamomea* (cinnamon fern)

CHARACTERISTIC SPECIES

Saint Croix National Scenic Riverway: *Acer rubrum* (red maple), *Acer spicatum* (mountain maple), *Athyrium filix-femina* (common ladyfern), *Betula alleghaniensis* (yellow birch), *Carex bromoides* (bromelike sedge), *Fraxinus nigra* (black ash), *Ilex verticillata* (common winterberry), *Osmunda cinnamomea* (cinnamon fern), *Symplocarpus foetidus* (skunk-cabbage)

OTHER NOTEWORTHY SPECIES

Saint Croix National Scenic Riverway: Vulnerable: *Carex gynocrates* (northern bog sedge, WI state-vulnerable, G5), *Equisetum palustre* (marsh horsetail, WI state-imperiled, G5), *Geum macrophyllum* var. *perincisum* (largeleaf avens, WI state-imperiled, G5T5), *Hydrocotyle americana* (American marshpennywort, MN state-vulnerable, G5), *Isopterygium tenerum* (isopterygium moss, WI state-vulnerable, G5), *Juglans cinerea* (butternut, MN & WI state-vulnerable, G4), *Malaxis brachypoda* (white adder's-mouth orchid, MN & WI state-vulnerable, G4Q), *Poa paludigena* (bog bluegrass, MN & WI state-imperiled, G3); **Exotic/Invasive**: *Agrostis gigantea* (redtop, invasive/exotic, Medium/Low), *Rhamnus cathartica* (common buckthorn, invasive/exotic, High/Medium), *Taraxacum officinale* (common dandelion, invasive/exotic), *Urtica dioica* (stinging nettle, invasive/exotic)
Global: Vulnerable: *Dryopteris crinalis* (serpent woodfern, G3), *Poa paludigena* (bog bluegrass, G3), *Rubus hispidoides* (bog dewberry, globally imperiled, G2?Q)

CONSERVATION STATUS RANK

Global Rank & Reasons: G4 (3-Oct-1996). In Wisconsin, where the type is ranked S2, few high-quality occurrences have been documented (E. Epstein pers. comm. 1999).

CLASSIFICATION

Status: Standard
Classification Confidence: 2 - Moderate
Global Comments: Hydrology of this type may be a combination of seasonally flooded and saturated. This type can arise as a result of logging cedar swamps, or where hydrology has been altered (E. Epstein pers. comm. 1999). *Fraxinus nigra* (black ash) is less than 50% of the cover; if greater, then see the *Fraxinus nigra* (black ash) type (CEGL002105). If *Larix laricina* (tamarack) is at least 25% of the canopy, then see *Larix laricina - Acer rubrum / (Rhamnus alnifolia*, *Vaccinium corymbosum* (highbush blueberry)) Forest (CEGL005232) or *Larix laricina / Alnus incana* Forest (CEGL002471).
Global Similar Associations:
- *Fraxinus nigra* - Mixed Hardwoods - Conifers / *Cornus sericea / Carex* spp. Forest (CEGL002105) This type is dominated by *Fraxinus nigra* and is more northern in distribution.
- *Larix laricina - Acer rubrum / (Rhamnus alnifolia, Vaccinium corymbosum)* Forest (CEGL005232) This type contains significant *Larix laricina* (generally at least 25%, and more typically over 50% cover) and *Acer rubrum* (at least 25%). May overlap in concept.
- *Larix laricina / Alnus incana* Forest (CEGL002471) This type is a rich swamp, with *Larix laricina* as the dominant (generally >50% cover).
- *Symplocarpus foetidus* Herbaceous Vegetation (CEGL002385)

Global Related Concepts:

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- Mixed Hardwood Swamp (MNNHP 1993) ><
- Mixed Hardwood Swamp Seepage Subtype (MNNHP 1993) <
- Northern Hardwood Swamp Red Maple-Ash-Birch Subtype (Faber-Langendoen 2001) =
- Southern Swamp (Chapman et al. 1989) >

ELEMENT DISTRIBUTION

Global Range: This red maple swamp forest type is found in the northern parts of the Great Lake states region of the United States and in adjacent Canada, ranging from Minnesota east to Michigan and Ontario.
Nations: CA, US
States/Provinces: MI, MN, ON, QC, WI:S2?
TNC Ecoregions: 35:C, 45:P, 46:C, 47:C, 48:C
USFS Ecoregions (1994/95): 212He:CCP, 212Hl:CCP, 212Hm:CCP, 212Hn:CCP, 212Ho:CCP, 212Hp:CCP, 212Hq:CCP, 212Hr:CCP, 212Hs:CCP, 212Ht:CCP, 212Hu:CCP, 212Hv:CCC, 212Hw:CCP, 212Hx:CCP, 212Hy:CCP, 212Ia:CCC, 212Ja:CPP, 212Jb:CPP, 212Jc:CPP, 212Jl:CPP, 212Jn:CPP, 212Jo:CPP, 212Kb:CCC, 212La:CPP, 212Mb:CPP, 212Na:CCP, 212Nb:CCP, 212Nc:CCC, 222Jc:CCC, 222Jg:CCC, 222Mc:CCC, 222Md:CCC, 222Na:CCC
Federal Lands: NPS (Apostle Islands, Isle Royale, Saint Croix, Sleeping Bear Dunes); USFS (Chequamegon-Nicolet?, Chequamegon?, Chippewa, Huron-Manistee, Huron?, Manistee, Nicolet?, Ottawa)

ELEMENT SOURCES

Saint Croix National Scenic Riverway Map Code: FRM
Saint Croix National Scenic Riverway Plots: SACN.217, SACN.0367, SACN.0388, SACN.0672, SACN.4471, SACN.4473, SACN.4719, SACN.4735, SACN.4736, SACN.4745, SACN.4779, SACN.5059, SACN.5115, SACN.5496, SACN.7493, SACN.7500, SACN.8325.
Local Description Authors: M.J. Russo
Global Description Authors: D. Faber-Langendoen
References: Chapman et al. 1989, Epstein pers. comm., Faber-Langendoen 2001, Hop et al. 2010a, MNNHP 1993, Midwestern Ecology Working Group n.d., TNC 1999b, WNHIP unpubl. data, Wovcha et al. 1995

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Black Ash - Mixed Hardwood Swamp

***Fraxinus nigra* - Mixed Hardwoods - Conifers / *Cornus sericea / Carex* spp. Forest**
Black Ash - Mixed Hardwoods - Conifers / Red-osier Dogwood / Sedge species Forest
Identifier: CEGL002105

NVC CLASSIFICATION

Division	Eastern North American Flooded & Swamp Forest (1.C.3.Na)
Macrogroup	Northern & Central Swamp Forest (M030)
Group	Northern & Central Conifer & Hardwood Alkaline Swamp (G046)
Association (Common name)	Black Ash - Mixed Hardwood Swamp

ELEMENT CONCEPT

Global Summary: This black ash - hardwood swamp forest is found widely in the northern midwestern region of the United States and into the boreal region of central Canada. Sites are found on well-decomposed woody peat or fine mineral soil. The type is found where perched wet pockets occur on fine sandy, clay loamy to fine loamy soils in valleys with impeded drainage or near shores. Hydrology can vary from seasonally flooded to saturated. Conditions are often transitional to uplands. Canopy structure is variable, ranging from 30-90% cover. The canopy is dominated by *Fraxinus nigra* (black ash) (at least 50% cover), with a diverse mix of hardwoods and conifers in the main and subcanopies, including *Abies balsamea* (balsam fir), *Acer rubrum* (red maple), *Betula papyrifera* (paper birch), *Betula alleghaniensis* (yellow birch), *Fraxinus pennsylvanica* (green ash), *Picea glauca* (white spruce), *Populus balsamifera* (balsam poplar), *Populus tremuloides* (quaking aspen), *Thuja occidentalis* (northern white-cedar), *Tilia americana* (American basswood), and *Ulmus americana* (American elm). Shrub and sapling species include *Abies balsamea* (balsam fir), *Acer spicatum* (mountain maple), *Cornus sericea* (red-osier dogwood), *Corylus cornuta* (beaked hazelnut), *Lonicera canadensis* (American fly honeysuckle), *Prunus virginiana* (chokecherry), *Ribes triste* (red currant), *Rubus idaeus* (American red raspberry), and *Rubus pubescens* (dwarf red blackberry). Herbaceous species include *Aralia nudicaulis* (wild sarsaparilla), *Eurybia macrophylla* (bigleaf aster), *Athyrium filix-femina* (common ladyfern), *Carex gracillima* (graceful sedge), *Carex intumescens* (greater bladder sedge), *Cinna latifolia* (drooping woodreed), *Circaea alpina* (small enchanter's nightshade), *Clintonia borealis* (bluebead), *Dryopteris carthusiana* (spinulose woodfern), *Equisetum sylvaticum* (woodland horsetail), *Fragaria virginiana* (Virginia strawberry), *Maianthemum canadense* (Canada mayflower), *Mitella nuda* (naked miterwort), *Streptopus lanceolatus* var. *longipes* (twistedstalk), *Thalictrum pubescens* (king-of-the-meadow), and *Trientalis borealis* (starflower). Mosses include *Climacium dendroides* (tree climacium moss), *Plagiomnium* (plagiomnium moss) spp. A floodplain variant may also occur, with more hardwood dominance, with wetter species present, such as *Alnus incana* (gray alder), *Calamagrostis canadensis* (bluejoint), and *Caltha palustris* (yellow marsh-marigold). Diagnostic features include the dominance by *Fraxinus nigra* (black ash).

ENVIRONMENTAL DESCRIPTION

Saint Croix National Scenic Riverway Environment: This common black ash - hardwood swamp forest was sampled at 22 locations in the park. Sites include flat seepage areas and floodplains as well as somewhat steep to gentle, west-facing slopes. Soils range from very poorly drained to moderately well-drained loamy sand, loam, silt loam, silty clay and muck. The unvegetated surface is dominated by leaf litter (1-94% cover) with some exposed bedrock (0-1%), large rocks (0-15%), wood (1-7%), bare soil (0-63%), standing water (0-1%) and dead plant stems (3-40%). Evidence of disturbance includes hiking trails, past logging, downed wood, tip-up mounds, erosion, and the presence of exotic plants.

Global Environment: Sites are found on well-decomposed woody peat or fine mineral soil. The type is found where perched wet pockets occur on fine sandy, clay loamy to fine loamy soils in valleys with impeded drainage or near shores. Hydrology can vary from seasonally flooded to saturated. Conditions are often transitional to uplands (Sims et al. 1989, MNNHP 1993, Cleland et al. 1994, Chambers et al. 1997).

VEGETATION DESCRIPTION

Saint Croix National Scenic Riverway Vegetation: The sparse to dense (20-80% cover) tree canopy, 10-20 m tall, and sparse to dense (20-80%) subcanopy (5-15 m) are dominated by *Fraxinus nigra* (black ash) and may include *Acer negundo* (box-elder), *Betula alleghaniensis* (yellow birch), *Fraxinus pennsylvanica* (green ash), *Ostrya virginiana* (hophornbeam), *Populus tremuloides* (quaking aspen), *Quercus macrocarpa* (bur oak), *Tilia americana* (American basswood), *Ulmus americana* (American elm), and/or *Ulmus rubra* (slippery elm). The very sparse to dense (5-80%) tall-shrub layer (1-5 m) and very sparse (5-20%) short-shrub layer (0.5-2 m) may include *Acer spicatum* (mountain maple), *Alnus incana* (gray alder), *Corylus americana* (American hazelnut), *Corylus cornuta* (beaked hazelnut), *Fraxinus nigra* (black ash), *Ilex verticillata* (common winterberry), *Rubus* (blackberry) sp., *Ulmus americana* (American elm), *Viburnum lentago* (nannyberry), and/or *Zanthoxylum americanum* (common pricklyash). The sparse to complete (20-100%) herbaceous layer may be dominated by *Carex bromoides* (bromelike sedge), *Carex interior* (inland sedge), *Carex lacustris* (hairy sedge), *Laportea canadensis* (Canadian woodnettle), *Onoclea sensibilis* (sensitive fern), and/or *Symplocarpus foetidus* (skunk-cabbage); additional herbs include *Amphicarpaea bracteata* (American hogpeanut), *Aralia nudicaulis* (wild sarsaparilla), *Athyrium filix-femina* ssp. *angustum* (subarctic ladyfern), *Elymus virginicus* (Virginia wildrye), *Equisetum palustre* (marsh horsetail), *Eurybia macrophylla* (bigleaf aster), *Impatiens capensis* (jewelweed), and *Ranunculus hispidus* (bristly buttercup). Nonvascular species (mosses), when present, cover 5-20% of the ground surface and include species of *Anomodon*, *Calliergon* (calliergon moss), *Hypnum* (hypnum moss), *Plagiomnium* (plagiomnium moss), and *Sphagnum* (sphagnum). In addition, this community may support Minnesota state-imperiled and globally vulnerable *Poa paludigena* (bog bluegrass) and state-vulnerable *Juglans cinerea* (butternut), and

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Wisconsin state-critically imperiled *Poa sylvestris* (woodland bluegrass) and *Galium brevipes* (limestone swamp bedstraw), state-imperiled *Equisetum palustre* (marsh horsetail), and state-vulnerable *Petasites frigidus* var. *sagittatus* (arrowleaf sweet coltsfoot), *Poa paludigena* (bog bluegrass), and *Juglans cinerea* (butternut), all of which were found in the sampled plots.

Global Vegetation: Canopy structure is variable, ranging from 30-90% cover. The canopy is dominated by *Fraxinus nigra* (black ash) (at least 50% cover), with a diverse mix of hardwoods and conifers in the main and sub canopies, including *Abies balsamea* (balsam fir), *Acer rubrum* (red maple), *Betula papyrifera* (paper birch), *Betula alleghaniensis* (yellow birch), *Fraxinus pennsylvanica* (green ash), *Picea glauca* (white spruce), *Populus balsamifera* (balsam poplar), *Populus tremuloides* (quaking aspen), *Thuja occidentalis* (northern white-cedar), *Tilia americana* (American basswood), and *Ulmus americana* (American elm). Shrub and sapling species include *Abies balsamea* (balsam fir), *Acer spicatum* (mountain maple), *Cornus sericea* (red-osier dogwood), *Corylus cornuta* (beaked hazelnut), *Lonicera canadensis* (American fly honeysuckle), *Prunus virginiana* (chokecherry), *Ribes triste* (red currant), *Rubus idaeus* (American red raspberry), and *Rubus pubescens* (dwarf red blackberry). Herbaceous species include *Aralia nudicaulis* (wild sarsaparilla), *Eurybia macrophylla* (bigleaf aster), *Athyrium filix-femina* (common ladyfern), *Carex gracillima* (graceful sedge), *Carex intumescens* (greater bladder sedge), *Cinna latifolia* (drooping woodreed), *Circaea alpina* (small enchanter's nightshade), *Clintonia borealis* (bluebead), *Dryopteris carthusiana* (spinulose woodfern), *Equisetum sylvaticum* (woodland horsetail), *Fragaria virginiana* (Virginia strawberry), *Maianthemum canadense* (Canada mayflower), *Mitella nuda* (naked miterwort), *Streptopus lanceolatus* (twistedstalk), *Thalictrum pubescens* (king-of-the-meadow), and *Trientalis borealis* (starflower). Mosses include *Climacium dendroides* (tree climacium moss), *Plagiomnium* (plagiomnium moss) spp. (Sims et al. 1989, MNNHP 1993, Cleland et al. 1994, Harris et al. 1996, Chambers et al. 1997). A floodplain variant may also occur, with more hardwood dominance, with wetter species present, such as *Alnus incana* (gray alder), *Calamagrostis canadensis* (bluejoint), and *Caltha palustris* (yellow marsh-marigold) (Harris et al. 1996). Diagnostic features include the dominance by *Fraxinus nigra* (black ash).

MOST ABUNDANT SPECIES

Saint Croix National Scenic Riverway

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Fraxinus nigra* (black ash)
Tall shrub/sapling	Broad-leaved deciduous shrub	*Alnus incana* (gray alder)
Herb (field)	Forb	*Laportea canadensis* (Canadian woodnettle), *Symplocarpus foetidus* (skunk-cabbage)
Herb (field)	Graminoid	*Carex bromoides* (bromelike sedge), *Carex lacustris* (hairy sedge)
Herb (field)	Fern or fern ally	*Onoclea sensibilis* (sensitive fern)

CHARACTERISTIC SPECIES

Saint Croix National Scenic Riverway: *Alnus incana* (gray alder), *Carex bromoides* (bromelike sedge), *Carex lacustris* (hairy sedge), *Fraxinus nigra* (black ash), *Laportea canadensis* (Canadian woodnettle), *Onoclea sensibilis* (sensitive fern), *Symplocarpus foetidus* (skunk-cabbage)

OTHER NOTEWORTHY SPECIES

Saint Croix National Scenic Riverway: Vulnerable: *Equisetum palustre* (marsh horsetail, WI state-imperiled, G5), *Galium brevipes* (limestone swamp bedstraw, WI state-imperiled, G4?), *Juglans cinerea* (butternut, MN & WI state-vulnerable, G4), *Petasites frigidus* var. *sagittatus* (arrowleaf sweet coltsfoot, WI state-vulnerable, G5), *Poa paludigena* (bog bluegrass, MN & WI state-imperiled, G3), *Poa sylvestris* (woodland bluegrass, WI state-critically imperiled, G5); **Exotic/Invasive**: *Convolvulus arvensis* (field bindweed, invasive/exotic, Medium/Low), *Crataegus monogyna* (oneseed hawthorn, invasive/exotic), *Crepis tectorum* (narrowleaf hawksbeard, invasive/exotic), *Lonicera tatarica* (Tatarian honeysuckle, invasive/exotic, High/Medium), *Myosotis scorpioides* (true forget-me-not, invasive/exotic), *Rhamnus cathartica* (common buckthorn, invasive/exotic, High/Medium), *Taraxacum officinale* (common dandelion, invasive/exotic), *Urtica dioica* (stinging nettle, invasive/exotic)

CONSERVATION STATUS RANK

Global Rank & Reasons: G4 (3-Oct-1996).

CLASSIFICATION

Status: Standard

Classification Confidence: 2 - Moderate

Global Comments: This type description is essentially boreal to sub-boreal in content, emphasizing the northern/western part of the range. Southern/eastern stands may differ and may warrant a separate type. For examples, see the description in Michigan provided by the Manistee National Forest FEC, ELTP 74 (Cleland et al. 1994), which lists *Hamamelis virginiana* (American witch-hazel), *Salix* (willow) spp. *Viburnum acerifolium* (mapleleaf viburnum), and *Viburnum nudum* var. *cassinoides* (withe-rod) in the shrub layer; and descriptions from central Minnesota (MNNHP 1993, Wovcha et al. 1995), which include virtually no conifers, lack a number of boreal species, and include others, such as the shrubs *Ilex verticillata* (common winterberry) and *Toxicodendron vernix* (poison-sumac), and the herbs *Arisaema triphyllum* (Jack in the pulpit), *Glyceria striata* (fowl mannagrass), *Impatiens capensis* (jewelweed), *Osmunda cinnamomea* (cinnamon fern), and *Onoclea sensibilis* (sensitive fern). A seepage variant has also been described in Minnesota, containing *Carex bromoides* (bromelike sedge) and *Symplocarpus foetidus* (skunk-cabbage). This seepage variant may resemble the riparian variant described in northern Ontario (MNNHP 1993, Harris et al. 1996 -W34). Finally, in Wisconsin stands have been described with a tree layer of *Fraxinus nigra* (black ash), *Tilia americana* (American basswood), *Picea glauca* (white

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spruce), a ground layer dominated by *Matteuccia struthiopteris* (ostrich fern) and *Laportea canadensis* (Canadian woodnettle), and a diverse mix of spring ephemerals that are more typical of southern Wisconsin (E. Epstein pers. comm. 1999).

Global Similar Associations:

- *Acer rubrum - Fraxinus* spp. - *Betula papyrifera / Cornus canadensis* Forest (CEGL002071)
- *Symplocarpus foetidus* Herbaceous Vegetation (CEGL002385)

Global Related Concepts:

- Black Ash Hardwood and Mixedwood (V2) (Sims et al. 1989) =
- Black Ash Swamp (MNNHP 1993) <
- Black Ash Swamp Seepage Subtype (MNNHP 1993) <
- Black Ash-Hardwoods-Herb Rich (V7) (Chambers et al. 1997) =
- ELTP 74 - Black ash-basswood-Viola plant association (Cleland et al. 1994) =
- Hardwood swamp: black ash (other hardwood): riparian (W34) (Harris et al. 1996) <
- Hardwood swamp: black ash (other hardwood): upland transition (W33) (Harris et al. 1996) <
- Northern Hardwood Swamp Black Ash Subtype (Faber-Langendoen 2001) =
- Northern Swamp (Chapman et al. 1989) >

ELEMENT DISTRIBUTION

Global Range: This black ash - hardwood swamp forest type is found widely in the northern midwestern region of the United States and into the boreal region of central Canada, ranging from northern Indiana and northern Illinois northward to Ontario and Manitoba.

Nations: CA, US

States/Provinces: IL, IN, MB:S2, MI, MN, ND:S3, ON, QC:S4?, WI:S3, WY

TNC Ecoregions: 35:C, 36:C, 46:C, 47:C, 48:C

USFS Ecoregions (1994/95): 212Ha:CCP, 212Hb:CCP, 212Hd:CCC, 212He:CCP, 212Hh:CCP, 212Hi:CCC, 212Hj:CCP, 212Hk:CCP, 212Hl:CCP, 212Hm:CCC, 212Hn:CCP, 212Ho:CCC, 212Hp:CCP, 212Hq:CCP, 212Hr:CCP, 212Hs:CCP, 212Ht:CCP, 212Hv:CCP, 212Hw:CCC, 212Hy:CCP, 212Ia:CCC, 212Ib:CCC, 212Ja:CCP, 212Jb:CCC, 212Jc:CCC, 212Jd:CCC, 212Je:CCP, 212Jf:CCP, 212Jj:CCP, 212Jk:CCP, 212Jl:CCP, 212Jm:CCC, 212Jn:CCP, 212Jo:CCP, 212Jr:CCP, 212Ka:CCC, 212Kb:CCC, 212La:CCC, 212Lb:CCC, 212Mb:CCC, 212Na:CCC, 212Nb:CCP, 212Nc:CCC, 212Oa:CCC, 222Ke:CCC, 222Kf:CCC, 222Kg:CCC, 222Lc:CCC, 222Ld:CCC, 222Lf:CCC, 222Mc:CCC, 222Md:CCC, 222Na:CCC, 251Aa:CCC, 251Dc:CCC

Federal Lands: NPS (Apostle Islands, Grand Portage, Isle Royale, Pictured Rocks, Saint Croix, Sleeping Bear Dunes, Voyageurs); USFS (Chequamegon, Chequamegon-Nicolet, Chippewa, Huron-Manistee, Manistee, Nicolet, Ottawa, Superior)

ELEMENT SOURCES

Saint Croix National Scenic Riverway Map Code: FBA

Saint Croix National Scenic Riverway Plots: SACN.1, SACN.2, SACN.31, SACN.38, SACN.52, SACN.83, SACN.90, SACN.100, SACN.224, SACN.258, SACN.0161, SACN.3536, SACN.3537, SACN.3541, SACN.4008, SACN.4780, SACN.5128, SACN.5129, SACN.5137, SACN.7494, SACN.7497, SACN.7602.

Local Description Authors: M.J. Russo

Global Description Authors: D. Faber-Langendoen

References: Chambers et al. 1997, Chapman et al. 1989, Cleland et al. 1994, Faber-Langendoen 2001, Greenall 1996, Harris et al. 1996, Hop et al. 2010a, Hop et al. 2010b, Hop et al. 2010c, MNNHP 1993, Midwestern Ecology Working Group n.d., NDNHI unpubl. data, Sims et al. 1989, TNC 1999b, WNHIP unpubl. data, Wovcha et al. 1995

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White-cedar - Black Ash Swamp

***Thuja occidentalis - Fraxinus nigra* Forest**
Northern White-cedar - Black Ash Forest
Identifier: CEGL005165

NVC CLASSIFICATION

Division	Eastern North American Flooded & Swamp Forest (1.C.3.Na)
Macrogroup	Northern & Central Swamp Forest (M030)
Group	Northern & Central Conifer & Hardwood Alkaline Swamp (G046)
Association (Common name)	White-cedar - Black Ash Swamp

ELEMENT CONCEPT

Global Summary: This white-cedar - black ash forest is found in the sub-boreal regions of the Great Lakes in the United States and Canada where it occurs on wet, saturated soils. Substrate is well-decomposed peat, and hummocky topography is present. Canopy cover is variable, sometimes fairly open. *Thuja occidentalis* (northern white-cedar) and *Fraxinus nigra* (black ash) dominate the canopy, but some stands may have *Fraxinus* (ash) in the upper canopy and *Thuja* (red cedar) in the lower canopy. *Thuja* (red cedar) tends to occur on the hummocks and *Fraxinus* (ash) in the hollows. *Populus tremuloides* (quaking aspen) can be a major component, but this may be caused by logging of *Thuja* (red cedar). *Acer rubrum* (red maple), *Betula alleghaniensis* (yellow birch), and *Picea glauca* (white spruce) may also be present. Shrubs include *Acer spicatum* (mountain maple), *Cornus alternifolia* (alternateleaf dogwood), *Lonicera canadensis* (American fly honeysuckle), *Ribes* (currant) spp., and *Rubus pubescens* (dwarf red blackberry). The herb layer includes *Aralia nudicaulis* (wild sarsaparilla), *Arisaema triphyllum* (Jack in the pulpit), *Clintonia borealis* (bluebead), *Cornus canadensis* (bunchberry dogwood), *Dryopteris carthusiana* (spinulose woodfern), *Galium triflorum* (fragrant bedstraw), *Maianthemum canadense* (Canada mayflower), *Tiarella cordifolia* (heartleaf foamflower) and *Trientalis borealis* (starflower).

ENVIRONMENTAL DESCRIPTION

Saint Croix National Scenic Riverway Environment: This white-cedar - black ash forest was sampled at 15 locations in the park. Sites include flat to gently sloping swamps and floodplains with moderately well-drained to very poorly drained muck or peat soils which may be saturated or intermittently flooded. The unvegetated surface is dominated by leaf litter (5-86% cover) or bare soil (2-60%) with some wood (3-10%), standing water (0-20%), and dead plant stems (2-10%). Evidence of disturbance includes trails, downed wood and tip-up mounds possibly due to wind, and the presence of exotic plants.
Global Environment: Stands occur on wet, saturated soils. Substrate is either wet mineral soils or well-decomposed peat, and hummocky topography is present.

VEGETATION DESCRIPTION

Saint Croix National Scenic Riverway Vegetation: The very sparse to total dense (10-100% cover) tree canopy, 10-20 m tall, and very sparse to moderately dense (5-70%) subcanopy (5-15 m) are dominated by *Thuja occidentalis* (northern white-cedar). Additional tree species may include *Abies balsamea* (balsam fir), *Betula alleghaniensis* (yellow birch), *Betula papyrifera* (paper birch), *Fraxinus nigra* (black ash), *Fraxinus pennsylvanica* (green ash), *Picea mariana* (black spruce), and *Ulmus americana* (American elm). The very sparse (5-10%) tall-shrub layer (2-5 m) and very sparse (5-200%) short-shrub layer (0.5-1 m), when present, are comprised of *Acer spicatum* (mountain maple), *Alnus incana* (gray alder), *Fraxinus nigra* (black ash), *Ilex verticillata* (common winterberry), *Ledum groenlandicum* (bog Labrador-tea), *Rubus* (blackberry) spp., and *Toxicodendron radicans* ssp. *radicans* (eastern poison-ivy). The sparse to dense (20-80%) herbaceous layer is often dominated by ferns, including *Athyrium filix-femina* ssp. *angustum* (subarctic ladyfern), *Onoclea sensibilis* (sensitive fern), *Osmunda cinnamomea* (cinnamon fern), and *Osmunda regalis* (royal fern). Additional herbs that may be present include *Amphicarpaea bracteata* (American hogpeanut), *Aralia nudicaulis* (wild sarsaparilla), *Calamagrostis canadensis* (bluejoint), *Carex leptalea* (bristly-stalked sedge), *Cinna latifolia* (drooping woodreed), *Coptis trifolia* (threeleaf goldthread), *Impatiens capensis* (jewelweed), *Lycopus uniflorus* (northern bugleweed), *Mitella nuda* (naked miterwort), *Symplocarpus foetidus* (skunk-cabbage), and *Trientalis borealis* (starflower). Nonvascular species (mosses) cover 30-80% of the ground surface and include species of *Brachythecium* (brachythecium moss), *Climacium* (climacium moss), *Mnium* (mnium calcareous moss), *Plagiomnium* (plagiomnium moss), *Sphagnum* (sphagnum), *Thuidium* (thuidium moss), *Rhizomnium magnifolium* (grandleaf rhizomnium moss), and *Rhytidiadelphus triquetrus* (rough gooseneck moss). In addition, this community supports may state-rare species, including *Selaginella selaginoides* (club spikemoss) (Minnesota and Wisconsin state-critically imperiled), Wisconsin state-imperiled *Geum macrophyllum* var. *perincisum* (largeleaf avens) and *Gymnocarpium robertianum* (scented oakfern), and Wisconsin state-vulnerable *Cypripedium parviflorum* (lesser yellow lady's slipper), *Cypripedium reginae* (showy lady's slipper), *Malaxis brachypoda* (white adder's-mouth orchid) (also Minnesota state-vulnerable), and *Petasites frigidus* var. *sagittatus* (arrowleaf sweet coltsfoot).
Global Vegetation: Canopy cover is variable, sometimes fairly open. *Thuja occidentalis* (northern white-cedar) and *Fraxinus nigra* (black ash) dominate the canopy, but some stands may have *Fraxinus* (ash) in the upper canopy and *Thuja* (red cedar) in the lower canopy. *Thuja* (red cedar) tends to occur on the hummocks and *Fraxinus* (ash) in the hollows. *Populus tremuloides* (quaking aspen) can be a major component, but this may be caused by logging of *Thuja* (red cedar). *Acer rubrum* (red maple), *Betula alleghaniensis* (yellow birch), and *Picea glauca* (white spruce) may also be present. Shrubs include *Acer spicatum* (mountain maple), *Cornus alternifolia* (alternateleaf dogwood), *Lonicera canadensis* (American fly honeysuckle), *Ribes* (currant) spp., and *Rubus pubescens* (dwarf red blackberry). The herb rich layer includes *Aralia nudicaulis* (wild sarsaparilla), *Arisaema triphyllum* (Jack in the pulpit),

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Clintonia borealis (bluebead), *Cornus canadensis* (bunchberry dogwood), *Dryopteris carthusiana* (spinulose woodfern), *Galium triflorum* (fragrant bedstraw), *Maianthemum canadense* (Canada mayflower), *Tiarella cordifolia* (heartleaf foamflower), and *Trientalis borealis* (starflower) (Chambers et al. 1997).

MOST ABUNDANT SPECIES

Saint Croix National Scenic Riverway

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Abies balsamea* (balsam fir), *Thuja occidentalis* (northern white-cedar)
Tree canopy	Broad-leaved deciduous tree	*Fraxinus nigra* (black ash)
Tall shrub/sapling	Broad-leaved deciduous shrub	*Acer spicatum* (mountain maple), *Alnus incana* (gray alder)
Herb (field)	Forb	*Mitella nuda* (naked miterwort)
Herb (field)	Graminoid	*Carex leptalea* (bristly-stalked sedge)
Herb (field)	Fern or fern ally	*Osmunda cinnamomea* (cinnamon fern), *Osmunda regalis* (royal fern)

CHARACTERISTIC SPECIES

Saint Croix National Scenic Riverway: *Abies balsamea* (balsam fir), *Acer spicatum* (mountain maple), *Alnus incana* (gray alder), *Carex leptalea* (bristly-stalked sedge), *Fraxinus nigra* (black ash), *Mitella nuda* (naked miterwort), *Osmunda cinnamomea* (cinnamon fern), *Osmunda regalis* (royal fern), *Thuja occidentalis* (northern white-cedar)

OTHER NOTEWORTHY SPECIES

Saint Croix National Scenic Riverway: Vulnerable: *Cypripedium parviflorum* (lesser yellow lady's slipper, WI state-vulnerable, G5), *Cypripedium reginae* (showy lady's slipper, WI state-vulnerable, G4), *Geum macrophyllum* var. *perincisum* (largeleaf avens, WI state-imperiled, G5T5), *Gymnocarpium robertianum* (scented oakfern, WI state-imperiled, G5), *Malaxis brachypoda* (white adder's-mouth orchid, MN & WI state-vulnerable, G4Q), *Petasites frigidus* var. *sagittatus* (arrowleaf sweet coltsfoot, WI state-vulnerable, G5), *Selaginella selaginoides* (club spikemoss, MN & WI state-critically imperiled, G5); **Exotic/Invasive**: *Agrostis gigantea* (redtop, invasive/exotic, Medium/Low), *Hieracium aurantiacum* (orange hawkweed, invasive/exotic, Medium/Low), *Polygonum convolvulus* (black bindweed, invasive/exotic), *Urtica dioica* (stinging nettle, invasive/exotic)
Global: Vulnerable: *Rubus hispidoides* (bog dewberry, globally imperiled, G2?Q)

CONSERVATION STATUS RANK

Global Rank & Reasons: GNR (3-Oct-1996).

CLASSIFICATION

Status: Standard
Classification Confidence: 3 - Weak
Global Comments: This type occurs on wet hummocky soils. Soils may be more minerotrophic than those found in pure white-cedar swamps. This type may better fit into a mixed conifer-hardwood category. Type may also be the same as *Thuja occidentalis - Acer rubrum / Cornus sericea* Forest (CEGL006199) or the White Cedar - (Mixed Conifer) / Alder Swamp, *Thuja occidentalis - (Picea mariana*, *Abies balsamea) / Alnus incana* Forest (CEGL002456). It may also be in Minnesota (Norm Aaseng). Distinctions at the association level are not clear, but will be reviewed as part of a Minnesota statewide analysis.
Global Similar Associations:
- *Thuja occidentalis - (Picea mariana, Abies balsamea) / Alnus incana* Forest (CEGL002456) A pure evergreen cedar swamp type.
- *Thuja occidentalis - Acer rubrum / Cornus sericea* Forest (CEGL006199) A more southerly distributed type.

Global Related Concepts:
- Hardwood-Conifer Swamp (Chapman et al. 1989) >
- White Cedar-Hardwoods-Fragrant Bedstraw-Herb Rich (V8) (Chambers et al. 1997) =

ELEMENT DISTRIBUTION

Global Range: This white-cedar - black ash swamp type is found in the northern Great Lakes region of the United States and Canada.
Nations: CA, US
States/Provinces: MI, MN, ON, WI
TNC Ecoregions: 47:C, 48:C
USFS Ecoregions (1994/95): 212Ha:CCP, 212Hb:CCP, 212He:CCP, 212Hh:CCP, 212Hi:CCC, 212Hj:CCC, 212Hk:CCP, 212Hl:CCC, 212Hm:CCC, 212Hn:CCP, 212Ho:CCC, 212Hp:CCP, 212Hq:CCP, 212Hr:CCP, 212Hs:CCC, 212Ht:CCC, 212Hu:CCP, 212Hv:CCC, 212Hw:CCC, 212Ia:CCC, 212Ja:CCP, 212Jb:CCC, 212Jc:CCP, 212Jk:CCP, 212Jl:CCP, 212Jn:CCP, 212Jo:CCP, 212Jr:CCP, 222If:CCC, 222Jc:CCC, 222Jg:CCC, 222Jh:CCC, 222Jj:CCC
Federal Lands: NPS (Apostle Islands, Isle Royale, Pictured Rocks, Saint Croix, Sleeping Bear Dunes, Voyageurs); USFS (Huron, Huron-Manistee, Ottawa, Superior?)

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ELEMENT SOURCES

Saint Croix National Scenic Riverway Map Code: FCA

Saint Croix National Scenic Riverway Plots: SACN.14, SACN.32, SACN.40, SACN.109, SACN.230, SACN.261, SACN.4462, SACN.4714, SACN.4715, SACN.4716, SACN.4717, SACN.4718, SACN.5125, SACN.7487, SACN.7491.

Local Description Authors: M.J. Russo

Global Description Authors: D. Faber-Langendoen

References: Chambers et al. 1997, Chapman et al. 1989, Hop et al. 2010a, Hop et al. 2010c, Midwestern Ecology Working Group n.d., TNC 1999b

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M160. Northern & Central Tall Shrub Wetland

G167. Northern & Central Shrub Swamp

Gray Alder Swamp

***Alnus incana* Swamp Shrubland**
Gray Alder Swamp Shrubland
Identifier: CEGL002381

NVC CLASSIFICATION

Division	Eastern North American Freshwater Wet Meadow, Riparian & Marsh (2.C.5.Na)
Macrogroup	Northern & Central Tall Shrub Wetland (M160)
Group	Northern & Central Shrub Swamp (G167)
Association (Common name)	Gray Alder Swamp

ELEMENT CONCEPT

Global Summary: This alder swamp community is widespread in the midwestern and northeastern United States and southern Canada. Stands occur on shores, edges of beaver meadows in stream floodplains, swales associated with small streams in peatlands, or upland forests. Soils are well-decomposed peat, muck or mineral soils. The hydrology is typically seasonally flooded, with most sites remaining saturated. The vegetation is dominated by tall shrubs, 2-8 m in height, with a moderately open to dense shrub canopy. There is an understory of shorter shrubs and herbaceous species. The density of the understory varies inversely with the tall-shrub canopy. The overstory is usually overwhelmingly dominated by *Alnus incana* (gray alder), but in the more southeastern portions of this type's range, *Alnus serrulata* (hazel alder) can occur with *Alnus incana* (gray alder). Where alder is not as dominant, other shrubs, such as *Cornus sericea* (red-osier dogwood), *Ilex verticillata* (common winterberry), *Rubus idaeus* (American red raspberry), *Salix* (willow) spp., *Spiraea alba* (white meadowsweet), *Spiraea tomentosa* (steeplebush), and *Viburnum* (viburnum) spp., can be found. At the southern range limit of this type in West Virginia, shrub layers may by be dominated or codominated by the Central Appalachian endemic *Ilex collina* (longstalk holly). The herbaceous layer contains species such as *Symphyotrichum lanceolatum* var. *lanceolatum* (white panicle aster), *Symphyotrichum puniceum* (purplestem aster), *Calamagrostis canadensis* (bluejoint), *Caltha palustris* (yellow marsh-marigold), *Carex lacustris* (hairy sedge), *Carex prairea* (prairie sedge), *Carex trisperma* (three-seeded sedge), *Doellingeria umbellata* (parasol whitetop), *Eupatorium maculatum* (spotted joepyeweed), *Glyceria melicaria* (melic mannagrass), *Glyceria striata* (fowl mannagrass), *Impatiens capensis* (jewelweed), *Lycopus uniflorus* (northern bugleweed), *Onoclea sensibilis* (sensitive fern), *Osmunda cinnamomea* (cinnamon fern), *Rubus pubescens* (dwarf red blackberry), *Scirpus atrovirens* (green bulrush), *Symplocarpus foetidus* (skunk-cabbage), *Thelypteris palustris* (eastern marsh fern), *Typha* (cattail) spp., and *Viola* (violet) spp. Mosses include *Climacium dendroides* (tree climacium moss) and *Sphagnum* (sphagnum) spp. Where the tall-shrub canopy is open, graminoids can become dense. Scattered trees are found in many stands, including *Acer rubrum* (red maple), *Fraxinus nigra* (black ash), and *Thuja occidentalis* (northern white-cedar).

ENVIRONMENTAL DESCRIPTION

Saint Croix National Scenic Riverway Environment: This alder swamp shrubland was sampled at 17 locations in the park. Sites are flat to gently sloping floodplains, fens and seeps with very poorly to poorly drained muck and peat soils. The unvegetated surface is dominated by leaf litter (5-97% cover) with some wood (0-4%), bare soil (0-80%), standing water (0-36%), and dead plant stems (1-15%). Evidence of disturbance includes the presence of exotic plants.

Global Environment: Sites are typically along streams, lakeshores, edges of beaver meadows, swales associated with small streams in peatlands or upland forests, or near seeps. Most have little to no slope, but some sites are on moderate slopes. Hydrologic conditions can range from temporarily flooded to seasonally flooded, or even saturated, but are typically seasonally flooded/saturated. The water ranges from non-stagnant, nutrient-rich, and often slightly calcareous (Curtis 1959) to rather stagnant and nutrient-poor where over acidic bedrock or till. Soils are wet, often mucks or peats (Anderson 1982, Chapman et al. 1989). In the upper Midwest, this community is found on Precambrian Shield bedrock that is overlaid with sandy loam soils, which are moderately well-drained and deep (>60 cm). In northeastern Minnesota stands can occur on northeast- and south-facing slopes that are moderate to steep, with slopes ranging from 4 to 45% (Ohmann and Ream 1971). The climate is highly variable, with temperature extremes between -46 and 38 degrees C and 58-91 cm precipitation.

VEGETATION DESCRIPTION

Saint Croix National Scenic Riverway Vegetation: The very sparse to very dense (5-90%) tall-shrub layer (2-5 m) and very sparse to moderate (5-50%) short-shrub layer (0.5-2 m) are dominated almost exclusively by *Alnus incana* (gray alder); additional shrubs may include *Cornus obliqua* (silky dogwood), *Cornus racemosa* (gray dogwood), *Cornus sericea* ssp. *sericea* (red-osier dogwood), *Rhamnus alnifolia* (alderleaf buckthorn), *Salix discolor* (pussy willow), *Salix petiolaris* (meadow willow), and *Spiraea alba* (white meadowsweet). The sparse to very dense (30-90%) herbaceous layer may be dominated by *Calla palustris* (water arum), *Carex lacustris* (hairy sedge), *Carex stricta* (upright sedge), *Carex utriculata* (Northwest Territory sedge), *Impatiens capensis* (jewelweed), *Polygonum arifolium* (halberdleaf tearthumb), and/or *Typha latifolia* (broadleaf cattail). Additional species include *Carex brunnescens* (brownish sedge), *Glyceria canadensis* (rattlesnake mannagrass), *Phalaris arundinacea* (reed canarygrass), *Sagittaria latifolia* (broadleaf arrowhead), and *Osmunda cinnamomea* (cinnamon fern). Nonvascular species (sphagnum mosses) may cover up to 90% of

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the ground surface. In addition, this community may support Minnesota and Wisconsin state-critically imperiled *Caltha natans* (floating marsh marigold) and Minnesota state-vulnerable *Hydrocotyle americana* (American marshpennywort) and *Juglans cinerea* (butternut) (also Wisconsin state-vulnerable), and Wisconsin state-vulnerable *Petasites frigidus* var. *sagittatus* (arrowleaf sweet coltsfoot).

Global Vegetation: The vegetation is dominated by tall shrubs, 2-8 m in height, with a moderately open to dense shrub canopy. There is an understory of shorter shrubs and herbaceous species. The density of the understory varies inversely with the tall-shrub canopy. The overstory is usually overwhelmingly dominated by *Alnus incana* (gray alder), but in the more southeastern portions of this type's range, *Alnus serrulata* (hazel alder) can occur with *Alnus incana* (gray alder). Where alder is not as dominant, other shrubs, such as *Cornus sericea* (red-osier dogwood), *Ilex verticillata* (common winterberry), *Rubus idaeus* (American red raspberry), *Salix* (willow) spp., *Spiraea alba* (white meadowsweet), *Spiraea tomentosa* (steeplebush), and *Viburnum* (viburnum) spp., can be found. The herbaceous layer contains species such as *Symphyotrichum lanceolatum* var. *lanceolatum* (white panicle aster), *Symphyotrichum puniceum* (purplestem aster), *Calamagrostis canadensis* (bluejoint), *Caltha palustris* (yellow marsh-marigold), *Carex lacustris* (hairy sedge), *Carex prairea* (prairie sedge), *Carex trisperma* (three-seeded sedge), *Doellingeria umbellata* (parasol whitetop), *Eupatorium maculatum* (spotted joepyeweed), *Impatiens capensis* (jewelweed), *Lycopus uniflorus* (northern bugleweed), *Onoclea sensibilis* (sensitive fern), *Osmunda cinnamomea* (cinnamon fern), *Rubus pubescens* (dwarf red blackberry), *Scirpus atrovirens* (green bulrush), *Symplocarpus foetidus* (skunk-cabbage), *Thelypteris palustris* (eastern marsh fern), *Typha* (cattail) spp., and *Viola* (violet) spp. Mosses include *Climacium dendroides* (tree climacium moss) and *Sphagnum* (sphagnum) spp. Where the tall-shrub canopy is open, the graminoids can become dense. Scattered trees are found in many stands, including *Acer rubrum* (red maple), *Fraxinus nigra* (black ash), and *Thuja occidentalis* (northern white-cedar) (Curtis 1959, Anderson 1982, MNNHP 1993, Harris et al. 1996, Sperduto 2000b, Thompson and Sorenson 2000, Gawler 2002). Where stands border on saturated conditions with peaty soils, peatland species such as *Chamaedaphne calyculata* (leatherleaf), *Rhododendron canadense* (rhodora), and *Sphagnum* (sphagnum) spp. may be present.

MOST ABUNDANT SPECIES

Saint Croix National Scenic Riverway

Stratum	Lifeform	Species
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Alnus incana* (gray alder)
Herb (field)	Forb	*Calla palustris* (water arum), *Polygonum arifolium* (halberdleaf tearthumb)
Herb (field)	Graminoid	*Carex lacustris* (hairy sedge), *Carex stricta* (upright sedge), *Carex utriculata* (Northwest Territory sedge), *Typha latifolia* (broadleaf cattail)

Global

Stratum	Lifeform	Species
Tall shrub/sapling	Broad-leaved deciduous shrub	*Alnus incana* (gray alder)

CHARACTERISTIC SPECIES

Saint Croix National Scenic Riverway: *Alnus incana* (gray alder), *Calla palustris* (water arum), *Carex lacustris* (hairy sedge), *Carex stricta* (upright sedge), *Carex utriculata* (Northwest Territory sedge), *Polygonum arifolium* (halberdleaf tearthumb), *Typha latifolia* (broadleaf cattail)

Global: *Alnus incana* (gray alder)

OTHER NOTEWORTHY SPECIES

Saint Croix National Scenic Riverway: Vulnerable: *Caltha natans* (floating marsh marigold, MN & WI state-critically imperiled, G5), *Hydrocotyle americana* (American marshpennywort, MN state-vulnerable, G5), *Juglans cinerea* (butternut, MN & WI state-vulnerable, G4), *Petasites frigidus* var. *sagittatus* (arrowleaf sweet coltsfoot, WI state-vulnerable, G5); **Exotic/Invasive**: *Frangula alnus* (glossy buckthorn, invasive/exotic, High/Medium), *Humulus lupulus* (common hop, invasive/exotic), *Myosotis scorpioides* (true forget-me-not, invasive/exotic), *Rhamnus cathartica* (common buckthorn, invasive/exotic, High/Medium), *Solanum dulcamara* (climbing nightshade, invasive/exotic, Low), *Urtica dioica* (stinging nettle, invasive/exotic)

Global: Vulnerable: *Ilex collina* (longstalk holly, vulnerable, G3)

CONSERVATION STATUS RANK

Global Rank & Reasons: G5 (23-Jun-2006). This association is widely distributed and considered secure in many states.

CLASSIFICATION

Status: Standard

Classification Confidence: 2 - Moderate

Global Comments: Type has a very broad distribution, and there may be a need to separate a northern (more boreal) type from a southern (more temperate) type, or perhaps an enriched versus lower-nutrient type, based on floristic differences. Hydrology may be quite variable, ranging from temporarily flooded to semipermanently flooded. In Ohio, this association sometimes merges with *Alnus serrulata* (hazel alder) stands in *Alnus serrulata* Swamp Shrubland (CEGL005082); that association is distinguished by somewhat more southern associates, including *Rhododendron viscosum* (swamp azalea), *Lindera benzoin* (northern spicebush), *Peltandra virginica* (green arrow-arum), etc.. With increasing tree canopy cover, this association can be similar to *Larix laricina* (tamarack) forest types, *Thuja occidentalis* (northern white-cedar) saturated forest types, and *Fraxinus nigra* - *Acer rubrum* saturated forest types.

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Global Similar Associations:
- *Alnus incana - Cornus (amomum, sericea) / Clematis virginiana* Shrubland (CEGL006062)
- *Alnus incana* ssp. *rugosa - Nemopanthus mucronatus / Sphagnum* spp. Shrubland (CEGL006158)
- *Alnus serrulata* Swamp Shrubland (CEGL005082)

Global Related Concepts:
- *Alnus incana - Sambucus canadensis* shrub community (Darlington 1943) <
- *Alnus incana - Viburnum cassinoides* shrub community (Darlington 1943) <
- *Alnus incana* ssp. *rugosa* tall shrub thicket (Fortney et al. 2005) =
- *Alnus rugosa* shrub (Walbridge and Lang 1982) =
- *Alnus rugosa* tall shrub community (Walbridge 1982) =
- *Alnus rugosa* tall shrub community (Robinette 1966) =
- *Alnus rugosa* thicket community (Fortney 1975) =
- Alder Shrub Swamp (Anderson and Schwegman 1991) =
- Alder Shrub Thicket (Gawler 2002) >
- Alder Swamp (MNNHP 1993) =
- Alder Thicket (Faber-Langendoen 2001) =
- Alder Thicket (Curtis 1959) =
- Thicket Swamp: Speckled Alder / Bluejoint Grass type , W35 (Harris et al. 1996) =

ELEMENT DISTRIBUTION

Global Range: This alder swamp shrubland is widespread in the midwestern and northeastern United States and southern Canada, ranging from Maine west to Manitoba, south to Iowa, and east to New York and perhaps northern New Jersey.
Nations: CA, US
States/Provinces: IA:S3?, IL, IN?, MA, MB?, ME, MI:S5, MN:S5, ND:S2?, NH:S3S4, NJ?:S2S4, NY, OH, ON, PA, QC:S4S5, VT, WI:S4, WV:S3, WY
TNC Ecoregions: 34:C, 35:C, 46:C, 47:C, 48:C, 60:C, 61:C, 62:C, 63:C, 64:C
USFS Ecoregions (1994/95): 212Cb:CCC, 212Da:CCC, 212Db:CCC, 212Dc:CCC, 212Fc:CCC, 212Ha:CCP, 212Hb:CCP, 212He:CCP, 212Hh:CCP, 212Hi:CCC, 212Hj:CCP, 212Hk:CCP, 212Hl:CCC, 212Hm:CCP, 212Hn:CCP, 212Ho:CCC, 212Hp:CCP, 212Hq:CCC, 212Hr:CCP, 212Hs:CCP, 212Ht:CCC, 212Hv:CCP, 212Hw:CCC, 212Hy:CCP, 212Ia:CCC, 212Ib:CCC, 212Ja:CCP, 212Jb:CCP, 212Jc:CCP, 212Je:CCP, 212Jf:CCC, 212Jj:CCP, 212Jk:CCP, 212Jl:CCP, 212Jm:CCP, 212Jn:CCP, 212Jo:CCP, 212Jr:CCC, 212Ka:CCP, 212Kb:CCC, 212La:CCC, 212Lb:CCC, 212Mb:CPP, 212Na:CCC, 212Nb:CCP, 212Nc:CCC, 221Ae:CCC, 221Ak:CCP, 221Al:CCP, 221Bc:CCC, 222Je:CCC, 222Lb:CCC, 222Lc:CCC, 222Mc:CCC, 222Md:CCC, 222Na:CCC, 251Aa:CCC, 251Ab:CCC, M212Aa:CCC, M212Ac:CCC, M212Ae:CCC, M212Af:CCC, M212B:CC, M212C:CC, M212D:CP
Federal Lands: NPS (Acadia, Apostle Islands, Appalachian Trail (Lower New England & Northern Appalachians), Grand Portage, Isle Royale, Pictured Rocks, Saint Croix, Saratoga, Sleeping Bear Dunes, Upper Delaware, Voyageurs); USFS (Chequamegon, Chequamegon-Nicolet, Chippewa, Huron, Huron-Manistee, Manistee, Nicolet, Ottawa, Superior); USFWS (Aroostook, Assabet River, Carlton Pond, Moosehorn?, Nulhegan Basin)

ELEMENT SOURCES

Saint Croix National Scenic Riverway Map Code: SAS
Saint Croix National Scenic Riverway Plots: SACN.43, SACN.54, SACN.71, SACN.72, SACN.80, SACN.99, SACN.208, SACN.211, SACN.234, SACN.0169, SACN.3514, SACN.3515, SACN.3527, SACN.5063, SACN.5065, SACN.5112, SACN.5130.
Local Description Authors: M.J. Russo
Global Description Authors: D. Faber-Langendoen, mod. S.C. Gawler
References: Anderson 1982, Anderson and Schwegman 1991, Breden et al. 2001, Byers et al. 2007, Chapman et al. 1989, Curtis 1959, Darlington 1943, DeMeo et al. 1998, Faber-Langendoen 2001, Fortney 1975, Fortney et al. 2005, Gawler 2002, Greenall 1996, Harris et al. 1996, Hop et al. 2010a, Hop et al. 2010b, Hop et al. 2010c, INAI unpubl. data, Lubinski et al. 2003, MNNHP 1993, Midwestern Ecology Working Group n.d., NDNHI unpubl. data, NRCS 2004a, Ohmann and Ream 1971, Perles et al. 2008, Rentch unpubl. data 2003, Robinette 1966, Sperduto 2000b, Swain and Kearsley 2001, TNC 1999b, Thompson and Sorenson 2000, WNHIP unpubl. data, Walbridge 1982, Walbridge and Lang 1982

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1.D.1. Boreal Forest

1.D.1.Na. North American Boreal Forest

M037. Eastern & Central North American Boreal Conifer & Hardwood Forest

G047. Jack Pine - Black Spruce Forest Group

Jack Pine Forest Alliance
***Pinus banksiana* Forest Alliance**
Jack Pine Forest Alliance
Identifier: A.116

NVC CLASSIFICATION

Division	North American Boreal Forest (1.D.1.Na)
Macrogroup	Eastern & Central North American Boreal Conifer & Hardwood Forest (M037)
Group	Jack Pine - Black Spruce Forest (G047)
Alliance (Common name)	Jack Pine Forest Alliance

ELEMENT CONCEPT

Global Summary: This alliance, found from lower Michigan and northwestern Indiana northwest to southern Manitoba, with occasional outliers eastward, is a dry forest. Stands may be found on rocky ridgetops and slopes, outwash plains, and lake dunes. These sites are most often dry to dry-mesic with sand, sandy loam, and less commonly, clay soils. The soils are of lacustrine, glaciofluvial, or eolian origin. They may be shallow to deep and are typically somewhat infertile. Bedrock is exposed in some stands. Stands in this alliance require fire or other disturbance to regenerate because *Pinus banksiana* does not reproduce well in established forests. In the absence of disturbance these stands will succeed to other forest types. Vegetation is characterized by moderately dense to dense stands of trees. The morphology and density of the dominant trees often allows enough light through the canopy to support abundant shrubs. The vegetation is dominated by coniferous trees, often almost entirely *Pinus banksiana*. Other conifers that may be present include *Abies balsamea, Pinus resinosa, Picea glauca*, and *Picea mariana*. Deciduous trees, such as *Acer rubrum, Betula papyrifera, Populus balsamifera, Populus grandidentata, Populus tremuloides, Quercus ellipsoidalis*, and *Quercus rubra*, may be scattered throughout stands of this alliance. All of these associated trees, except *Betula papyrifera, Pinus resinosa*, and *Populus tremuloides*, are minor canopy components. The latter three species may be codominant in some stands. The associated trees often make up the bulk of the saplings and seedlings. Shrubs may be absent to abundant. Both tall and short shrubs occur in stands of this alliance. These include *Alnus viridis* (especially in northwest Ontario), *Amelanchier* spp., *Arctostaphylos uva-ursi, Corylus cornuta, Diervilla lonicera, Gaultheria procumbens, Linnaea borealis*, and *Viburnum rafinesquianum*. *Vaccinium* spp. are very common throughout this alliance. The herbaceous layer is often not well represented. It may include *Aralia nudicaulis, Eurybia macrophylla (= Aster macrophyllus), Maianthemum canadense*, and *Melampyrum lineare*. Mosses and lichens, especially *Pleurozium schreberi* and *Cladonia* spp., are abundant in some communities of this alliance.

ENVIRONMENTAL DESCRIPTION

Saint Croix National Scenic Riverway Environment: This community was found on flat to moderately sloping dry-mesic sites with sandy to loamy soils.
Global Environment: Stands may be found on rocky ridgetops and slopes, outwash plains, and lake dunes. These sites are most often dry to dry-mesic with sand, sandy loam, and less commonly, clay soils (Eyre 1980). The soils are of lacustrine, glaciofluvial, or eolian origin (Sims et al. 1989). They may be shallow to deep and are typically somewhat infertile. Bedrock is exposed in some stands (Kurmis et al. 1986). Stands in this alliance require fire or other disturbance to regenerate because *Pinus banksiana* does not reproduce well in established forests. In the absence of disturbance these stands will succeed to other forest types.

VEGETATION DESCRIPTION

Saint Croix National Scenic Riverway Vegetation: The canopy of this dry-mesic forest alliance was dominated by *Pinus banksiana* (jack pine) with *Pinus resinosa* (red pine) and *Pinus strobus* (white pine) as frequent associates. The subcanopy often had the canopy species plus *Quercus ellipsoidalis* (northern pin oak), *Quercus rubra* (northern red oak), and, in some stands, *Abies balsamea* (balsam fir) and *Picea glauca* (white spruce). The moderate to dense shrub canopy was dominated by *Corylus americana* (American hazelnut) and *Corylus cornuta* (beaked hazelnut). *Vaccinium* spp. (blueberries) were common dwarf-shrubs. The herbaceous layer was usually moderate to dense and dominated by *Carex pensylvanica* (Pennsylvanica sedge), *Eurybia macrophylla* (bigleaved aster), *Maianthemum canadense* (Canada mayflower), and *Pteridium aquilinum (*western brackenfern).
Global Vegetation: This alliance, found from lower Michigan and northwestern Indiana northwest to southern Manitoba with occasional outliers eastward, is a dry forest. It is characterized by moderately dense to dense stands of trees. The morphology and density of the dominant trees often allows enough light through the canopy to support abundant shrubs. The vegetation is dominated by coniferous trees, often almost entirely *Pinus banksiana*. Other conifers that may be present include *Abies balsamea, Pinus resinosa, Picea glauca*, and *Picea mariana*. Deciduous trees, such as *Acer rubrum, Betula papyrifera, Populus balsamifera, Populus*

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grandidentata, Populus tremuloides, Quercus ellipsoidalis, and *Quercus rubra*, may be scattered throughout stands of this alliance. All of these associated trees except *Betula papyrifera, Pinus resinosa*, and *Populus tremuloides* are minor canopy components. The latter three species may be codominant in some stands (Eyre 1980). The associated trees often make up the bulk of the saplings and seedlings (Grigal and Ohmann 1975, MNNHP 1993). Shrubs may be absent to abundant. Both tall and short shrubs occur in stands of this alliance. These include *Alnus viridis* (especially in northwestern Ontario), *Amelanchier* spp., *Arctostaphylos uva-ursi, Corylus cornuta, Diervilla lonicera, Gaultheria procumbens, Linnaea borealis*, and *Viburnum rafinesquianum*. *Vaccinium* spp. are very common throughout this alliance. The herbaceous layer is often not well represented. It may include *Aralia nudicaulis, Eurybia macrophylla (= Aster macrophyllus), Maianthemum canadense*, and *Melampyrum lineare*. Mosses and lichens, especially *Pleurozium schreberi* and *Cladonia* spp., are abundant in some communities of this alliance.

MOST ABUNDANT SPECIES

Saint Croix National Scenic Riverway

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Pinus banksiana* (jack pine)
Sapling/short shrub	Broad-leaved deciduous shrub	*Corylus americana* (American hazelnut), *Quercus macrocarpa* (bur oak)
Short/shrub/sapling	Dwarf-shrub	*Vaccinium angustifolium* (lowbush blueberry)
Herb (field)	Forb	*Carex pensylvanica* (Pennsylvania sedge), *Eurybia macrophylla* (bigleaf aster), *Pteridium aquilinum* (western brackenfern)

CHARACTERISTIC SPECIES

Saint Croix National Scenic Riverway:

OTHER NOTEWORTHY SPECIES

Saint Croix National Scenic Riverway:

CONSERVATION STATUS RANK

Global Rank & Reasons: GNA – Alliances not ranked.

CLASSIFICATION

Status: Standard

Classification Confidence:

Global Comments: This alliance is typically easy to distinguish from other forest alliances based on the dominance of *Pinus banksiana*. Some stands that contain moderate amounts of *Pinus banksiana* and *Pinus resinosa* may be similar to *Pinus resinosa* Forest Alliance (A.126). Difficulties are more likely to be encountered with more open stands that may resemble stands in the *Pinus (banksiana, resinosa)* Woodland Alliance (A.507). Stands may be floristically and physiognomically intermediate between these alliances.

Global Similar Associations:

•

Global Related Concepts:

•

ELEMENT DISTRIBUTION

Global Range: This alliance is found in Michigan, extreme northern Indiana, extreme northern Illinois, central and northern Wisconsin, northern Minnesota, and disjunct in Maine, and in Canada in southern Manitoba and Ontario. This alliance probably occurs in parts of Canada beyond those listed above.

Nations: CA, US

States/Provinces: IL, IN, MB, ME, MI, MN, NB, NY, ON, QC, WI

TNC Ecoregions: 47, 48, 63, 64

USFS Ecoregions (1994/95): 212E:CC, 212H:CC, 212I:CC, 212J:CC, 212K:CC, 212L:CC, 212M:CC, 212N:CC, 212O:CC, 222J:CC, M212A:CC, M212D:CP

Federal Lands:

ELEMENT SOURCES

Saint Croix National Scenic Riverway Map Code: FJP

Saint Croix National Scenic Riverway Plots: SACN.53, SACN.203, SACN.225, SACN.266, SACN.269

Local Description Authors: J. Drake

Global Description Authors: Midwestern Ecology Group

References: Curtis 1959, Eyre 1980, Faber-Langendoen 1996, Gawler 2002, Grigal and Ohmann 1975, Kurmis, et al. 1986, MNNHP 1993,Midwestern Ecology Working Group of NatureServe. No date. Sims, et. al. 1989.

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Jack Pine - Quaking Aspen Forest Alliance

***Pinus banksiana - Populus tremuloides* Forest Alliance**
Jack Pine - Quaking Aspen Forest Alliance
Identifier: A.390

NVC CLASSIFICATION

Division	North American Boreal Forest (1.D.1.Na)
Macrogroup	Eastern & Central North American Boreal Conifer & Hardwood Forest (M037)
Group	Jack Pine - Black Spruce Forest (G047)
Alliance (Common name)	Jack Pine - Quaking Aspen Forest Alliance

ELEMENT CONCEPT

Global Summary: This alliance, found in the extreme north-central United States and adjacent Canada, is composed of a mix of coniferous and deciduous trees, with the conifers tending to be more abundant in the north. The canopy is typically dominated by *Pinus banksiana* and *Populus tremuloides* with lesser amounts of *Abies balsamea, Betula papyrifera, Picea glauca*, and *Picea mariana*. Tree density and crown spacing may be moderately dense to dense, but sufficient light penetrates to permit the growth of a vigorous shrub layer. Most shrubs are less than 1 m tall. The herbaceous layer is also typically quite rich with species. This alliance is found on generally level sandy outwash plains or moderately sloping moraines. The soils are fresh to dry, deep, sandy loams, loams, and fine sands. In Manitoba, the soils tend to be somewhat more moist and finer.

ENVIRONMENTAL DESCRIPTION

Saint Croix National Scenic Riverway Environment: Soils tend to be dry-mesic to dry and sandy. Sites can be found on many landscape positions (flat uplands, dry river terraces, slight to moderate slopes) though rarely on steep slopes.
Global Environment: This alliance is found on generally level sandy outwash plains or moderately sloping moraines (Sims et al. 1989, MNNHP 1993). The soils are fresh to dry, deep, sandy loams, loams, and fine sands (Sims et al. 1989). In Manitoba, the soils tend to be somewhat more moist and finer (Zoladeski et al. 1995).

VEGETATION DESCRIPTION

Saint Croix National Scenic Riverway Vegetation: This forest community has a moderately closed tree canopy dominated by *Pinus banksiana* (jack pine) mixed with *Populus tremuloides* (quaking aspen) and/or *Populus grandidentata* (bigtooth aspen). *Pinus resinosa* (red pine) is often present in lesser amounts. The morphology of the dominant trees tends to allow substantial light to reach the understory so, even though the canopy of the tallest trees is nearly complete, enough light reaches the understory to allow a moderate to dense tree subcanopy, shrub, and herbaceous layer to form. The subcanopy is dominated by *Acer rubrum* (red maple), *Populus tremuloides* (quaking aspen), and oaks, particularly *Q. rubra (*northern red oak), *Q. ellipsoidalis* (northern pin oak), and *Q. macrocarpa* (bur oak). *Corylus americana* (American hazelnut) and *C. cornuta* (beaked hazelnut) are common in the shrub layer with *Vaccinium angustifolium* (lowbush blueberry) in the short/dwarf shrub stratum. The herbaceous layer averages 60% cover and is dominated by *Carex pensylvanica* (Pennsylvania sedge) and *Pteridium aquilinum* (western brackenfern) with some *Maianthemum canadense* (Canada mayflower) and *Eurybia macrophylla* (bigleaf aster).
Global Vegetation: This alliance, found in the extreme north-central United States and adjacent Canada, is composed of a mix of coniferous and deciduous trees, with the conifers tending to be more abundant in the north (Sims et al. 1989, Zoladeski et al. 1995). The canopy is typically dominated by *Pinus banksiana* and *Populus tremuloides* with lesser amounts of *Abies balsamea, Betula papyrifera, Picea glauca*, and *Picea mariana*. Tree density and crown spacing may be moderately dense to dense, but sufficient light penetrates to permit the growth of a vigorous shrub layer. Most shrubs are less than 1 m tall. The most common among these are *Corylus cornuta, Diervilla lonicera, Linnaea borealis, Rosa acicularis, Rubus pubescens*, and *Vaccinium* spp. The herbaceous layer is also typically quite rich with species such as *Aralia nudicaulis, Eurybia macrophylla (= Aster macrophyllus), Cornus canadensis, Clintonia borealis, Streptopus lanceolatus* var. *longipes (= Streptopus roseus), Trientalis borealis*, and *Viola* spp.

MOST ABUNDANT SPECIES

Saint Croix National Scenic Riverway

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Pinus banksiana* (jack pine)
Tree canopy	Broad-leaved deciduous tree	*Populus grandidentata* (bigtooth aspen), *Populus tremuloides* (quaking aspen)
Tall shrub/sapling	Broad-leaved deciduous shrub	*Corylus americana* (American hazelnut), *Corylus cornuta* (beaked hazelnut)
Short shrub/sapling	Dwarf-shrub	*Vaccinium angustifolium* (lowbush blueberry)
Herb (field)	Graminoid	*Carex pensylvanicum* (Pennsylvania sedge)
Herb (field)	Forb	*Maianthemum canadense* (Canada mayflower), *Pteridium aquilinum* (western brackenfern)

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CHARACTERISTIC SPECIES

Saint Croix National Scenic Riverway:

OTHER NOTEWORTHY SPECIES

Saint Croix National Scenic Riverway:

CONSERVATION STATUS RANK

Global Rank & Reasons: GNA – Alliances not ranked.

CLASSIFICATION

Status: Standard
Classification Confidence:
Global Comments: The codominance of *Pinus banksiana* and *Populus tremuloides* makes this alliance relatively distinct. Some stands in this alliance can be similar to stands in the *Picea mariana - Populus tremuloides* Forest Alliance (A.414) and, in Canada, to the *Pinus banksiana* Forest Alliance (A.116).
Global Similar Associations:
•
Global Related Concepts:
•

ELEMENT DISTRIBUTION

Global Range: This alliance is found in northern Minnesota and is currently listed in Canada in northwestern Ontario and Manitoba, but probably occurs more widely throughout the boreal region.
Nations: CA, US
States/Provinces: MB, MI, MN, ON, QC, WI
TNC Ecoregions: 47, 48
USFS Ecoregions (1994/95): 212H:CC, 212I:CC, 212L:CC
Federal Lands:

ELEMENT SOURCES

Saint Croix National Scenic Riverway Map Code: FJA
Saint Croix National Scenic Riverway Plots: No plots
Local Description Authors: J. Drake
Global Description Authors: Midwestern Ecology Group

References: Faber-Langendoen 1996, MNNHP 1993, Midwestern Ecology Working Group of NatureServe. No date, Sims, et al. 1989, Zoladeski et al. 1995

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G048. White Spruce - Balsam Fir Forest

Spruce - Fir - Aspen Forest

***Picea glauca - Abies balsamea - Populus tremuloides* / Mixed Herbs Forest**
White Spruce - Balsam Fir - Quaking Aspen / Mixed Herbs Forest
Identifier: CEGL002475

NVC CLASSIFICATION

Division	North American Boreal Forest (1.D.1.Na)
Macrogroup	Eastern & Central North American Boreal Conifer & Hardwood Forest (M037)
Group	White Spruce - Balsam Fir Forest (G048)
Association (Common name)	Spruce - Fir - Aspen Forest

ELEMENT CONCEPT

Global Summary: This spruce - fir - aspen forest is found in the western Great Lakes area of the United States and Canada and elsewhere in parts of central Canada. Stands occur on deep, well-drained to rapidly drained, moist, fine-textured mineral soils. Loams are the most common, but silts and clays are also possible. The overstory is a mixture of coniferous and deciduous trees. Species composition is varied. The most abundant tree species are *Abies balsamea* (balsam fir), *Acer rubrum* (red maple), *Picea glauca* (white spruce), *Pinus strobus* (eastern white pine), *Populus tremuloides* (quaking aspen), and *Populus balsamifera* (balsam poplar). The sapling/shrub layer is usually moderately well-developed. *Acer spicatum* (mountain maple), *Corylus cornuta* (beaked hazelnut), *Rosa acicularis* (prickly rose), *Rubus pubescens* (dwarf red blackberry), and saplings of *Abies balsamea* (balsam fir) are the most commonly encountered in this stratum. Herb diversity is usually high. *Aralia nudicaulis* (wild sarsaparilla), *Symphyotrichum ciliolatum* (Lindley's aster), *Eurybia macrophylla* (bigleaf aster), *Clintonia borealis* (bluebead), *Cornus canadensis* (bunchberry dogwood), *Galium triflorum* (fragrant bedstraw), *Maianthemum canadense* (Canada mayflower), *Mitella nuda* (naked miterwort), and *Trientalis borealis* (starflower) are typical of this community. A Lake Superior clayplain variant may occur in northern Wisconsin.

ENVIRONMENTAL DESCRIPTION

Saint Croix National Scenic Riverway Environment: This spruce - fir - aspen forest was sampled at eight locations in the park. Sites are flat to gently sloping uplands with moderately well- to well-drained loam, loamy sand, silt loam and silty clay soils. The unvegetated surface is dominated by leaf litter (66-92% cover) with some large rocks (0-20%), wood (3-6%), bare soil (0-5%) and dead plant stems (3-8%). Evidence of disturbance includes the presence of trash and exotic plants.
Global Environment: This upland community is found on deep, well-drained to rapidly drained, moist, fine-textured mineral soils. Loams are the most common, but silts and clays are not rare (Sims et al. 1989, Zoladeski et al. 1995).

VEGETATION DESCRIPTION

Saint Croix National Scenic Riverway Vegetation: The sparse to very dense (20-90% cover) tree canopy, 10-20 m tall, is dominated by various combinations of *Abies balsamea* (balsam fir), *Picea glauca* (white spruce), and *Populus tremuloides* (quaking aspen); additional tree species include *Acer rubrum* (red maple), *Betula papyrifera* (paper birch), *Fraxinus nigra* (black ash), *Fraxinus pennsylvanica* (green ash), *Quercus macrocarpa* (bur oak), and *Thuja occidentalis* (northern white-cedar). The sparse to moderate (5-40%) subcanopy (5-10 m) is made up of canopy species. The sparse (5-20%) tall-shrub (1-2 m) and very sparse (5-10%) short-shrub (0.5-1 m) layers, when present, may include *Amelanchier sanguinea* (roundleaf serviceberry), *Corylus cornuta* (beaked hazelnut), *Diervilla lonicera* (northern bush honeysuckle), *Ilex verticillata* (common winterberry), *Lonicera canadensis* (American fly honeysuckle), *Prunus virginiana* (chokecherry), *Viburnum lentago* (nannyberry), *Viburnum rafinesquianum* (downy arrow-wood), and others. *Cornus canadensis* (bunchberry dogwood), *Gaultheria procumbens* (eastern teaberry), *Rubus pubescens* (dwarf red blackberry), *Vaccinium angustifolium* (lowbush blueberry), and *Vaccinium myrtilloides* (velvetleaf huckleberry) may form a very sparse (5%) dwarf-shrub layer. The sparse to very dense (20-90%) herbaceous layer may include *Anemone quinquefolia* (wood anemone), *Aralia nudicaulis* (wild sarsaparilla), *Brachyelytrum erectum* (bearded shorthusk), *Clintonia borealis* (bluebead), *Eurybia macrophylla* (bigleaf aster), *Lycopodium hickeyi* (Pennsylvania clubmoss), *Maianthemum canadense* (Canada mayflower), *Mitchella repens* (partridgeberry), *Oryzopsis asperifolia* (roughleaf ricegrass), *Pteridium aquilinum* (western brackenfern), *Trientalis borealis* (starflower), and others. Nonvascular species (sphagnum mosses) cover 5-80% of the ground surface. In addition, this community may support Minnesota state-vulnerable *Waldsteinia fragarioides* (Appalachian barren strawberry) and Wisconsin state-imperiled *Dryopteris expansa* (spreading woodfern) and state-vulnerable *Ribes oxyacanthoides* (Canadian gooseberry).
Global Vegetation: The overstory composition is varied. The most abundant tree species typically are *Abies balsamea* (balsam fir), *Acer rubrum* (red maple), *Picea glauca* (white spruce), *Pinus strobus* (eastern white pine), *Populus tremuloides* (quaking aspen), and *Populus balsamifera* (balsam poplar). The sapling/shrub layer is usually moderately well-developed. *Acer spicatum* (mountain maple), *Corylus cornuta* (beaked hazelnut), *Rosa acicularis* (prickly rose), *Rubus pubescens* (dwarf red blackberry), and saplings of *Abies balsamea* (balsam fir) are the most commonly encountered in this stratum. Herb diversity is usually high. *Aralia nudicaulis* (wild sarsaparilla), *Symphyotrichum ciliolatum* (Lindley's aster), *Eurybia macrophylla* (bigleaf aster), *Clintonia borealis* (bluebead), *Cornus canadensis* (bunchberry dogwood), *Galium triflorum* (fragrant bedstraw), *Maianthemum canadense* (Canada mayflower), *Mitella nuda* (naked miterwort), and *Trientalis borealis* (starflower) are typical of this community (Sims et al. 1989, MNNHP 1993). A Lake Superior clayplain variant may occur in northern Wisconsin. Leading canopy dominants include *Picea glauca* (white spruce), *Pinus strobus* (eastern white pine), and *Betula papyrifera* (paper birch). Common associates include *Abies balsamea* (balsam fir), *Populus*

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tremuloides (quaking aspen), *Populus balsamifera* (balsam poplar), *Thuja occidentalis* (northern white-cedar), and *Acer rubrum* (red maple). Shrubs include *Cornus sericea* (red-osier dogwood), *Corylus cornuta* (beaked hazelnut), *Diervilla lonicera* (northern bush honeysuckle), *Lonicera hirsuta* (hairy honeysuckle), *Rubus parviflorus* (thimbleberry), *Rubus pubescens* (dwarf red blackberry), *Sorbus decora* (northern mountain-ash), and *Viburnum opulus* var. *americanum* (American cranberrybush). Typical herbaceous species include *Anemone quinquefolia* (wood anemone), *Eurybia macrophylla* (bigleaf aster), *Aralia nudicaulis* (wild sarsaparilla), *Calamagrostis canadensis* (bluejoint), *Carex arctata* (drooping woodland sedge), *Fragaria virginiana* (Virginia strawberry), *Luzula acuminata* (hairy woodrush), *Maianthemum canadense* (Canada mayflower), *Petasites frigidus* (arctic sweet coltsfoot), and *Pteridium aquilinum* (western brackenfern) (E. Epstein pers. comm. 1999).

MOST ABUNDANT SPECIES

Saint Croix National Scenic Riverway

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Abies balsamea* (balsam fir), *Picea glauca* (white spruce)
Tree canopy	Broad-leaved deciduous tree	*Populus tremuloides* (quaking aspen)
Herb (field)	Forb	*Clintonia borealis* (bluebead), *Eurybia macrophylla* (bigleaf aster)

CHARACTERISTIC SPECIES

Saint Croix National Scenic Riverway: *Abies balsamea* (balsam fir), *Clintonia borealis* (bluebead), *Eurybia macrophylla* (bigleaf aster), *Picea glauca* (white spruce), *Populus tremuloides* (quaking aspen)

OTHER NOTEWORTHY SPECIES

Saint Croix National Scenic Riverway: Vulnerable: *Dryopteris expansa* (spreading woodfern, WI state-imperiled, G5), *Ribes oxyacanthoides* (Canadian gooseberry, WI state-imperiled, G5), *Waldsteinia fragarioides* (Appalachian barren strawberry, MN state-vulnerable, G5); **Exotic/Invasive**: *Hieracium aurantiacum* (orange hawkweed, invasive/exotic, Medium/Low), *Rosa rugosa* (rugosa rose, invasive/exotic, Low), *Taraxacum officinale* (common dandelion, invasive/exotic)

CONSERVATION STATUS RANK

Global Rank & Reasons: G5 (3-Oct-1996). No old-growth stands are known for the Lake Superior clayplain variant.

CLASSIFICATION

Status: Standard

Classification Confidence: 2 - Moderate

Global Comments: This type overlaps in concept with *Abies balsamea - Betula papyrifera / Diervilla lonicera* Forest (CEGL002474). A red maple variant may occur in the Great Lake states (Michigan, Minnesota, Wisconsin). The Lake Superior clayplain variant should be reviewed range-wide to see if it may represent a distinct association.

Global Similar Associations:

- *Abies balsamea - Betula papyrifera / Diervilla lonicera* Forest (CEGL002474)
- *Picea glauca - Abies balsamea / Acer spicatum / Rubus pubescens* Forest (CEGL002446)
- *Populus tremuloides - (Populus grandidentata)* Rocky Woodland (CEGL002487)
- *Populus tremuloides - Populus balsamifera* - Mixed Hardwoods Lowland Forest (CEGL005036)

Global Related Concepts:

- Boreal Forest Spruce-Fir-Hardwoods Subtype (Faber-Langendoen 2001) =
- Boreal Hardwood - Conifer Forest (MNNHP 1993) >
- White Spruce Mixedwood (V13) (Zoladeski et al. 1995) =
- White Spruce Mixedwood (V15) (Sims et al. 1989) =

ELEMENT DISTRIBUTION

Global Range: This spruce - fir - aspen forest type is found in the western Great Lakes area of the United States and Canada and elsewhere in parts of central Canada, ranging from northern Minnesota and Manitoba east to Michigan and possibly Quebec.

Nations: CA, US

States/Provinces: MB:S4S5, MI, MN, ON, QC, WI:S2

TNC Ecoregions: 35:C, 46:C, 47:C, 48:C

USFS Ecoregions (1994/95): 212He:CC?, 212Hi:CCC, 212Hl:CCP, 212Hm:CCP, 212Hn:CCP, 212Ho:CCP, 212Hp:CCP, 212Hq:CCP, 212Hr:CCP, 212Hs:CCP, 212Hv:CCP, 212Hw:CCP, 212Ia:CCP, 212Ib:CCC, 212Ja:CCP, 212Jb:CCP, 212Jc:CCP, 212Jl:CCP, 212Jm:CCC, 212Jn:CCP, 212Jo:CCP, 212La:CCC, 212Lb:CCC, 212Lc:CCC, 212Mb:CCC, 212Na:CPP, 212Nb:CPP, 212Nc:CPP, 212Ob:C??, 222Ma:CCC, 222Na:CCC

Federal Lands: NPS (Grand Portage, Isle Royale, Pictured Rocks, Saint Croix, Sleeping Bear Dunes, Voyageurs); USFS (Chippewa, Hiawatha, Huron, Huron-Manistee, Manistee, Ottawa, Superior)

ELEMENT SOURCES

Saint Croix National Scenic Riverway Map Code: FCP

Saint Croix National Scenic Riverway Plots: SACN.39, SACN.228, SACN.237, SACN.240, SACN.247, SACN.262, SACN.4918, SACN.5069.

Local Description Authors: M.J. Russo

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Global Description Authors: J. Drake

References: Epstein pers. comm., Faber-Langendoen 2001, Greenall 1996, Hop et al. 2010b, Hop et al. 2010c, MNNHP 1993, Midwestern Ecology Working Group n.d., Sims et al. 1989, TNC 1999b, WNHIP unpubl. data, Zoladeski et al. 1995

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Spruce - Fir / Mountain Maple Forest

***Picea glauca - Abies balsamea / Acer spicatum / Rubus pubescens* Forest**
White Spruce - Balsam Fir / Mountain Maple / Dwarf Red Blackberry Forest
Identifier: CEGL002446

NVC CLASSIFICATION

Division	North American Boreal Forest (1.D.1.Na)
Macrogroup	Eastern & Central North American Boreal Conifer & Hardwood Forest (M037)
Group	White Spruce - Balsam Fir Forest (G048)
Association (Common name)	Spruce - Fir / Mountain Maple Forest

ELEMENT CONCEPT

Global Summary: This white spruce - balsam fir conifer forest is found in the southern boreal region of the Great Lakes in the United States and elsewhere in central Canada. Stands are found primarily on dry-mesic to mesic sites with well-drained, deep (>60 cm), loam, sand, or silt soils. Less commonly, it may be found on wetter sites. The soils have little organic content, and the topography is flat to gently sloping. This community is a closed-canopy forest dominated by a combination of *Picea glauca* (white spruce) and *Abies balsamea* (balsam fir). Common associates include *Acer rubrum* (red maple), *Betula papyrifera* (paper birch), *Picea mariana* (black spruce), *Pinus banksiana* (jack pine), *Populus tremuloides* (quaking aspen), and *Populus balsamifera* (balsam poplar). There is usually a prominent shrub/sapling layer containing *Abies balsamea* (balsam fir), *Acer spicatum* (mountain maple), *Corylus cornuta* (beaked hazelnut), *Diervilla lonicera* (northern bush honeysuckle), *Lonicera canadensis* (American fly honeysuckle), *Picea glauca* (white spruce), *Rosa acicularis* (prickly rose), *Rubus pubescens* (dwarf red blackberry), *Sorbus americana* (American mountain-ash), *Vaccinium myrtilloides* (velvetleaf huckleberry), and (eastward) *Viburnum nudum* var. *cassinoides* (withe-rod). The herbaceous layer is often moderately sparse, with species such as *Anemone quinquefolia* (wood anemone), *Aralia nudicaulis* (wild sarsaparilla), *Eurybia macrophylla* (bigleaf aster), *Clintonia borealis* (bluebead), *Coptis trifolia* (threeleaf goldthread), *Cornus canadensis* (bunchberry dogwood), *Dryopteris carthusiana* (spinulose woodfern), *Maianthemum canadense* (Canada mayflower), *Mitella nuda* (naked miterwort), and *Trientalis borealis* (starflower). Mosses include *Dicranum polysetum* (dicranum moss), *Pleurozium schreberi* (Schreber's big red stem moss), *Ptilium crista-castrensis* (knights plume moss), and *Rhytidiadelphus triquetrus* (rough gooseneck moss).

ENVIRONMENTAL DESCRIPTION

Saint Croix National Scenic Riverway Environment: This white spruce - balsam fir forest was sampled twice in the park. Sites have moderately well-drained loamy sand soil. Evidence of disturbance include past fires (charcoal) and much standing dead balsam fir.

Global Environment: This community is found primarily on dry-mesic to mesic sites with well-drained, deep (>60 cm) loam, sand, or silt soils (Sims et al. 1989, Zoladeski et al. 1995). Less commonly, it may be found on wetter sites, that may approach seasonally saturated conditions (Maycock 1961). The soils have little organic content and the topography is flat to gently sloping.

VEGETATION DESCRIPTION

Saint Croix National Scenic Riverway Vegetation: No height or cover data were provided. The tree canopy is codominated by *Abies balsamea* (balsam fir) (15-35% cover) and *Picea glauca* (white spruce) (35-65% cover) and may include lesser amounts of *Populus tremuloides* (quaking aspen). The relatively sparse shrub layer includes *Corylus cornuta* (beaked hazelnut), *Diervilla lonicera* (northern bush honeysuckle), *Linnaea borealis* (twinflower), *Lonicera canadensis* (American fly honeysuckle), *Vaccinium angustifolium* (lowbush blueberry), and *Vaccinium myrtilloides* (velvetleaf huckleberry). The herbaceous layer includes many tree seedlings as well as *Clintonia borealis* (bluebead), *Coptis trifolia* (threeleaf goldthread), *Cornus canadensis* (bunchberry dogwood), *Eurybia macrophylla* (bigleaf aster), *Lycopodium hickeyi* (Pennsylvania clubmoss), *Osmunda claytoniana* (interrupted fern), *Pteridium aquilinum* (western brackenfern), *Trientalis borealis* (starflower), and others. Nonvascular species (mosses and lichens) can cover up to 65% of the surface and include dominants *Pleurozium schreberi* (Schreber's big red stem moss) and *Ptilium crista-castrensis* (knights plume moss).

Global Vegetation: This community is a closed-canopy forest dominated by a combination of *Picea glauca* (white spruce) and *Abies balsamea* (balsam fir). Some stands have a preponderance of one of these species and the other may then be an important associate. In these situations it is typically *Picea glauca* (white spruce) that is the most abundant (Maycock and Curtis 1960, MNNHP 1993). Common associates include *Acer rubrum* (red maple), *Betula papyrifera* (paper birch), *Picea mariana* (black spruce), *Pinus banksiana* (jack pine), *Populus tremuloides* (quaking aspen), and *Populus balsamifera* (balsam poplar). There is usually a prominent shrub/sapling layer containing *Abies balsamea* (balsam fir), *Acer spicatum* (mountain maple), *Corylus cornuta* (beaked hazelnut), *Diervilla lonicera* (northern bush honeysuckle), *Lonicera canadensis* (American fly honeysuckle), *Picea glauca* (white spruce), *Rosa acicularis* (prickly rose), *Rubus pubescens* (dwarf red blackberry), *Sorbus americana* (American mountain-ash), *Vaccinium myrtilloides* (velvetleaf huckleberry), and (eastward) *Viburnum nudum* var. *cassinoides* (withe-rod). The herbaceous layer is often moderately sparse, with species such as *Anemone quinquefolia* (wood anemone), *Aralia nudicaulis* (wild sarsaparilla), *Eurybia macrophylla* (bigleaf aster), *Clintonia borealis* (bluebead), *Coptis trifolia* (threeleaf goldthread), *Cornus canadensis* (bunchberry dogwood), *Dryopteris carthusiana* (spinulose woodfern), *Maianthemum canadense* (Canada mayflower), *Mitella nuda* (naked miterwort) and *Trientalis borealis* (starflower). Mosses include *Dicranum polysetum* (dicranum moss), *Pleurozium schreberi*

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(Schreber's big red stem moss), *Ptilium crista-castrensis* (knights plume moss), and *Rhytidiadelphus triquetrus* (rough gooseneck moss) (Sims et al. 1989, Chambers et al. 1997).

MOST ABUNDANT SPECIES

Saint Croix National Scenic Riverway

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Abies balsamea* (balsam fir), *Picea glauca* (white spruce)
Herb (field)	Forb	*Clintonia borealis* (bluebead), *Cornus canadensis* (bunchberry dogwood)
Herb (field)	Fern or fern ally	*Pteridium aquilinum* (western brackenfern)
Nonvascular	Moss	*Pleurozium schreberi* (Schreber's big red stem moss), *Ptilium crista-castrensis* (knights plume moss)

CHARACTERISTIC SPECIES

Saint Croix National Scenic Riverway: *Abies balsamea* (balsam fir), *Clintonia borealis* (bluebead), *Cornus canadensis* (bunchberry dogwood), *Linnaea borealis* (twinflower), *Picea glauca* (white spruce), *Pleurozium schreberi* (Schreber's big red stem moss), *Pteridium aquilinum* (western brackenfern), *Ptilium crista-castrensis* (knights plume moss), *Vaccinium angustifolium* (lowbush blueberry), *Vaccinium myrtilloides* (velvetleaf huckleberry)

CONSERVATION STATUS RANK

Global Rank & Reasons: G4G5 (3-Oct-1996).

CLASSIFICATION

Status: Standard

Classification Confidence: 1 - Strong

Global Comments: This type occurs in a variety of sites, including sites that are fairly wet, and occurs both after disturbances and as a late-successional type. It is difficult to separate from the mixed spruce-fir-hardwood types, *Picea glauca - Abies balsamea - Populus tremuloides* / Mixed Herbs Forest (CEGL002475), from which it may only differ in the degree of conifer dominance. Treefalls in this type can create a very open canopy. Inclusions of Spruce-Fir/Feathermoss, *Picea glauca - Abies balsamea / Pleurozium schreberi* Forest (CEGL002509), may occur in this type in the Great Lake states. Conversely, CEGL002509 appears to be the common type in Manitoba, and this type is not expected (J. Greenall pers. comm. 1999). In northern Wisconsin this type has been documented only in ravines or on stable clay bluffs and is not known from the extensive Lake Superior clayplains [see *Picea glauca - Abies balsamea - Populus tremuloides* / Mixed Herbs Forest (CEGL002475)].

Global Similar Associations:

- *Abies balsamea - Betula papyrifera / Diervilla lonicera* Forest (CEGL002474)
- *Picea glauca - Abies balsamea - Populus tremuloides* / Mixed Herbs Forest (CEGL002475) This is the mixed hardwood-conifer equivalent.
- *Picea glauca - Abies balsamea / Pleurozium schreberi* Forest (CEGL002509)
- *Pinus strobus - Populus tremuloides / Corylus cornuta* Forest (CEGL002479)
- *Populus tremuloides - Populus balsamifera* - Mixed Hardwoods Lowland Forest (CEGL005036)

Global Related Concepts:

- *Abies-Populus/Rosa/Mertensia, Corylus/Diervilla/Aster-Anemone* Group (La Roi 1967) =
- Aetna Creek Stand (Maycock 1961) =
- Boreal Forest Spruce-Fir Subtype (Faber-Langendoen 2001) =
- Delaware Stand (Maycock 1961) =
- Dry-mesic Stands (Maycock and Curtis 1960) =
- Spruce - Fir Forest White Spruce - Balsam Fir Subtype (MNNHP 1993) =
- White Spruce - Balsam Fir / Shrub Forest (Zoladeski et al. 1995) =
- White Spruce - Balsam Fir / Shrub Rich Forest (Sims et al. 1989) =

ELEMENT DISTRIBUTION

Global Range: This white spruce - balsam fir conifer forest is found in the southern boreal region of the Great Lakes of the United States and elsewhere in central Canada.

Nations: CA, US

States/Provinces: MB:S4, MI, MN:S3, ON, QC, WI:S2

TNC Ecoregions: 47:C, 48:C

USFS Ecoregions (1994/95): 212Ha:CCP, 212Hb:CCP, 212He:CCP, 212Hh:CCP, 212Hi:CCC, 212Hj:CCC, 212Hk:CCP, 212Hl:CCP, 212Hm:CCP, 212Hn:CCP, 212Hr:CCP, 212Hs:CC?, 212Hv:CC?, 212Hw:CCP, 212Ib:CCC, 212Ja:CCC, 212Jb:CCP, 212Jc:CCC, 212Jk:CCP, 212Jl:CCP, 212Jn:CCP, 212Jo:CCP, 212Jr:CCP, 212Kb:CCC, 212La:CCC, 212Lb:CCC, 212Lc:CCP, 212Ld:CCP, 212Ma:CCC, 212Mb:CCP, 212Na:CPP, 212Nb:CPP, 212Nc:CPP, 212Oa:CCC

Federal Lands: NPS (Grand Portage, Pictured Rocks, Saint Croix, Voyageurs); USFS (Chippewa, Hiawatha, Huron, Huron-Manistee, Manistee, Ottawa, Superior)

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ELEMENT SOURCES

Saint Croix National Scenic Riverway Map Code: FSF
Saint Croix National Scenic Riverway Plots: SACN.4753, SACN.5070.
Local Description Authors: M.J. Russo
Global Description Authors: J. Drake
References: Chambers et al. 1997, Faber-Langendoen 2001, Greenall 1996, Hop et al. 2010b, Hop et al. 2010c, La Roi 1967, MNNHP 1993, Maycock 1961, Maycock and Curtis 1960, Midwestern Ecology Working Group n.d., Sims et al. 1989, WNHIP unpubl. data, Zoladeski et al. 1995

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Aspen - Birch / Boreal Conifer Forest

***Populus tremuloides - Betula papyrifera / (Abies balsamea, Picea glauca)* Forest**
Quaking Aspen - Paper Birch / (Balsam Fir, White Spruce) Forest
Identifier: CEGL002466

NVC CLASSIFICATION

Division	North American Boreal Forest (1.D.1.Na)
Macrogroup	Eastern & Central North American Boreal Conifer & Hardwood Forest (M037)
Group	White Spruce - Balsam Fir Forest (G048)
Association (Common name)	Aspen - Birch / Boreal Conifer Forest

ELEMENT CONCEPT

Global Summary: This aspen - birch boreal hardwoods forest type is found in the boreal regions of the midwestern United States and in central Canada. Sites occupy a variety of topographic positions, including ridgetops and gentle to moderate upper, mid, and lower slopes. The soils are deep, well-drained to rapidly drained mineral soils (dry to mesic soils). Soil textures are usually clay loamy but can be silt or fine sand. This community is dominated by deciduous trees, with a moderate amount of conifers (<25%). The canopy is dominated by *Betula papyrifera* (paper birch) and *Populus tremuloides* (quaking aspen), and occasionally *Populus grandidentata* (bigtooth aspen). Conifer associates include *Abies balsamea* (balsam fir) and *Picea glauca* (white spruce), either in the canopy or, more characteristically, in the subcanopy. *Abies balsamea* (balsam fir) and *Picea glauca* (white spruce) are abundant in the sapling layer. Common shrubs include *Acer spicatum* (mountain maple), *Corylus cornuta* (beaked hazelnut), *Diervilla lonicera* (northern bush honeysuckle), *Linnaea borealis* (twinflower), *Lonicera canadensis* (American fly honeysuckle), *Rosa acicularis* (prickly rose), *Rubus pubescens* (dwarf red blackberry), *Sorbus decora* (northern mountain-ash), and *Vaccinium myrtilloides* (velvetleaf huckleberry). The herbaceous stratum is sometimes dominated by *Eurybia macrophylla* (bigleaf aster), but can include a diversity of forbs, such as *Anemone quinquefolia* (wood anemone), *Aralia nudicaulis* (wild sarsaparilla), *Clintonia borealis* (bluebead), *Cornus canadensis* (bunchberry dogwood), *Galium triflorum* (fragrant bedstraw), *Maianthemum canadense* (Canada mayflower), *Mitella nuda* (naked miterwort), *Pteridium aquilinum* (western brackenfern), *Streptopus lanceolatus* var. *longipes* (twistedstalk), *Trientalis borealis* (starflower), and *Viola renifolia* (white violet). Mosses include *Plagiomnium cuspidatum* (toothed plagiomnium moss), *Pleurozium schreberi* (Schreber's big red stem moss), *Ptilium crista-castrensis* (knights plume moss), and *Rhytidiadelphus triquetrus* (rough gooseneck moss). Diagnostic features of this type are the dominance by the combination of *Populus tremuloides* (quaking aspen) and *Betula papyrifera* (paper birch), boreal conifer associates (but very little *Picea mariana* (black spruce) or *Pinus banksiana* (jack pine)), and lack of more southern hardwoods (such as *Acer saccharum* (sugar maple)).

ENVIRONMENTAL DESCRIPTION

Saint Croix National Scenic Riverway Environment:
Global Environment: This community is found on a variety of topographic positions. Ohmann and Ream (1971) found it on ridgetops, upper, mid, and lower slopes. These slopes are gentle to moderate. The soils are deep, well-drained to rapidly drained mineral soils (Sims et al. 1989). The soils are usually loam but can be clay (including lacustrine clays or clayier tills), silt, or sand.

VEGETATION DESCRIPTION

Saint Croix National Scenic Riverway Vegetation: This forest association is dominated by deciduous trees but can have moderate amounts of conifers in the canopy. Populus tremuloides (quaking aspen), Populus grandidentata (bigtooth aspen), and Acer rubrum (red maple) dominate with Abies balsamea (balsam fir) and Picea glauca (white spruce) the most frequent canopy conifers. These conifers are common to abundant in the subcanopy and tree regeneration layers. The herbaceous stratum is usually dominated by *Aralia nudicaulis* (wild sarsaparilla), *Clintonia borealis* (bluebead), *Cornus canadensis* (bunchberry dogwood), *Eurybia macrophylla* (bigleaf aster), *Maianthemum canadense* (Canada mayflower), *Streptopus lanceolatus* (twistedstalk), *Trientalis borealis* (starflower), and *Pteridium aquilinum* (western brackenfern).
Global Vegetation: This community is dominated by deciduous trees, with a moderate amount of conifers (<25%). The dominant tree species do not have dense leaf layers and allow a significant amount of light to pass through. This promotes the establishment of prominent sapling and shrub layers and a moderately dense herbaceous stratum. The canopy is dominated by *Betula papyrifera* (paper birch) and *Populus tremuloides* (quaking aspen), and occasionally *Populus grandidentata* (bigtooth aspen). Conifer associates include *Abies balsamea* (balsam fir) and *Picea glauca* (white spruce), either in the canopy or, more characteristically, in the subcanopy. *Abies balsamea* (balsam fir) and *Picea glauca* (white spruce) are abundant in the sapling layer. Common shrubs include *Acer spicatum* (mountain maple), *Corylus cornuta* (beaked hazelnut), *Diervilla lonicera* (northern bush honeysuckle), *Linnaea borealis* (twinflower), *Lonicera canadensis* (American fly honeysuckle), *Rosa acicularis* (prickly rose), *Rubus pubescens* (dwarf red blackberry), *Sorbus decora* (northern mountain-ash), and *Vaccinium myrtilloides* (velvetleaf huckleberry). The herbaceous stratum is sometimes dominated by *Eurybia macrophylla* (bigleaf aster), but can include a diversity of forbs, such as *Anemone quinquefolia* (wood anemone), *Aralia nudicaulis* (wild sarsaparilla), *Clintonia borealis* (bluebead), *Cornus canadensis* (bunchberry dogwood), *Galium triflorum* (fragrant bedstraw), *Maianthemum canadense* (Canada mayflower), *Mitella nuda* (naked miterwort), *Pteridium aquilinum* (western brackenfern), *Streptopus lanceolatus* (twistedstalk), *Trientalis borealis* (starflower), and *Viola renifolia* (white violet). Mosses include *Plagiomnium cuspidatum* (toothed plagiomnium moss), *Pleurozium schreberi* (Schreber's big red stem moss), *Ptilium crista-castrensis* (knights plume moss), and *Rhytidiadelphus triquetrus* (rough gooseneck moss) (Sims et al. 1989, Chambers et al. 1997).

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MOST ABUNDANT SPECIES

Saint Croix National Scenic Riverway

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Acer rubrum* (red maple), *Betula papyrifera* (paper birch), *Populus grandidentata* (bigtooth aspen), *Populus tremuloides* (quaking aspen)
Tall shrub/sapling	Needle-leaved tree	*Abies balsamea* (balsam fir), *Picea glauca* (white spruce)
Herb (field)	Forb	*Aralia nudicaulis* (wild sarsaparilla), *Clintonia borealis* (bluebead), *Cornus canadensis* (bunchberry dogwood), *Eurybia macrophylla* (bigleaf aster), *Maianthemum canadense* (Canada mayflower), *Streptopus lanceolatus* (twistedstalk), *Trientalis borealis* (starflower), and *Pteridium aquilinum* (western brackenfern)

CONSERVATION STATUS RANK

Global Rank & Reasons: G5 (3-Oct-1996).

CLASSIFICATION

Status: Standard
Classification Confidence: 1 - Strong
Global Comments: Further north in Ontario, a *Populus tremuloides* - *Betula papyrifera* type, *Populus (tremuloides*, *balsamifera)* - *(Betula papyrifera)* - *Picea mariana / Alnus viridis* Forest (CEGL002514), occurs that contains greater proportions of *Picea mariana* (black spruce) and *Pinus banksiana* (jack pine). *Acer spicatum* (mountain maple) drops out of this type in the more western part of the type's range in Ontario and Minnesota. This type is often an early successional type following fire or logging, and occupies a wide variety of site types.
Global Similar Associations:
- *Betula papyrifera / Diervilla lonicera* - *(Abies balsamea)* Forest (CEGL002463)
- *Populus (tremuloides, balsamifera)* - *(Betula papyrifera)* - *Picea mariana / Alnus viridis* Forest (CEGL002514)
- *Populus tremuloides* - *(Populus grandidentata)* Rocky Woodland (CEGL002487)
- *Populus tremuloides* - *Betula papyrifera* - *(Acer rubrum, Populus grandidentata)* Forest (CEGL002467) This type contains neither a northern hardwoods understory nor a boreal conifer understory.
- *Populus tremuloides* - *Betula papyrifera / Acer saccharum* - Mixed Hardwoods Forest (CEGL002468) This type contains a mixed northern hardwoods understory.

Global Related Concepts:
- Aspen - Birch (Ohmann and Ream 1971) =
- Aspen - Birch Forest Spruce - Fir Subtype (MNNHP 1993) =
- Boreal Forest (Chapman et al. 1989) >
- Boreal Forest Aspen-Birch-Spruce-Fir Subtype (Faber-Langendoen 2001) =
- Paper Birch - Aspen - Balsam Fir - White Spruce (Hansen et al. 1973) =
- Trembling Aspen (White Birch) - Balsam Fir / Mountain Maple (V6) (Sims et al. 1989) <
- Trembling Aspen - Balsam Fir / Balsam Fir Shrub (V7) (Sims et al. 1989) <
- Trembling Aspen-White Birch-White Spruce-Dwarf Raspberry (V22) (Chambers et al. 1997) =

ELEMENT DISTRIBUTION

Global Range: This aspen - birch boreal hardwoods forest type is found in the boreal regions of the midwestern United States and in central Canada, ranging from Minnesota and Manitoba east to Michigan, Ontario and possibly Quebec.
Nations: CA, US
States/Provinces: MB:S4S5, MI, MN:S4?, ON, QC:S4, WI:S5
TNC Ecoregions: 47:C, 48:C
USFS Ecoregions (1994/95): 212Ha:CPP, 212Hb:CPP, 212He:CPP, 212Hh:CPP, 212Hi:CPP, 212Hj:CPP, 212Hk:CPP, 212Ia:CCC, 212Ib:CCC, 212Ja:CPP, 212Jb:CPP, 212Jc:CPP, 212Jk:CPP, 212Jl:CPP, 212Jm:CP?, 212Jn:CPP, 212Jo:CPP, 212Jr:CPP, 212La:CCP, 212Lb:CCC, 212Lc:CCC, 212Ld:CCC, 212Mb:CPP, 212Na:CPP, 212Nb:CPP, 212Nc:CPP
Federal Lands: NPS (Apostle Islands, Grand Portage, Isle Royale, Saint Croix, Voyageurs); USFS (Chippewa, Ottawa, Superior)

ELEMENT SOURCES

Saint Croix National Scenic Riverway Map Code: FAC
Saint Croix National Scenic Riverway Plots: No plots.
Local Description Authors: J. Drake
Global Description Authors: J. Drake
References: Chambers et al. 1997, Chapman et al. 1989, Faber-Langendoen 2001, Greenall 1996, Hansen et al. 1973, Hop et al. 2010a, Hop et al. 2010b, MNNHP 1993, Midwestern Ecology Working Group n.d., Ohmann and Ream 1971, Sims et al. 1989, TNC 1999b, WNHIP unpubl. data

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1.D.2. Boreal Swamp & Flooded Forest

1.D.2.Na. North American Boreal Flooded & Swamp Forest

M299. North American Boreal Swamp Forest

G050. Eastern Black Spruce - Tamarack Acidic Swamp Forest

Black Spruce - Tamarack / Labrador-tea Poor Swamp

***Picea mariana - (Larix laricina) / Ledum groenlandicum / Sphagnum* spp. Forest**
Black Spruce - (Tamarack) / Bog Labrador-tea / Peatmoss species Forest
Identifier: CEGL005271

NVC CLASSIFICATION

Division	North American Boreal Flooded & Swamp Forest (1.D.2.Na)
Macrogroup	North American Boreal Swamp & Bog Forest (M299)
Group	Eastern Black Spruce - Tamarack Acidic Swamp & Bog Forest (G050)
Association (Common name)	Black Spruce - Tamarack / Labrador-tea Poor Swamp

ELEMENT CONCEPT

Global Summary: This community is found in the northern Great Lakes and Northern Appalachian/Boreal region of the United States and Canada and elsewhere in the boreal regions of central and eastern Canada. Sites are found on level, wet sites with organic soils, but not generally as components of large open peatlands. These sites are poorly drained and acidic, allowing a moderate to thick layer of peat to accumulate. Nutrient levels are very low. The overstory of this community is dominated by conifers. The tree canopy is closed to broken to closed with a moderately well-developed low-shrub layer, sparse herbaceous layer, and a carpet of mosses. The canopy is often pure *Picea mariana* (black spruce). The only other trees that are occasionally found with it are *Abies balsamea* (balsam fir), *Larix laricina* (tamarack), and *Pinus banksiana* (jack pine). The shrubs are primarily ericaceous and include *Chamaedaphne calyculata* (leatherleaf), *Gaultheria hispidula* (creeping snowberry), *Kalmia polifolia* (bog laurel), *Ledum groenlandicum* (bog Labrador-tea), and *Vaccinium myrtilloides* (velvetleaf huckleberry), as well as *Cornus canadensis* (bunchberry dogwood). In the Northeast, shrubs may include *Kalmia angustifolia* (sheep laurel), *Nemopanthus mucronatus* (catberry), *Viburnum nudum* var. *cassinoides* (withe-rod), or *Rhododendron canadense* (rhodora). The few herbaceous species that live in this community include *Carex trisperma* (three-seeded sedge), *Eriophorum vaginatum* var. *spissum* (tussock cottongrass), *Clintonia borealis* (bluebead), and *Maianthemum trifolium* (threeleaf false lily of the valley). *Sphagnum* (sphagnum) spp., *Dicranum polysetum* (dicranum moss), and *Pleurozium schreberi* (Schreber's big red stem moss) are the major species constituting the abundant moss layer.

ENVIRONMENTAL DESCRIPTION

Saint Croix National Scenic Riverway Environment: This black spruce / Labrador-tea bog forest was sampled at seven locations in the park. Sites are wet-mesic bogs and depressions often with mossy hummocks and saturated peat soils. The ground surface is dominated by peatmosses (70% cover) with some leaf litter (23%), wood (4%) and dead plant stems (3%). No evidence of disturbance was reported.
Global Environment: This community is found on level, wet sites with organic soils (Zoladeski et al. 1995). These sites are poorly to very poorly drained and acidic, allowing a moderate to thick layer of peat to accumulate. Nutrient levels are very low (Kurmis et al. 1986).

VEGETATION DESCRIPTION

Saint Croix National Scenic Riverway Vegetation: Height or cover data were provided for one of the plots. In that example, the tree canopy is stunted (1-2 m tall) with 10% cover, the shrub layer (0.5-1 m) has 20% cover, the dwarf-shrub layer has 30% cover, the herbaceous layer 20% cover, and the dominant nonvascular layer has 70% cover. *Picea mariana* (black spruce) is nearly exclusively the dominant in the tree layer with up to 60% cover in other sampled plots; *Larix laricina* (tamarack) may also occur in lesser amounts. The shrub layer is dominated by *Ledum groenlandicum* (bog Labrador-tea) and may include *Andromeda polifolia* var. *glaucophylla* (bog rosemary), *Chamaedaphne calyculata* (leatherleaf), *Kalmia polifolia* (bog laurel), *Vaccinium angustifolium* (lowbush blueberry), *Vaccinium myrtilloides* (velvetleaf huckleberry), and others. Dominants in the herbaceous layer (with up to 60% cover) include *Carex chordorrhiza* (creeping sedge), *Carex oligosperma* (fewseed sedge), *Carex pauciflora* (fewflower sedge), *Carex trisperma* (three-seeded sedge), *Eriophorum tenellum* (fewnerved cottongrass), *Eriophorum vaginatum* var. *spissum* (tussock cottongrass), *Eriophorum virginicum* (tawny cottongrass), *Maianthemum trifolium* (threeleaf false lily of the valley), and *Vaccinium oxycoccos* (small cranberry); other common species include *Carex magellanica* ssp. *irrigua* (boreal bog sedge), *Cypripedium acaule* (moccasin flower), and insectivore *Sarracenia purpurea* (purple pitcherplant). *Sphagnum* (sphagnum) spp. and *Polytrichum* (polytrichum moss) spp. dominate the nonvascular layer (60-95% cover). In addition, this community may support Wisconsin state-vulnerable *Pseudobryum cinclidioides* (pseudobryum moss).
Global Vegetation: The overstory of this community is dominated by conifers. The tree canopy is closed to broken to closed with a moderately well-developed low-shrub layer, sparse herbaceous layer, and a carpet of mosses (Kurmis et al. 1986). The canopy is often

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pure *Picea mariana* (black spruce). *Abies balsamea* (balsam fir) can be present as a codominant. The only other trees that are occasionally found with it are *Larix laricina* (tamarack) and *Pinus banksiana* (jack pine) (Sims et al. 1989). The shrubs are primarily ericaceous and include *Chamaedaphne calyculata* (leatherleaf), *Gaultheria hispidula* (creeping snowberry), *Kalmia polifolia* (bog laurel), *Ledum groenlandicum* (bog Labrador-tea), and *Vaccinium* (blueberry) spp., as well as *Cornus canadensis* (bunchberry dogwood). In the Northeast, shrubs may include *Kalmia angustifolia* (sheep laurel), *Nemopanthus mucronatus* (catberry), *Viburnum nudum* var. *cassinoides* (withe-rod), or *Rhododendron canadense* (rhodora). The few herbaceous species that live in this community include *Carex lasiocarpa* (woollyfruit sedge), *Carex trisperma* (three-seeded sedge), *Eriophorum vaginatum* var. *spissum* (tussock cottongrass), *Clintonia borealis* (bluebead), *Coptis trifolia* (threeleaf goldthread), and *Maianthemum trifolium* (threeleaf false lily of the valley). *Dicranum polysetum* (dicranum moss), *Sphagnum* (sphagnum) spp., and *Pleurozium schreberi* (Schreber's big red stem moss) are the major species constituting the abundant moss layer (Damman and French 1987, Sims et al. 1989, Harris et al. 1996). Localized minerotrophic areas may contain a more diverse herbaceous layer, including species such as *Osmunda cinnamomea* (cinnamon fern).

MOST ABUNDANT SPECIES

Saint Croix National Scenic Riverway

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Larix laricina* (tamarack), *Picea mariana* (black spruce)
Tall shrub/sapling	Broad-leaved evergreen shrub	*Kalmia polifolia* (bog laurel), *Ledum groenlandicum* (bog Labrador-tea)
Short shrub/sapling	Dwarf-shrub	*Chamaedaphne calyculata* (leatherleaf)
Herb (field)	Forb	*Maianthemum trifolium* (threeleaf false lily of the valley), *Vaccinium oxycoccos* (small cranberry)
Herb (field)	Graminoid	*Carex pauciflora* (fewflower sedge)

CHARACTERISTIC SPECIES

Saint Croix National Scenic Riverway: *Carex pauciflora* (fewflower sedge), *Chamaedaphne calyculata* (leatherleaf), *Kalmia polifolia* (bog laurel), *Larix laricina* (tamarack), *Ledum groenlandicum* (bog Labrador-tea), *Maianthemum trifolium* (threeleaf false lily of the valley), *Picea mariana* (black spruce), *Vaccinium angustifolium* (lowbush blueberry), *Vaccinium oxycoccos* (small cranberry)

OTHER NOTEWORTHY SPECIES

Saint Croix National Scenic Riverway: Vulnerable: *Pseudobryum cinclidioides* (pseudobryum moss, WI state-vulnerable, G5)

CONSERVATION STATUS RANK

Global Rank & Reasons: G5 (27-Jun-2000).

CLASSIFICATION

Status: Standard

Classification Confidence: 2 - Moderate

Global Comments: This type represents poor black spruce swamps in closed peatland basins. Conceptually, it overlaps with black spruce bog forests, *Picea mariana / Ledum groenlandicum / Carex trisperma / Sphagnum* spp. Forest (CEGL002485), which are more typically found in open peatland complexes. This type is found in smaller basins, where a weakly minerotrophic influence is more likely. In the Northern Appalachian/Boreal ecoregion, *Abies balsamea* (balsam fir) differentiates this type from bogs of lower elevations and latitudes. Stands in northeast U.S. and Canada may also contain a suite of shrub species, such as *Kalmia angustifolia* (sheep laurel), *Nemopanthus mucronatus* (catberry), *Viburnum nudum* var. *cassinoides* (withe-rod), or *Rhododendron canadense* (rhodora). These species differ from those in the midwestern U.S. and central Canada, but their constancy in this type needs further evaluation.

Global Similar Associations:

- *Larix laricina / Alnus incana* Forest (CEGL002471)
- *Picea mariana / (Vaccinium corymbosum, Gaylussacia baccata) / Sphagnum* sp. Woodland (CEGL006098)
- *Picea mariana / Alnus incana / Sphagnum* spp. Forest (CEGL002452) is similar but tends to have a greater diversity and coverage of herbs and to be more nutrient-rich.
- *Picea mariana / Ledum groenlandicum / Carex trisperma / Sphagnum* spp. Forest (CEGL002485) overlaps.
- *Picea mariana / Pleurozium schreberi* Forest (CEGL002447)
- *Pinus banksiana - (Picea mariana)* - Mixed Hardwoods / *Sphagnum* spp. Forest (CEGL005166)
- *Populus tremuloides - (Populus grandidentata)* Rocky Woodland (CEGL002487)
- *Thuja occidentalis - Larix laricina / Sphagnum* spp. Forest (CEGL005225)

Global Related Concepts:

- *Carex trisperma* - Black spruce forest (Damman and French 1987) =
- *Habenario - Picetum* Association (Janssen 1967) =
- Black Spruce (eastern type): 12 (Eyre 1980) >
- Black Spruce - *Kalmia* Type (Kurmis et al. 1986) =
- Black Spruce / Bunchberry / Sphagnum (Feathermoss) (V36) (Sims et al. 1989) <
- Black Spruce / Ericaceous Shrub / Sphagnum (V37) (Sims et al. 1989) <

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- Black Spruce / Herb Poor / Sphagnum (Feathermoss) (Zoladeski et al. 1995) =
- Black Spruce / Labrador Tea / Feathermoss (Sphagnum) (V34) (Sims et al. 1989) <
- Black Spruce Bog (Woodland) (Thompson 1996) **?**
- Black Spruce Swamp (MNNHP 1993) >
- Northern Wet Forest Black Spruce Poor Swamp Subtype (Faber-Langendoen 2001) =
- Palustrine Scrub-Shrub Needle-leaved Evergreen Saturated Wetland (PSS4B) (Cowardin et al. 1979) **?**
- Poor Conifer Swamp - Black Spruce (Tamarack) Swamp (Chapman et al. 1989) =
- Poor conifer swamp: black spruce / Labrador Tea / Sphagnum (W27) (Harris et al. 1996) <
- Poor conifer swamp: black spruce / Labrador Tea / bluejoint grass (W28) (Harris et al. 1996) <
- Spring-fen forest (Glaser 1992b) =
- Spruce - Larch Wooded Bog (Gawler 2002) >

ELEMENT DISTRIBUTION

Global Range: This community is found in the northern Great Lakes region and Northern Appalachian-Acadian region of the United States and Canada and elsewhere in the boreal regions of central Canada. It ranges from northern Michigan to northern Minnesota, and northward to parts of Manitoba, Ontario, Quebec, and the Atlantic Provinces.

Nations: CA, US

States/Provinces: MB:S5, ME, MI:S4, MN, NB, NH, NY, ON, PA, QC:S4, VT:S2, WI:S3

TNC Ecoregions: 47:C, 48:C, 63:C, 64:C

USFS Ecoregions (1994/95): 212Aa:CCC, 212Ab:CCC, 212Ba:CCC, 212Bb:CCC, 212Ca:CCC, 212Cb:CCC, 212Da:CCC, 212Dc:CCC, 212Ha:CCP, 212Hb:CCP, 212He:CCP, 212Hh:CCP, 212Hi:CCC, 212Hj:CCC, 212Hk:CCP, 212Ho:CCC, 212Hp:CCP, 212Hq:CCC, 212Hr:CCP, 212Hs:CCP, 212Hv:CCP, 212Hw:CCC, 212Ia:CCC, 212Ib:CCC, 212Ja:CPP, 212Jb:CPP, 212Jc:CPP, 212Je:CPP, 212Jf:CPP, 212Jj:CPP, 212Jk:CPP, 212Jl:CPP, 212Jm:CPP, 212Jn:CPP, 212Jo:CPP, 212Jr:CPP, 212Ka:CCP, 212Kb:CCC, 212La:CCC, 212Lb:CCC, 212Lc:CCC, 212Ld:CCC, 212Ma:CCC, 212Mb:CCC, 212Na:CCC, 212Nb:CCC, 212Nc:CCC, 221Ag:CCC, 221Ah:CCC, 221Ai:CCC, 221Ak:CCC, 221Al:CCC, M212Aa:CCC, M212Ab:CCC, M212Ac:CCC, M212Ad:CCC, M212Ae:CCC, M212Af:CCC, M212Ag:CCC, M212Ba:CCC, M212Ca:CCC, M212Cd:CCC, M212Da:CCC, M212Db:CCC, M212Dc:CCC, M212Dd:CCP

Federal Lands: NPS (Acadia, Apostle Islands, Isle Royale, Pictured Rocks, Saint Croix, Sleeping Bear Dunes, Voyageurs); USFS (Chequamegon, Chequamegon-Nicolet, Chippewa, Hiawatha?, Huron, Huron-Manistee, Manistee, Nicolet, Ottawa, Superior)

ELEMENT SOURCES

Saint Croix National Scenic Riverway Map Code: FST

Saint Croix National Scenic Riverway Plots: SACN.253, SACN.0203, SACN.4460, SACN.4468, SACN.4743, SACN.7489, SACN.7492.

Local Description Authors: M.J. Russo

Global Description Authors: D. Faber-Langendoen

References: Anderson and Davis 1997, Chapman et al. 1989, Cowardin et al. 1979, Damman and French 1987, Edinger et al. 2002, Eyre 1980, Faber-Langendoen 2001, Farrand and Bell 1982, Fike 1999, Gawler 2002, Glaser 1992b, Harris et al. 1996, Hop et al. 2010a, Hop et al. 2010c, Janssen 1967, Kurmis et al. 1986, Lubinski et al. 2003, MNNHP 1993, Midwestern Ecology Working Group n.d., Sims et al. 1989, Sperduto 2000b, TNC 1999b, Thompson 1996, Thompson and Sorenson 2000, WNHIP unpubl. data, Zoladeski et al. 1995

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G051. Eastern Tamarack - Conifer Alkaline Swamp

Northern Tamarack Rich Swamp

***Larix laricina / Alnus incana* Forest**
Tamarack / Gray Alder Forest
Identifier: CEGL002471

NVC CLASSIFICATION

Division	North American Boreal Flooded & Swamp Forest (1.D.2.Na)
Macrogroup	North American Boreal Swamp & Bog Forest (M299)
Group	Eastern Tamarack - Conifer Alkaline Swamp (G051)
Association (Common name)	Northern Tamarack Rich Swamp

ELEMENT CONCEPT

Global Summary: This rich to moderately poor tamarack swamp community is found in the northern Great Lakes region of the United States and Canada. Stands are found on the shores of lakes and rivers above the flooding level, as well as margins of flowage areas of peatland complexes. The substrate is primarily a well-decomposed woody peat in wet, saturated soils, but can also be a moist mineral soil. The canopy layer varies from closed (60-100% cover) to open (25-60% cover), and varies from 3-10 m in height. *Larix laricina* (tamarack) is the dominant tree species, with associates of *Picea mariana* (black spruce) and *Thuja occidentalis* (northern white-cedar). The shrub, herb and moss layers can be very rich to somewhat poor. The shrub layer typically contains *Alnus incana* (gray alder), along with *Abies balsamea* (balsam fir), *Cornus sericea* (red-osier dogwood), *Rhamnus alnifolia* (alderleaf buckthorn), and *Picea mariana* (black spruce). The dwarf-shrub layer is strongly ericaceous, including *Ledum groenlandicum* (bog Labrador-tea) and *Gaultheria hispidula* (creeping snowberry). Other dwarf-shrubs include *Cornus canadensis* (bunchberry dogwood), *Linnaea borealis* (twinflower), *Lonicera villosa* (mountain fly honeysuckle), *Ribes triste* (red currant), *Rosa acicularis* (prickly rose), and *Rubus pubescens* (dwarf red blackberry). Herbaceous species include *Carex disperma* (softleaf sedge), *Carex aquatilis* (water sedge), *Coptis trifolia* (threeleaf goldthread), *Equisetum sylvaticum* (woodland horsetail), *Galium triflorum* (fragrant bedstraw), *Maianthemum canadense* (Canada mayflower), *Maianthemum trifolium* (threeleaf false lily of the valley), *Mitella nuda* (naked miterwort), *Trientalis borealis* (starflower), and *Viola renifolia* (white violet). The moss layer, which is sometimes patchy, includes *Dicranum polysetum* (dicranum moss), *Hylocomium splendens* (splendid feather moss), *Pleurozium schreberi* (Schreber's big red stem moss), *Ptilium crista-castrensis* (knights plume moss), *Rhytidiadelphus triquetrus* (rough gooseneck moss), *Sphagnum capillifolium* (sphagnum), and *Sphagnum girgensohnii* (Girgensohn's sphagnum). Diagnostic characteristics include the dominance of *Larix laricina* (tamarack), presence of both minerotrophic shrubs (*Alnus incana* (gray alder), *Cornus sericea* (red-osier dogwood)) and some ericaceous shrubs (e.g., *Ledum groenlandicum* (bog Labrador-tea)), and the incomplete moss layer.

ENVIRONMENTAL DESCRIPTION

Saint Croix National Scenic Riverway Environment: This tamarack swamp forest was sampled at 18 locations in the park. Sites are flat depressions and swamps with somewhat poorly to poorly drained peat soils that may experience intermittent flooding. The ground surface (recorded for two plots) is either dominated by bare soil (0-91% cover) or mosses (0-50%) with some leaf litter (1-44% cover) wood (1-4%), and dead plant stems (2-7%). No evidence of disturbance other than the presence of a few exotic plants was reported.

Global Environment: Stands are found on the shores of lakes and rivers above the flooding level, as well as margins of flowage areas of peatland complexes. The substrate is primarily a well-decomposed woody peat in wet, saturated soils, but can also be a moist mineral soil (Sims et al. 1989, MNNHP 1993, Harris et al. 1996).

VEGETATION DESCRIPTION

Saint Croix National Scenic Riverway Vegetation: Strata height or cover data were provided for two of the sampled plots. The moderate (40-60% cover) tree canopy is 10-15 m tall, the very sparse (5-10%) tall-shrub layer is 2-5 m, the sparse (20-40%) short-shrub layer is 0.5-1 m, and there is a sparse (20-40%) herbaceous layer. Nonvascular species (many sphagnum mosses) cover 60-90% of the ground surface. *Larix laricina* (tamarack) is the dominant tree; additional species may include *Acer rubrum* (red maple), *Betula alleghaniensis* (yellow birch), *Betula papyrifera* (paper birch), *Fraxinus nigra* (black ash), and *Picea mariana* (black spruce). Dominant shrubs include *Alnus incana* (gray alder), *Betula pumila* var. *glandulifera* (bog birch), *Chamaedaphne calyculata* (leatherleaf), *Cornus sericea* ssp. *sericea* (red-osier dogwood), *Ilex verticillata* (common winterberry), *Ledum groenlandicum* (bog Labrador-tea), *Nemopanthus mucronatus* (catberry), *Toxicodendron vernix* (poison-sumac), *Vaccinium angustifolium* (lowbush blueberry), and *Vaccinium myrtilloides* (velvetleaf huckleberry); the percent cover for these species were reported to range from 15 to 62.5%. Common and/or abundance herbs include *Calamagrostis canadensis* (bluejoint), *Calla palustris* (water arum), *Carex lacustris* (hairy sedge), *Carex oligosperma* (fewseed sedge), *Carex pseudocyperus* (cypress-like sedge), *Clintonia borealis* (bluebead), *Leersia oryzoides* (rice cutgrass), *Lysimachia thyrsiflora* (tufted loosestrife) (62.5% cover in one plot), *Maianthemum canadense* (Canada mayflower), *Maianthemum trifolium* (threeleaf false lily of the valley), *Osmunda cinnamomea* (cinnamon fern), *Thelypteris palustris* (eastern marsh fern) (62.5% cover in one plot), *Vaccinium macrocarpon* (cranberry), and others. In addition, this community may support Minnesota state-imperiled *Poa paludigena* (bog bluegrass) (also Wisconsin state-vulnerable), Wisconsin state-critically imperiled *Salix pellita* (satiny willow) (also Minnesota state-vulnerable), and Wisconsin state-vulnerable *Cypripedium parviflorum* (lesser yellow lady's slipper) and *Isopterygium tenerum* (isopterygium moss).

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Global Vegetation: The canopy layer varies from closed (60-100% cover) to open (25-60% cover), and may also range from 3-10 m in height. *Larix laricina* (tamarack) is the dominant tree species, with associates of *Picea mariana* (black spruce) and *Thuja occidentalis* (northern white-cedar). The shrub, herb and moss layers can be very rich to somewhat poor. The shrub layer typically contains *Alnus incana* (gray alder), along with *Abies balsamea* (balsam fir), *Cornus sericea* (red-osier dogwood), *Rhamnus alnifolia* (alderleaf buckthorn), and *Picea mariana* (black spruce). The dwarf-shrub layer is strongly ericaceous, including *Ledum groenlandicum* (bog Labrador-tea) and *Gaultheria hispidula* (creeping snowberry). Other dwarf-shrubs include *Cornus canadensis* (bunchberry dogwood), *Linnaea borealis* (twinflower), *Lonicera villosa* (mountain fly honeysuckle), *Ribes triste* (red currant), *Rosa acicularis* (prickly rose), and *Rubus pubescens* (dwarf red blackberry). Herbaceous species include *Carex disperma* (softleaf sedge), *Coptis trifolia* (threeleaf goldthread), *Equisetum sylvaticum* (woodland horsetail), *Galium triflorum* (fragrant bedstraw), *Maianthemum canadense* (Canada mayflower), *Maianthemum trifolium* (threeleaf false lily of the valley), *Mitella nuda* (naked miterwort), *Trientalis borealis* (starflower), and *Viola renifolia* (white violet). The moss layer, which is sometimes patchy, includes *Dicranum polysetum* (dicranum moss), *Hylocomium splendens* (splendid feather moss), *Pleurozium schreberi* (Schreber's big red stem moss), *Ptilium crista-castrensis* (knights plume moss), *Rhytidiadelphus triquetrus* (rough gooseneck moss), *Sphagnum capillifolium* (sphagnum), *Sphagnum girgensohnii* (Girgensohn's sphagnum), and *Sphagnum capillifolium* (sphagnum) (Sims et al. 1989, MNNHP 1993, Harris et al. 1996).

MOST ABUNDANT SPECIES

Saint Croix National Scenic Riverway

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Larix laricina* (tamarack)
Tall shrub/sapling	Broad-leaved deciduous shrub	*Alnus incana* (gray alder), *Cornus sericea* ssp. *sericea* (red-osier dogwood), *Ilex verticillata* (common winterberry), *Nemopanthus mucronatus* (catberry), *Toxicodendron vernix* (poison-sumac)
Short shrub/sapling	Dwarf-shrub	*Chamaedaphne calyculata* (leatherleaf), *Ledum groenlandicum* (bog Labrador-tea)
Herb (field)	Forb	*Lysimachia thyrsiflora* (tufted loosestrife)
Herb (field)	Graminoid	*Carex oligosperma* (fewseed sedge), *Carex pseudocyperus* (cypress-like sedge)
Herb (field)	Fern or fern ally	*Thelypteris palustris* (eastern marsh fern)

CHARACTERISTIC SPECIES

Saint Croix National Scenic Riverway: *Alnus incana* (gray alder), *Carex oligosperma* (fewseed sedge), *Carex pseudocyperus* (cypress-like sedge), *Chamaedaphne calyculata* (leatherleaf), *Cornus sericea* ssp. *sericea* (red-osier dogwood), *Ilex verticillata* (common winterberry), *Larix laricina* (tamarack), *Ledum groenlandicum* (bog Labrador-tea), *Lysimachia thyrsiflora* (tufted loosestrife), *Nemopanthus mucronatus* (catberry), *Thelypteris palustris* (eastern marsh fern), *Toxicodendron vernix* (poison-sumac)

OTHER NOTEWORTHY SPECIES

Saint Croix National Scenic Riverway: Vulnerable: *Cypripedium parviflorum* (lesser yellow lady's slipper, WI state-vulnerable, G5), *Isopterygium tenerum* (isopterygium moss, WI state-vulnerable, G5), *Poa paludigena* (bog bluegrass, MN & WI state-imperiled, G3), *Salix pellita* (satiny willow, WI state-critically imperiled & MN state-vulnerable, G5); **Exotic/Invasive**: *Frangula alnus* (glossy buckthorn, invasive/exotic, High/Medium), *Poa pratensis* (Kentucky bluegrass, invasive/exotic, Medium), *Rhamnus cathartica* (common buckthorn, invasive/exotic, High/Medium), *Solanum dulcamara* (climbing nightshade, invasive/exotic, Low), *Taraxacum officinale* (common dandelion, invasive/exotic)

CONSERVATION STATUS RANK

Global Rank & Reasons: G4 (3-Oct-1996).

CLASSIFICATION

Status: Standard

Classification Confidence: 2 - Moderate

Global Comments: This type in concept is found in the boreal/mixed conifer-hardwood region (Province 212). It varies from having a tall-shrub layer and more minerotrophic indicators to a more patchy layer with dwarf-shrub/sphagnum mat and fewer minerotrophic indicators. This type lacks the more southern species found in central tamarack minerotrophic swamps, such as *Larix laricina / Photinia melanocarpa / Sphagnum* spp. Forest (CEGL002472), which is found in the hardwood and prairie-forest border regions.

Global Similar Associations:

- *Acer rubrum - Fraxinus* spp. - *Betula papyrifera / Cornus canadensis* Forest (CEGL002071)
- *Larix laricina - Acer rubrum / (Rhamnus alnifolia, Vaccinium corymbosum)* Forest (CEGL005232) is a more southern minerotrophic version of this type.
- *Larix laricina / Photinia melanocarpa / Sphagnum* spp. Forest (CEGL002472) This type has a more southern distribution and is more nutrient-poor.
- *Picea mariana - (Larix laricina) / Ledum groenlandicum / Sphagnum* spp. Forest (CEGL005271)
- *Thuja occidentalis - Larix laricina / Sphagnum* spp. Forest (CEGL005225)

Global Related Concepts:

- Forested fingers (Glaser 1992b) =

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- Northern Wet Forest Tamarack Rich Subtype (Faber-Langendoen 2001) <
- Rich conifer swamp: cedar-(tamarack) (W32) (Harris et al. 1996) ><
- Tamarack (Black Spruce) / Speckled Alder / Labrador Tea (V23) (Sims et al. 1989) =
- Tamarack Fen (Northern) (Faber-Langendoen 2001) <
- Tamarack Swamp Minerotrophic Subtype (MNNHP 1993) ><
- Tamarack Swamp Seepage Subtype (MNNHP 1993) <
- Tamarack Swamp Sphagnum Subtype (MNNHP 1993) ><

ELEMENT DISTRIBUTION

Global Range: This rich to moderately poor tamarack swamp community is found in the northern Great Lakes region of the United States and Canada, ranging from the northern and central parts of Minnesota, Wisconsin, and Michigan to Ontario, Manitoba, and probably elsewhere.
Nations: CA, US
States/Provinces: MB:S4?, MI, MN, ON, QC:S4?, WI
TNC Ecoregions: 35:C, 47:C, 48:C
USFS Ecoregions (1994/95): 212Ha:CCP, 212Hb:CCP, 212He:CCP, 212Hh:CCP, 212Hi:CCC, 212Hj:CCP, 212Hk:CCP, 212Hl:CCP, 212Hm:CCP, 212Hn:CCP, 212Ho:CCP, 212Hp:CCP, 212Hq:CCP, 212Hr:CCP, 212Hs:CCP, 212Ht:CCP, 212Hv:CCP, 212Hw:CCP, 212Hy:CCP, 212Ia:CCC, 212Ib:CC?, 212Ja:CCC, 212Jb:CCP, 212Jc:CCP, 212Jk:CCP, 212Jl:CCP, 212Jm:CCP, 212Jn:CCP, 212Jo:CCP, 212Jr:CCP, 212Ka:CCP, 212Kb:CCC, 212La:CCC, 212Mb:CCC, 212Na:CCC, 212Nb:CCP, 212Nc:CCC, 222Na:CCC, M212:C
Federal Lands: NPS (Apostle Islands, Isle Royale, Saint Croix, Sleeping Bear Dunes, Voyageurs); USFS (Chequamegon, Chequamegon-Nicolet, Chippewa, Huron, Huron-Manistee, Manistee, Nicolet, Ottawa, Superior)

ELEMENT SOURCES

Saint Croix National Scenic Riverway Map Code: FST
Saint Croix National Scenic Riverway Plots: SACN.70, SACN.236, SACN.0136, SACN.0163, SACN.0170, SACN.0207, SACN.0208, SACN.0356, SACN.3540, SACN.4726, SACN.4744, SACN.4751, SACN.4752, SACN.5131, SACN.5498, SACN.7488, SACN.7490, SACN.7495, SACN.7499.
Local Description Authors: M.J. Russo
Global Description Authors: J. Drake
References: Brewer 1966, Catana 1967, Faber-Langendoen 2001, Glaser 1992b, Greenall 1996, Harris et al. 1996, Hop et al. 2010a, MNNHP 1993, Midwestern Ecology Working Group n.d., Sims et al. 1989, Sytsma and Pippen 1981a, Sytsma and Pippen 1981b, TNC 1999b

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White-cedar - (Mixed Conifer) / Alder Swamp

***Thuja occidentalis - (Picea mariana, Abies balsamea) / Alnus incana* Forest**
Northern White-cedar - (Black Spruce, Balsam Fir) / Gray Alder Forest
Identifier: CEGL002456

NVC CLASSIFICATION

Division	North American Boreal Flooded & Swamp Forest (1.D.2.Na)
Macrogroup	North American Boreal Swamp & Bog Forest (M299)
Group	Eastern Tamarack - Conifer Alkaline Swamp (G051)
Association (Common name)	White-cedar - (Mixed Conifer) / Alder Swamp

ELEMENT CONCEPT

Global Summary: This sub-boreal white-cedar - mixed conifer swamp forest is found in the northern Great Lakes region of the United States and Canada. Stands occur on level to gently sloping ground with wet, organic or mineral soil. It is typically along the margins of peatlands, in drainage courses, shores of lakes and rivers above flooding level, or in shallow depressions. The groundwater is moderately minerotrophic and has circumneutral pH. The canopy is often moderately dense to dense. The understory structure consists of high hummocks and deep, water-filled hollows, with fallen, moss-covered logs common. *Thuja occidentalis* (northern white-cedar) is moderately to strongly dominant in the canopy, or *Picea mariana* (black spruce) may overtop the subdominant *Thuja occidentalis* (northern white-cedar). Other species include *Abies balsamea* (balsam fir), *Acer rubrum* (red maple), *Betula papyrifera* (paper birch), *Fraxinus nigra* (black ash), *Larix laricina* (tamarack) and, more rarely, *Picea glauca* (white spruce), or *Tsuga canadensis* (eastern hemlock). The shrub layer in this community is sparse to dense, in inverse proportion to the tree canopy. Species present in this stratum include *Alnus incana* (gray alder), *Chamaedaphne calyculata* (leatherleaf), *Cornus canadensis* (bunchberry dogwood), *Cornus sericea* (red-osier dogwood), *Gaultheria hispidula* (creeping snowberry), *Ledum groenlandicum* (bog Labrador-tea), *Linnaea borealis* (twinflower), *Rosa acicularis* (prickly rose), *Rubus pubescens* (dwarf red blackberry), and *Vaccinium myrtilloides* (velvetleaf huckleberry). *Nemopanthus mucronatus* (catberry) and *Viburnum nudum* var. *cassinoides* (withe-rod) are more common eastward. The most common herbaceous species are *Carex* (sedge) spp. (including *Carex disperma)*, *Coptis trifolia* (threeleaf goldthread), *Clintonia borealis* (bluebead), *Dryopteris carthusiana* (spinulose woodfern), *Galium triflorum* (fragrant bedstraw), *Maianthemum canadense* (Canada mayflower), *Mitella nuda* (naked miterwort), *Trientalis borealis* (starflower), and *Viola renifolia* (white violet). Mosses include *Hylocomium splendens* (splendid feather moss), *Pleurozium schreberi* (Schreber's big red stem moss), *Ptilium crista-castrensis* (knights plume moss), *Rhytidiadelphus triquetrus* (rough gooseneck moss), *Sphagnum capillifolium* (sphagnum), *Sphagnum girgensohnii* (Girgensohn's sphagnum), and *Sphagnum magellanicum* (Magellan's sphagnum). Moss cover may be thin where the canopy is very dense. Diagnostic species include *Thuja occidentalis* (northern white-cedar) as a dominant/codominant species, with a combination of acidic and minerotrophic understory species, such as *Alnus incana* (gray alder) and *Cornus sericea* (red-osier dogwood).

ENVIRONMENTAL DESCRIPTION

Saint Croix National Scenic Riverway Environment: This association was found in the northern half of the park on wet soils. Sites had little to no slope.
Global Environment: This community is found on level to gently sloping ground with wet, organic (Sims et al. 1989) or mineral soil (MNNHP 1993). It is typically along the margins of peatlands, in drainage courses, or shallow depressions. Schwintzer and Tomberlin (1982) reported detailed results on the chemical characteristics of the groundwater of several wetland types in Lower Michigan. They found that it was difficult to differentiate swamps dominated by conifers from those dominated by other vegetation on the basis of groundwater. The swamps were moderately to strongly minerotrophic and had circumneutral pH.

VEGETATION DESCRIPTION

Saint Croix National Scenic Riverway Vegetation: This forest association usually has a dense canopy, though some rare examples may be quite open. The canopy is dominated by coniferous trees tolerant of wet-mesic to wet conditions. *Thuja occidentalis* (northern white-cedar) is usually the most common and is accompanied by *Abies balsamea* (balsam fir), *Betula papyrifera* (paper birch), *Picea glauca* (white spruce), and *Picea mariana* (black spruce). The subcanopy and shrub strata are composed of the same species along with *Alnus incana* (gray alder). A dwarf-shrub stratum may be absent to moderately dense and, where present, is dominated by *Ledum groenlandicum* (bog Labrador tea) and *Vaccinium angustifolium* (lowbush blueberry). The herbaceous layer may be composed of species typical of mesic forests such as *Cornus canadensis* (bunchberry dogwood), *Aralia nudicaulis* (wild sarsaparilla), *Eurybia macrophylla* (bigleaf aster), and *Athyrium filix-femina* (common ladyfern) and/or wet forests such as *Osmunda cinnamomea* (cinnamon fern), *Carex stricta* (upright sedge), *Carex aquatilis* (water sedge), and *Calamagrostis canadensis* (bluejoint). A sparse to dense layer of Sphagnum moss may be present.
Global Vegetation: The canopy is often moderately dense to dense (MNNHP 1993). Basal areas of 42.2-62.2 m2/ha and densities of 2457-7565 stems/ha have been reported in four stands in Lower Michigan, using a tree definition of woody stems greater than 2.5 cm dbh (Schwintzer 1981). The understory structure consists of high hummocks and deep, water-filled hollows, with fallen, moss-covered logs common. *Thuja occidentalis* (northern white-cedar) is moderately to strongly dominant in the canopy, or *Picea mariana* (black spruce) may overtop the subdominant *Thuja occidentalis* (northern white-cedar). Other species include *Abies balsamea* (balsam fir), *Acer rubrum* (red maple), *Betula papyrifera* (paper birch), *Fraxinus nigra* (black ash), *Larix laricina* (tamarack) and, more rarely, *Picea glauca* (white spruce) (in northern Minnesota and northwestern Ontario), or *Tsuga canadensis* (eastern hemlock). The shrub

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layer in this community is sparse to dense, in inverse proportion to the tree canopy. Species present in this stratum include *Alnus incana* (gray alder), *Chamaedaphne calyculata* (leatherleaf), *Cornus canadensis* (bunchberry dogwood), *Cornus sericea* (red-osier dogwood), *Gaultheria hispidula* (creeping snowberry), *Ledum groenlandicum* (bog Labrador-tea), *Linnaea borealis* (twinflower), *Rosa acicularis* (prickly rose), *Rubus pubescens* (dwarf red blackberry), and *Vaccinium myrtilloides* (velvetleaf huckleberry). *Nemopanthus mucronatus* (catberry) and *Viburnum nudum* var. *cassinoides* (withe-rod) are more common eastward. The most common herbaceous species are *Carex* (sedge) spp. (including *Carex disperma)*, *Coptis trifolia* (threeleaf goldthread), *Clintonia borealis* (bluebead), *Dryopteris carthusiana* (spinulose woodfern), *Galium triflorum* (fragrant bedstraw), *Maianthemum canadense* (Canada mayflower), *Mitella nuda* (naked miterwort), *Trientalis borealis* (starflower), and *Viola renifolia* (white violet). Mosses include *Hylocomium splendens* (splendid feather moss), *Pleurozium schreberi* (Schreber's big red stem moss), *Ptilium crista-castrensis* (knights plume moss), *Rhytidiadelphus triquetrus* (rough gooseneck moss), *Sphagnum capillifolium* (sphagnum), *Sphagnum girgensohnii* (Girgensohn's sphagnum), and *Sphagnum magellanicum* (Magellan's sphagnum). Moss cover may be thin where the canopy is very dense. Diagnostic species include *Thuja occidentalis* (northern white-cedar) as a dominant/codominant species, with a combination of acidic and more minerotrophic understory species, such as *Alnus incana* (gray alder) and *Cornus sericea* (red-osier dogwood) (Sims et al. 1989, Harris et al. 1996, Chambers et al. 1997).

MOST ABUNDANT SPECIES

Saint Croix National Scenic Riverway

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Thuja occidentalis* (northern white-cedar), *Abies balsamea* (balsam fir), *Picea mariana* (black spruce)
Tall shrub/sapling	Broad-leaved deciduous shrub	*Alnus incana* (gray alder)
Short shrub/sapling	Dwarf-shrub	*Ledum groenlandicum* (bog Labrador tea), *Vaccinium angustifolium* (lowbush blueberry)
Herb (field)	Forb	*Cornus canadensis* (bunchberry dogwood), *Aralia nudicaulis* (wild sarsaparilla), *Eurybia macrophylla* (bigleaf aster)
Herb (field)	Graminoid	*Carex stricta* (upright sedge), *Carex aquatilis* (water sedge), and *Calamagrostis canadensis* (bluejoint)
Herb (field)	Fern or fern ally	*Athyrium filix-femina* (common ladyfern). *Osmunda cinnamomea* (cinnamon fern)
Nonvascular	Moss	*Sphagnum* spp. (Sphagnum moss)

CONSERVATION STATUS RANK

Global Rank & Reasons: G4 (3-Oct-1996). This rank may need to be higher. In Wisconsin, for example, there is very poor regeneration of cedar in many stands. There was also widespread strip cutting on federal lands several decades ago, but little cedar reproduction has occurred. Currently, there is a moratorium on cutting on federal and state lands, but cutting continues on private lands (E. Epstein pers. comm. 1999). Deer browse is also a major factor affecting regeneration (Van Deelen 1999).

CLASSIFICATION

Status: Standard

Classification Confidence: 2 - Moderate

Global Comments: The white-cedar seepage type, *Thuja occidentalis - (Larix laricina)* Seepage Forest (CEGL002455) could be lumped with this type, but this type may represent more northern stands. This type may need to be separated into a slightly poorer *Thuja - Larix - Picea* type, *Thuja occidentalis - Larix laricina / Sphagnum* spp. Forest (CEGL005225), and a richer *Thuja* (red cedar) type (see Harris et al. 1996, W31, W32).

Global Similar Associations:

- *Thuja occidentalis - (Larix laricina)* Seepage Forest (CEGL002455)
- *Thuja occidentalis - Abies balsamea / Ledum groenlandicum / Carex trisperma* Woodland (CEGL006507)
- *Thuja occidentalis - Fraxinus nigra* Forest (CEGL005165)
- *Thuja occidentalis - Larix laricina / Sphagnum* spp. Forest (CEGL005225)
- *Thuja occidentalis / Abies balsamea - Acer spicatum* Forest (CEGL002449)
- *Thuja occidentalis / Sphagnum (girgensohnii, warnstorfii)* Forest (CEGL006007) This type is found in the northeastern United States.
- *Tsuga canadensis - Betula alleghaniensis* Saturated Forest (CEGL005003)

Global Related Concepts:

- Cedar (inc. Mixedwood) / Speckled Alder / Sphagnum Forest (Sims et al. 1989) =
- Conifer Swamp (Schwintzer 1981) =
- Rich Conifer Swamp (cedar) (Chapman et al. 1989) >
- Rich conifer swamp: cedar-(tamarack) (W32) (Harris et al. 1996) ><
- Segments 7 and 8 of northern swamps (Clausen 1957) =
- White Cedar Swamp (MNNHP 1993) >
- White Cedar Swamp Cedar-Mixed Conifer Subtype (Faber-Langendoen 2001) =
- White Cedar-Goldthread-Sphagnum (V38) (Chambers et al. 1997) =

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ELEMENT DISTRIBUTION

Global Range: This sub-boreal white-cedar - mixed conifer swamp forest is found in the northern Great Lakes region on level to gently sloping ground with wet, organic or mineral soil.
Nations: CA, US
States/Provinces: MB:S2, MI, MN, ON, WI:S3S4
TNC Ecoregions: 35:C, 46:C, 47:C, 48:C
USFS Ecoregions (1994/95): 212Ha:CCC, 212Hb:CCC, 212Hd:CCC, 212He:CCC, 212Hh:CCC, 212Hi:CCC, 212Hj:CCC, 212Hk:CCP, 212Hl:CCC, 212Hm:CCC, 212Hn:CCP, 212Ho:CCP, 212Hp:CCC, 212Hq:CCC, 212Hr:CCP, 212Hs:CCC, 212Ht:CCC, 212Hv:CCC, 212Hw:CCC, 212Hy:CCC, 212Ia:CCC, 212Ib:CCC, 212Ja:CCC, 212Jb:CCP, 212Jc:CCC, 212Je:CCP, 212Jf:CCC, 212Jj:CCC, 212Jk:CCC, 212Jl:CCC, 212Jm:CCC, 212Jn:CCP, 212Jo:CCP, 212Jr:CCP, 212Ka:CCC, 212La:CCC, 212Lb:CCP, 212Lc:CCC, 212Mb:CCC, 212Na:CCC, 212Nb:CCC, 212Nc:CCC, 212Nd:CCC, 212Oa:CCC, 212Pa:CCC, 222Jc:CCC, 222Ke:CCC, 222Mc:CCC, 222Na:CCC
Federal Lands: NPS (Apostle Islands, Isle Royale, Pictured Rocks, Saint Croix, Sleeping Bear Dunes, Voyageurs); USFS (Chequamegon, Chequamegon-Nicolet, Chippewa, Hiawatha, Huron, Huron-Manistee, Nicolet, Ottawa, Superior)

ELEMENT SOURCES

Saint Croix National Scenic Riverway Map Code: FCS
Local Description Authors: J. Drake
Global Description Authors: J. Drake
References: Chambers et al. 1997, Chapman et al. 1989, Clausen 1957, Faber-Langendoen 2001, Greenall 1996, Harris et al. 1996, Hop et al. 2010a, Hop et al. 2010c, MNNHP 1993, Midwestern Ecology Working Group n.d., Schwintzer 1981, Schwintzer and Tomberlin 1982, Sims et al. 1989, TNC 1999b, Van Deelen 1999, WNHIP unpubl. data, Wanek and Newman 1976

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2. SHRUBLAND & GRASSLAND

2.C.1. Temperate Grassland, Meadow, and Shrubland

2.C.1.Nb. Great Plains Grassland & Shrubland

M054. Great Plains Tallgrass Prairie, Savanna & Shrubland

G333. Central Great Plains Tallgrass Prairie

Midwest Dry-Mesic Prairie
***Schizachyrium scoparium - Sorghastrum nutans - Bouteloua curtipendula* Herbaceous Vegetation**
Little Bluestem - Yellow Indiangrass - Sideoats Grama Herbaceous Vegetation
Identifier: CEGL002214

NVC CLASSIFICATION

Division	Great Plains Grassland & Shrubland (2.C.1.Nb)
Macrogroup	Great Plains Tallgrass Prairie, Savanna & Shrubland (M054)
Group	Central Great Plains Tallgrass Prairie (G333)
Association (Common name)	Midwest Dry-Mesic Prairie

ELEMENT CONCEPT

Global Summary: This dry-mesic prairie community type is found in the central midwestern United States. Stands occur on upper slopes and hillcrests with moderate to steep slopes. Rarely, it can be found on level plains, especially in the southern parts of its range. The aspect is most often southern or western, but others are possible. Soils are shallow (40-100 cm), well-drained to excessively well-drained, and clay loam, sandy loam, or loamy sand. The sites typically occur over loess, glacial outwash, or glacial till. The dominant vegetation of this community is mid and tall grasses, 1-2 m tall. Total plant cover is moderate to dense. The most abundant species are *Schizachyrium scoparium* (little bluestem), *Sorghastrum nutans* (Indiangrass), and *Hesperostipa spartea* (porcupinegrass). Other common herbaceous species include *Andropogon gerardii* (big bluestem), *Bouteloua curtipendula* (sideoats grama), *Echinacea pallida* (pale purple coneflower), *Potentilla arguta* (tall cinquefoil), and *Sporobolus heterolepis* (prairie dropseed). *Amorpha canescens* (leadplant) is a common subshrub species. Woody species occur but are not common in high-quality examples of this community.

ENVIRONMENTAL DESCRIPTION

Saint Croix National Scenic Riverway Environment: This dry-mesic prairie community was sampled at eight locations in the park. Sites are generally flat to gently sloping with an easterly aspect, although one site is located on a somewhat steep, east-facing hill slope. The soil at one site is silt loam. The unvegetated surface of one of the plots is dominated by leaf litter (88% cover) while that of another is exposed bedrock (90%), along with some small rocks (0-1%), bare soil (8-13%) and dead plant stems (2-4%). Evidence of disturbance includes lack of fire at one site that is leading to shrub encroachment and the presence of many exotic plants.
Global Environment: This community is found on upper slopes and hillcrests with moderate to steep slopes. Rarely, it can be found on level plains, especially in the southern parts of its range (Nelson 1985). The aspect is most often southern or western, but others are possible (Curtis 1959, Chapman 1984). Soils are 40-100 cm deep (Nelson 1985), well-drained to excessively well-drained, and clay loam, sandy loam, or loamy sand (MNNHP 1993). The sites typically occur over loess, glacial outwash, or glacial till.

VEGETATION DESCRIPTION

Saint Croix National Scenic Riverway Vegetation: This herbaceous community is dominated by grasses *Andropogon gerardii* (big bluestem) and *Schizachyrium scoparium* (little bluestem) (50-60% cover); additional graminoids include *Bromus kalmii* (arctic brome), *Carex siccata* (dryspike sedge), *Danthonia spicata* (poverty oatgrass), *Hesperostipa spartea* (porcupinegrass), *Poa pratensis* (Kentucky bluegrass) (exotic), and *Sorghastrum nutans* (Indiangrass). Forbs include *Asclepias tuberosa* (butterfly milkweed), *Comptonia peregrina* (sweet fern), *Helianthus pauciflorus* ssp. *pauciflorus* (stiff sunflower), *Solidago canadensis* (Canada goldenrod), and *Symphyotrichum oolentangiense* (skyblue aster). A scattering of shrubs may also occur, including *Rhus glabra* (smooth sumac), *Amelanchier* (serviceberry) sp., and *Rubus* (blackberry) sp. In addition, this community may support Minnesota state-critically imperiled and Wisconsin state-vulnerable *Talinum rugospermum* (prairie fameflower), MN and WI state-vulnerable *Cirsium hillii* (Hill's thistle), and Wisconsin state-vulnerable *Opuntia fragilis* (brittle pricklypear).
Global Vegetation: The dominant vegetation of this community is mid and tall grasses, 1-2 m tall. Total plant cover is moderate to dense. The most abundant species are *Schizachyrium scoparium* (little bluestem), *Sorghastrum nutans* (Indiangrass), and *Hesperostipa spartea* (porcupinegrass). Other common herbaceous species include *Andropogon gerardii* (big bluestem), *Bouteloua curtipendula* (sideoats grama), *Echinacea pallida* (pale purple coneflower), *Potentilla arguta* (tall cinquefoil), and *Sporobolus heterolepis* (prairie dropseed). *Amorpha canescens* (leadplant) is a common subshrubby species. Woody species occur but are not common in high-quality examples of this community (Curtis 1959, Nelson 1985, MNNHP 1993).

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MOST ABUNDANT SPECIES

Saint Croix National Scenic Riverway

Stratum	Lifeform	Species
Herb (field)	Graminoid	*Andropogon gerardii* (big bluestem), *Danthonia spicata* (poverty oatgrass), *Hesperostipa spartea* (porcupinegrass), *Schizachyrium scoparium* (little bluestem), *Sorghastrum nutans* (Indiangrass)

CHARACTERISTIC SPECIES

Saint Croix National Scenic Riverway: *Andropogon gerardii* (big bluestem), *Danthonia spicata* (poverty oatgrass), *Hesperostipa spartea* (porcupinegrass), *Schizachyrium scoparium* (little bluestem), *Sorghastrum nutans* (Indiangrass)

OTHER NOTEWORTHY SPECIES

Saint Croix National Scenic Riverway: Vulnerable: *Cirsium hillii* (Hill's thistle, MN & WI state-vulnerable, G3), *Opuntia fragilis* (brittle pricklypear, WI state-vulnerable, G4G5), *Talinum rugospermum* (prairie fameflower, MN state-critically imperiled & WI state-vulnerable, G3G4); **Exotic/Invasive**: *Crepis tectorum* (narrowleaf hawksbeard, invasive/exotic), *Lonicera tatarica* (Tatarian honeysuckle, invasive/exotic, High/Medium), *Poa compressa* (Canada bluegrass, invasive/exotic, High/Low), *Poa pratensis* (Kentucky bluegrass, invasive/exotic, Medium), *Polygonum convolvulus* (black bindweed, invasive/exotic), *Rhamnus cathartica* (common buckthorn, invasive/exotic, High/Medium), *Rumex acetosella* (common sheep sorrel, invasive/exotic, Medium/Low), *Taraxacum officinale* (common dandelion, invasive/exotic), *Tragopogon dubius* (yellow salsify, invasive/exotic, Medium/Low), *Ulmus pumila* (Siberian elm, invasive/exotic, Medium), *Verbascum thapsus* (common mullein, invasive/exotic, Medium)
Global: Vulnerable: *Cirsium hillii* (Hill's thistle, G3)

CONSERVATION STATUS RANK

Global Rank & Reasons: G2G3 (6-Feb-2007). This community has a fairly broad and matrix-scale distribution in the Midwest, but current high-quality sites tend to be small patches restricted to upper slopes and hillcrests. This community has probably been substantially reduced by conversion to agriculture, or degraded by grazing and fire suppression.

CLASSIFICATION

Status: Standard
Classification Confidence: 2 - Moderate
Global Comments: This type is currently reported from subsections 251Bd and 251Be (and subsections east), but these two subsections could also go with *Schizachyrium scoparium - Bouteloua curtipendula - Hesperostipa spartea - (Pascopyrum smithii)* Herbaceous Vegetation (CEGL002377), which occurs primarily in 251A. In Ohio, this type is probably extirpated, except perhaps Buffalo Beats (on clay dome). However, those stands are far east of much of the range of this type, and they should be compared to other eastern prairie openings. Type may closely resemble *Schizachyrium scoparium - Bouteloua curtipendula* Gravel Herbaceous Vegetation (CEGL002215).
Global Similar Associations:
- *Quercus macrocarpa - (Quercus alba, Quercus velutina) / Andropogon gerardii* Wooded Herbaceous Vegetation (CEGL002020)
- *Schizachyrium scoparium - Bouteloua curtipendula - Hesperostipa spartea - (Pascopyrum smithii)* Herbaceous Vegetation (CEGL002377)
- *Schizachyrium scoparium - Bouteloua curtipendula* Gravel Herbaceous Vegetation (CEGL002215)
- *Schizachyrium scoparium - Sorghastrum nutans - Bouteloua curtipendula* Hill Herbaceous Vegetation (CEGL005183)

Global Related Concepts:
- Dry Prairie (Central Section) Hill Subtype (MNNHP 1993) <
- Dry Prairie (Southeast Section Hill Subtype (MNNHP 1993) <
- Dry-Mesic Prairie (Nelson 1985) >
- Dry-Mesic Prairie (Faber-Langendoen 2001) =
- Dry-mesic Prairie (Curtis 1959) =
- Hillside Prairie (Chapman et al. 1989) =
- Hilltop Prairie (Chapman 1984) =

ELEMENT DISTRIBUTION

Global Range: This dry-mesic prairie community type is found in the central midwestern United States, ranging from outliers in Ohio west to east-central Minnesota, south to Missouri and possibly Oklahoma, and east to Indiana.
Nations: US
States/Provinces: AR, IA:S2, IL, IN, MI:S1, MN, MO, OH, OK, WI:S2
TNC Ecoregions: 35:C, 36:C, 38:C, 39:C, 44:C, 45:C, 46:C, 47:C, 48:C, 49:C
USFS Ecoregions (1994/95): 221Ea:CCC, 221Ed:CCP, 221Eg:CCC, 221Fa:CCC, 222Ai:CCC, 222Ga:CCC, 222Gb:CCC, 222Ge:CCC, 222Ha:CCC, 222Hb:CCC, 222Hf:CCC, 222If:CCC, 222Ja:CCP, 222Jh:CCC, 222Ji:CCC, 222Jj:CCC, 222Ka:CCC, 222Ke:CCC, 222Kf:CCC, 222Kg:CCC, 222Kh:CCC, 222Kj:CCC, 222Lc:CCC, 222Le:CCC, 222Lf:CCC, 222Ma:CCC, 222Mb:CCC, 222Mc:CCC, 222Me:CCC, 251Aa:CCC, 251Ba:CCC, 251Bb:CCC, 251Bd:CCC, 251Be:CCC, 251Ca:CCC, 251Cc:CCC, 251Cf:CCC, 251Ch:CCC, 251Cj:CCC, 251Ck:CCC, 251Db:CCC, 251Dc:CCC, 251Dd:CCC, 251Dg:CCC, 251Dh:CCC
Federal Lands: NPS (Chickasaw NRA, Indiana Dunes, Saint Croix)

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ELEMENT SOURCES

Saint Croix National Scenic Riverway Map Code: HMP

Saint Croix National Scenic Riverway Plots: SACN.129, SACN.292, SACN.0204, SACN.3516, SACN.3539, SACN.4739, SACN.4740, SACN.5358.

Local Description Authors: M.J. Russo

Global Description Authors: J. Drake

References: Baalman 1965, Chapman 1984, Chapman et al. 1989, Curtis 1959, Ewing et al. 1984, Faber-Langendoen 2001, Gardner 1958, Gardner et al. 1957, Hoagland 2000, Hop et al. 2009, INAI unpubl. data, Kelting 1951, Kelting 1954, Kelting 1957, MNNHP 1993, Midwestern Ecology Working Group n.d., Murray 1974a, Nelson 1985, Netherland 1979, Penfound 1964, WNHIP unpubl. data, Zanoni et al. 1979

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G151. Sand & Gravel Tallgrass Prairie

Little Bluestem Bedrock Bluff Prairie

***Schizachyrium scoparium - Bouteloua curtipendula* Bedrock Bluff Herbaceous Vegetation**
Little Bluestem - Sideoats Grama Bedrock Bluff Herbaceous Vegetation
Identifier: CEGL002245

NVC CLASSIFICATION

Division	Great Plains Grassland & Shrubland (2.C.1.Nb)
Macrogroup	Great Plains Tallgrass Prairie, Savanna & Shrubland (M054)
Group	Sand & Gravel Tallgrass Prairie (G151)
Association (Common name)	Little Bluestem Bedrock Bluff Prairie

ELEMENT CONCEPT

Global Summary: This little bluestem bluff prairie community occurs primarily in the Driftless Area of the upper midwestern United States. Stands occur on very thin soils on limestone ridges and steep hillsides, usually with a southwestern aspect. These dry prairie soils occupy the highest position on the moisture catena and may be less than 10 cm deep over extensive areas. The vegetation is dominated by grasses or, locally, low shrubs. Grasses are less than 1 m tall. *Schizachyrium scoparium* (little bluestem), *Bouteloua curtipendula* (sideoats grama), *Sporobolus heterolepis* (prairie dropseed), and *Andropogon gerardii* (big bluestem) are abundant grasses across this community's range. Forbs that are common include *Amorpha canescens* (leadplant), *Symphyotrichum sericeum* (western silver aster), *Dalea purpurea* var. *purpurea* (purple prairie clover), *Dichanthelium linearifolium* (slimleaf panicgrass), *Euphorbia corollata* (flowering spurge), and *Solidago nemoralis* (gray goldenrod). Species that do best toward the east include *Minuartia michauxii* var. *michauxii* (Michaux's stitchwort), *Asclepias verticillata* (whorled milkweed), and *Geum triflorum* (old man's whiskers), while those that do best along the Mississippi River include *Symphyotrichum oblongifolium* (aromatic aster), *Bouteloua hirsuta* (hairy grama), and *Scutellaria parvula* var. *missouriensis* (Leonard's skullcap). In addition, *Muhlenbergia cuspidata* (plains muhly) and *Pediomelum esculentum* (large Indian breadroot) are restricted to the Driftless Area. This community is structurally very stable and not very dependent on fire. Moisture conditions on these sites are so severe that trees and most woody species cannot grow.

ENVIRONMENTAL DESCRIPTION

Saint Croix National Scenic Riverway Environment: This little bluestem bluff prairie community was sampled at nine locations in the park. Sites range from gentle to steep slopes with mostly southerly aspects, although other aspects are possible. The soil at one site is well-drained loam, and the unvegetated surface is dominated by leaf litter (96% cover) with some bare soil (2%) and dead plant stems (2%). Evidence of disturbance includes the presence of many exotic plants.
Global Environment: This community occurs on very thin soils on limestone ridges and steep hillsides, usually with a southwest aspect. The low water storage capacity of the soil, the strong insolation of southwest slopes, and exposure to high winds make these sites prone to high desiccation. It is likely that these prairies receive significant quantities of water from condensation rather than precipitation. The organic content of the soil acts as a sponge to hold the condensate.

These dry prairie soils occupy the highest position on the moisture catena. The runoff of rainwater is very rapid on the slopes. There is continual movement of soil particles so the soil remains very thin except where dissolution pockets occur in the underlying limestone. The soil may be less than 10 cm deep over extensive areas. Both water retention and nutrient content in the actual soils are very good, but the thinness of the layers means that the total available quantity of either is quite limited. There is great uniformity from prairie to prairie in many of the soil chemical properties. The average pH is 7.8. The soil groups are Brunizem and Melanized Rendzina (Curtis 1959, MNNHP 1993).

VEGETATION DESCRIPTION

Saint Croix National Scenic Riverway Vegetation: The herbaceous layer with up to 80% cover dominates this community. However, there may also be a scattering (5-15%) of trees and shrubs, including *Amorpha canescens* (leadplant), *Juniperus virginiana* (eastern red-cedar), and *Quercus macrocarpa* (bur oak). Dominants in the herb layer include graminoids *Andropogon gerardii* (big bluestem), *Bouteloua curtipendula* (sideoats grama), *Bouteloua hirsuta* (hairy grama), *Hesperostipa spartea* (porcupinegrass), *Poa pratensis* (Kentucky bluegrass) (exotic), *Schizachyrium scoparium* (little bluestem), *Sorghastrum nutans* (Indiangrass), and *Sporobolus heterolepis* (prairie dropseed). Common and/or dominant forbs include *Antennaria plantaginifolia* (woman's tobacco), *Campanula rotundifolia* (bluebell bellflower), *Comandra umbellata* (bastard toadflax), *Dalea purpurea* (purple prairie clover), *Erigeron strigosus* (prairie fleabane), *Packera plattensis* (prairie groundsel), *Solidago canadensis* (Canada goldenrod), and *Symphyotrichum sericeum* (western silver aster). A total of 16 exotic species were reported from nine sampled plots. In addition, this community supports Wisconsin state-critically imperiled and Minnesota state-vulnerable *Minuartia dawsonensis* (rock stitchwort), Wisconsin state-critically imperiled *Pediomelum argophyllum* (silverleaf Indian breadroot), state-imperiled *Astragalus crassicarpus* (groundplum milkvetch) and *Calylophus serrulatus* (yellow sundrops), and state-vulnerable *Packera plattensis* (prairie groundsel) and *Pediomelum esculentum* (large Indian breadroot).
Global Vegetation: The vegetation is dominated by grasses or, locally, low shrubs. Trees may be present, but tree canopy cover is less than 10%. Grasses are less than 1 m tall. *Schizachyrium scoparium* (little bluestem), *Bouteloua curtipendula* (sideoats grama), *Sporobolus heterolepis* (prairie dropseed), and *Andropogon gerardii* (big bluestem) are abundant grasses across this community's

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range. Forbs that are common include *Amorpha canescens* (leadplant), *Symphyotrichum sericeum* (western silver aster), *Dalea purpurea* var. *purpurea* (purple prairie clover), *Dichanthelium linearifolium* (slimleaf panicgrass), *Euphorbia corollata* (flowering spurge), and *Solidago nemoralis* (gray goldenrod) (Curtis 1959, MNNHP 1993). There is a high degree of uniformity among different stands of this community in Wisconsin. The greatest differences are between those prairies on the Mississippi River and those in Dane County and other more eastern locations (Umbanhowar 1992). Although noticeable, these differences are minor and reflect slight changes in importance along an east-west gradient. Species that do best toward the east include *Minuartia michauxii* var. *michauxii* (Michaux's stitchwort), *Asclepias verticillata* (whorled milkweed), and *Geum triflorum* (old man's whiskers), while those that do best along the Mississippi River include *Symphyotrichum oblongifolium* (aromatic aster), *Bouteloua hirsuta* (hairy grama), and *Scutellaria parvula* var. *missouriensis* (Leonard's skullcap). In addition, *Muhlenbergia cuspidata* (plains muhly) and *Pediomelum esculentum* (large Indian breadroot) are restricted to the Driftless Area.

MOST ABUNDANT SPECIES

Saint Croix National Scenic Riverway

Stratum	Lifeform	Species
Herb (field)	Forb	*Erigeron strigosus* (prairie fleabane), *Symphyotrichum sericeum* (western silver aster)
Herb (field)	Graminoid	*Andropogon gerardii* (big bluestem), *Bouteloua curtipendula* (sideoats grama), *Schizachyrium scoparium* (little bluestem), *Sporobolus heterolepis* (prairie dropseed)

Global

Stratum	Lifeform	Species
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Amorpha canescens* (leadplant)
Herb (field)	Semi-shrub	*Dalea purpurea var. purpurea* (purple prairie clover)
Herb (field)	Forb	*Euphorbia corollata* (flowering spurge), *Solidago nemoralis* (gray goldenrod), *Symphyotrichum sericeum* (western silver aster)
Herb (field)	Graminoid	*Andropogon gerardii* (big bluestem), *Bouteloua curtipendula* (sideoats grama), *Dichanthelium linearifolium* (slimleaf panicgrass), *Schizachyrium scoparium* (little bluestem), *Sporobolus heterolepis* (prairie dropseed)

CHARACTERISTIC SPECIES

Saint Croix National Scenic Riverway: *Andropogon gerardii* (big bluestem), *Bouteloua curtipendula* (sideoats grama), *Erigeron strigosus* (prairie fleabane), *Schizachyrium scoparium* (little bluestem), *Sporobolus heterolepis* (prairie dropseed), *Symphyotrichum sericeum* (western silver aster)

Global: *Bouteloua curtipendula* (sideoats grama), *Dalea purpurea* (purple prairie clover), *Dichanthelium linearifolium* (slimleaf panicgrass), *Euphorbia corollata* (flowering spurge), *Schizachyrium scoparium* (little bluestem), *Solidago nemoralis* (gray goldenrod), *Sporobolus heterolepis* (prairie dropseed), *Symphyotrichum sericeum* (western silver aster)

OTHER NOTEWORTHY SPECIES

Saint Croix National Scenic Riverway: Vulnerable: *Astragalus crassicarpus* (groundplum milkvetch, WI state-imperiled, G5), *Calylophus serrulatus* (yellow sundrops, WI state-imperiled, G5), *Minuartia dawsonensis* (rock stitchwort, WI state-critically imperiled & MN state-vulnerable, G5), *Packera plattensis* (prairie groundsel, WI state-vulnerable, G5), *Pediomelum argophyllum* (silverleaf Indian breadroot, WI state-critically imperiled, G5), *Pediomelum esculentum* (large Indian breadroot, WI state-vulnerable, G5); **Exotic/Invasive**: *Asparagus officinalis* (garden asparagus, invasive/exotic, Medium/Insignificant), *Bromus inermis* (smooth brome, invasive/exotic, High/Medium), *Carduus nutans* (nodding plumeless thistle, invasive/exotic, High/Low), *Glechoma hederacea* (ground ivy, invasive/exotic, Low), *Hypericum perforatum* (common St. Johnswort, invasive/exotic, High/Medium), *Nepeta cataria* (catnip, invasive/exotic), *Pennisetum glaucum* (pearl millet, invasive/exotic), *Phleum pratense* (timothy, invasive/exotic, Medium), *Poa compressa* (Canada bluegrass, invasive/exotic, High/Low), *Poa pratensis* (Kentucky bluegrass, invasive/exotic, Medium), *Potentilla recta* (sulphur cinquefoil, invasive/exotic, High/Medium), *Rhamnus cathartica* (common buckthorn, invasive/exotic, High/Medium), *Taraxacum officinale* (common dandelion, invasive/exotic), *Tragopogon dubius* (yellow salsify, invasive/exotic, Medium/Low), *Trifolium pratense* (red clover, invasive/exotic, Low/Insignificant), *Verbascum thapsus* (common mullein, invasive/exotic, Medium)

CONSERVATION STATUS RANK

Global Rank & Reasons: G3G4 (23-Mar-2000). There have been 341 occurrences documented: 239 in Minnesota (where the community is ranked S3), 57 in Iowa (S2?), 43 in Wisconsin (S3), and 2 in Illinois (S1,S1). The community occurs in 12 ecoregional subsections. There are probably fewer than 10,000 acres rangewide. Sizes of 334 occurrences total 2690 acres. This community is found on very thin soils on limestone ridges and steep hillsides, usually with a southwestern aspect. Lack of fire permits invasion by more woody vegetation.

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CLASSIFICATION

Status: Standard
Classification Confidence: 2 - Moderate
Global Similar Associations:
- *Schizachyrium scoparium - Bouteloua curtipendula - Muhlenbergia cuspidata - Symphyotrichum sericeum* Alkaline Herbaceous Vegetation (CEGL002403)
- *Schizachyrium scoparium - Sorghastrum nutans - Clinopodium arkansanum* Alkaline Herbaceous Vegetation (CEGL005179)
- *Schizachyrium scoparium - Sorghastrum nutans - Tradescantia bracteata* Alkaline Bedrock Herbaceous Vegetation (CEGL005280)

Global Related Concepts:
- Dry Prairie (Southeast Section) Bedrock Bluff Subtype (MNNHP 1993) =
- Dry Prairie Bedrock Bluff Subtype (Faber-Langendoen 2001) =

ELEMENT DISTRIBUTION

Global Range: This little bluestem bluff prairie community occurs primarily in the Driftless Area of the upper midwestern United States, particularly in southern Wisconsin, northern Illinois, northeastern Iowa, and southeastern Minnesota. Range extent probably approaches 150,000 square km.
Nations: US
States/Provinces: IA:S2?, IL:S1, MN:S3, WI:S3
TNC Ecoregions: 36:C, 46:C, 47:C
USFS Ecoregions (1994/95): 222Ka:CCC, 222Ke:CCC, 222Kh:CCC, 222Lb:CCC, 222Lc:CCC, 222Ld:CCC, 222Le:CCC, 222Lf:CCC, 222Md:CCC, 222Me:CCC, 251Ch:CCC, 251Da:CCC
Federal Lands: NPS (Saint Croix)

ELEMENT SOURCES

Saint Croix National Scenic Riverway Map Code: Not mapped separately.
Saint Croix National Scenic Riverway Plots: SACN.281, SACN.0085, SACN.0171, SACN.0327, SACN.0660, SACN.0661, SACN.0664, SACN.5361, SACN.8384.
Local Description Authors: M.J. Russo
Global Description Authors: J. Drake, D. Faber-Langendoen, and D. M. Ambrose
References: Curtis 1959, Faber-Langendoen 2001, INAI unpubl. data, MNNHP 1993, Midwestern Ecology Working Group n.d., Umbanhowar 1992, WNHIP unpubl. data, White and Madany 1978

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Midwest Dry Sand Prairie

***Schizachyrium scoparium - Danthonia spicata - Carex pensylvanica - (Viola pedata)* Herbaceous Vegetation**
Little Bluestem - Poverty Oatgrass - Pennsylvania Sedge - (Bird's-foot Violet) Herbaceous Vegetation
Identifier: CEGL002318

NVC CLASSIFICATION

Division	Great Plains Grassland & Shrubland (2.C.1.Nb)
Macrogroup	Great Plains Tallgrass Prairie, Savanna & Shrubland (M054)
Group	Sand & Gravel Tallgrass Prairie (G151)
Association (Common name)	Midwest Dry Sand Prairie

ELEMENT CONCEPT

Global Summary: This dry sand prairie community is widespread throughout the midwestern region of the United States and adjacent Canada. Stands occur on steep slopes, sandy outwash, sandy lake plains, and alluvial deposits. They may occur on sand ridges (including inland dunes and sandy areas of coarse-textured end moraines), where, particularly if blowouts have occurred, they may resemble sand barrens. Soils are well-drained to excessively drained, coarse-textured sands, loamy sands, and sandy loams. Gravels are very minor. Graminoids dominate the herbaceous layer, which can be open to closed. Dominant species include *Carex pensylvanica* (Pennsylvania sedge), *Danthonia spicata* (poverty oatgrass), *Koeleria macrantha* (prairie Junegrass), *Schizachyrium scoparium* (little bluestem), and *Hesperostipa spartea* (porcupinegrass). Other graminoids include *Bouteloua hirsuta* (hairy grama), *Digitaria cognata* (fall witchgrass) and *Dichanthelium acuminatum* var. *fasciculatum* (western panicgrass). In more open dune-like habitats *Calamovilfa longifolia* (prairie sandreed) may be present. A wide variety of forbs are present including *Asclepias verticillata* (whorled milkweed), *Ambrosia psilostachya* (Cuman ragweed), *Artemisia frigida* (prairie sagewort), *Pseudognaphalium obtusifolium* (rabbit-tobacco), *Euphorbia corollata* (flowering spurge), *Hieracium longipilum* (hairy hawkweed), *Lechea tenuifolia* (narrowleaf pinweed), *Liatris aspera* (tall blazing star), *Liatris cylindracea* (Ontario blazing star), *Nuttallanthus canadensis* (Canada toadflax), *Lithospermum canescens* (hoary puccoon), *Lupinus perennis* (sundial lupine), *Oenothera rhombipetala* (fourpoint evening-primrose), *Polygala polygama* (racemed milkwort), *Packera plattensis* (prairie groundsel), *Solidago nemoralis* (gray goldenrod), *Tephrosia virginiana* (Virginia tephrosia) and *Viola pedata* (birdfoot violet). *Hudsonia tomentosa* (woolly beach-heather), and other sand barrens species, are more often restricted to local disturbances such as blowouts or slipfaces.

ENVIRONMENTAL DESCRIPTION

Saint Croix National Scenic Riverway Environment: This dry sand prairie community was sampled at 12 locations in the park. Sites range from gentle to somewhat steep, mid- and upper hillslopes with southern, southwestern, southeastern, eastern and western aspects. Soils are rapidly drained sand and loamy sand. The unvegetated surface is dominated either by leaf litter (1-91% cover) or bare sand/soil (1-84%) with some wood (0-2%) and dead plant stems (6-8%). Evidence of disturbance includes trails, past logging, grazing and cultivation, past fire, and the presence of many exotic plants. Several sites are being managed with prescribed burning and shrub removal.

Global Environment: Stands can occur on steep slopes, sandy outwash, sandy lakeplains, and alluvial deposits. They may occur on sand ridges (including inland dunes and sandy areas of coarse-textured end moraines), where, particularly if blowouts have occurred, they may resemble sand barrens. Soils are well-drained to excessively drained, coarse-textured sands, loamy sands, and sandy loams. Gravels are very minor. They generally lack a dark A horizon, have brownish, yellowish, grayish, or reddish thin B horizons, and no mottling (Curtis 1959, White and Madany 1978, Homoya et al. 1985, Chapman et al. 1989, MNNHP 1993).

VEGETATION DESCRIPTION

Saint Croix National Scenic Riverway Vegetation: The sparse to very dense (10-90% cover) herbaceous layer dominates this community. However, there may also be a scattering (5-10%) of trees and shrubs, including *Amorpha canescens* (leadplant), *Corylus americana* (American hazelnut), *Pinus banksiana* (jack pine), *Prunus virginiana* (chokecherry), *Quercus ellipsoidalis X rubra*, *Rhus glabra* (smooth sumac), and *Rubus occidentalis* (black raspberry). Dominants in the herb layer include graminoids *Bouteloua hirsuta* (hairy grama), *Carex pensylvanica* (Pennsylvania sedge), *Hesperostipa spartea* (porcupinegrass), *Koeleria macrantha* (prairie Junegrass), *Poa pratensis* (Kentucky bluegrass) (exotic), and *Schizachyrium scoparium* (little bluestem). Additional herbs include *Ambrosia psilostachya* (Cuman ragweed), *Andropogon gerardii* (big bluestem), *Anemone cylindrica* (candle anemone), *Elymus trachycaulus* (slender wheatgrass), *Eurybia macrophylla* (bigleaf aster), *Helianthemum bicknellii* (hoary frostweed), *Lithospermum caroliniense* (Carolina puccoon), *Oligoneuron rigidum* (stiff goldenrod), *Pteridium aquilinum* (western brackenfern), *Symphyotrichum ericoides* (white heath aster), *Symphyotrichum oolentangiense* (skyblue aster), *Symphyotrichum sericeum* (western silver aster), and others. A total of 17 exotic species were reported from 12 sampled plots. In addition, this community may support Minnesota state-critically imperiled and Wisconsin state-vulnerable *Talinum rugospermum* (prairie fameflower), Minnesota state-vulnerable *Aristida tuberculosa* (seaside threeawn), Wisconsin state-imperiled *Astragalus crassicarpus* (groundplum milkvetch), and Wisconsin state-vulnerable *Packera plattensis* (prairie groundsel).

Global Vegetation: Graminoids dominate the herbaceous layer, which can be open to closed. Dominant species include *Carex pensylvanica* (Pennsylvania sedge), *Danthonia spicata* (poverty oatgrass), *Koeleria macrantha* (prairie Junegrass), *Schizachyrium scoparium* (little bluestem), and *Hesperostipa spartea* (porcupinegrass). Other graminoids include *Bouteloua hirsuta* (hairy grama), *Digitaria cognata* (fall witchgrass) and *Dichanthelium acuminatum* var. *fasciculatum* (western panicgrass). In more open dune-like habitats *Calamovilfa longifolia* (prairie sandreed) may be present. A wide variety of forbs are present, including *Asclepias verticillata*

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(whorled milkweed), *Ambrosia psilostachya* (Cuman ragweed), *Artemisia frigida* (prairie sagewort), *Pseudognaphalium obtusifolium* (rabbit-tobacco), *Euphorbia corollata* (flowering spurge), *Hieracium longipilum* (hairy hawkweed), *Lechea tenuifolia* (narrowleaf pinweed), *Liatris aspera* (tall blazing star), *Liatris cylindracea* (Ontario blazing star), *Nuttallanthus canadensis* (Canada toadflax), *Lithospermum canescens* (hoary puccoon), *Lupinus perennis* (sundial lupine), *Oenothera rhombipetala* (fourpoint evening-primrose), *Polygala polygama* (racemed milkwort), *Packera plattensis* (prairie groundsel), *Solidago nemoralis* (gray goldenrod), *Tephrosia virginiana* (Virginia tephrosia), and *Viola pedata* (birdfoot violet). *Hudsonia tomentosa* (woolly beach-heather), and other sand barrens species, are more often restricted to local disturbances such as blowouts or slipfaces (Curtis 1959, White and Madany 1978, Homoya et al. 1985, Chapman et al. 1989, MNNHP 1993).

MOST ABUNDANT SPECIES

Saint Croix National Scenic Riverway

Stratum	Lifeform	Species
Herb (field)	Graminoid	*Bouteloua hirsuta* (hairy grama), *Carex pensylvanica* (Pennsylvania sedge), *Hesperostipa spartea* (porcupinegrass), *Koeleria macrantha* (prairie Junegrass), *Schizachyrium scoparium* (little bluestem)

CHARACTERISTIC SPECIES

Saint Croix National Scenic Riverway: *Bouteloua hirsuta* (hairy grama), *Carex pensylvanica* (Pennsylvania sedge), *Hesperostipa spartea* (porcupinegrass), *Koeleria macrantha* (prairie Junegrass), *Schizachyrium scoparium* (little bluestem)

OTHER NOTEWORTHY SPECIES

Saint Croix National Scenic Riverway: Vulnerable: *Aristida tuberculosa* (seaside threeawn, MN state-vulnerable, G5), *Astragalus crassicarpus* (groundplum milkvetch, WI state-imperiled, G5), *Packera plattensis* (prairie groundsel, WI state-vulnerable, G5), *Talinum rugospermum* (prairie fameflower, MN state-critically imperiled & WI state-vulnerable, G3G4); **Exotic/Invasive**: *Cirsium arvense* (Canada thistle, invasive/exotic, High/Medium), *Cirsium vulgare* (bull thistle, invasive/exotic, Medium/Low), *Elymus repens* (quackgrass, invasive/exotic, High/Medium), *Euphorbia cyparissias* (cypress spurge, invasive/exotic, Medium/Low), *Glechoma hederacea* (ground ivy, invasive/exotic, Low), *Lotus corniculatus* (bird's-foot trefoil, invasive/exotic, Medium/Low), *Pinus sylvestris* (Scotch pine, invasive/exotic, Medium/Low), *Poa compressa* (Canada bluegrass, invasive/exotic, High/Low), *Poa pratensis* (Kentucky bluegrass, invasive/exotic, Medium), *Polygonum convolvulus* (black bindweed, invasive/exotic), *Potentilla recta* (sulphur cinquefoil, invasive/exotic, High/Medium), *Rumex acetosella* (common sheep sorrel, invasive/exotic, Medium/Low), *Silene latifolia* ssp. *alba* (bladder campion, invasive/exotic), *Taraxacum officinale* (common dandelion, invasive/exotic), *Tragopogon dubius* (yellow salsify, invasive/exotic, Medium/Low), *Urtica dioica* (stinging nettle, invasive/exotic), *Verbascum thapsus* (common mullein, invasive/exotic, Medium)

CONSERVATION STATUS RANK

Global Rank & Reasons: G2G3 (22-Jun-1998). Although the community has a fairly broad distribution, few occurrences have been documented, and most remnants are probably very disturbed, low quality examples. This community is ranked S1S2 or S2 in 5 states, and occurs in at least one more state, possibly several more. It is extirpated from Missouri. Many occurrences have been converted to agriculture, or disturbed by grazing and/or fire suppression.

CLASSIFICATION

Status: Standard

Classification Confidence: 2 - Moderate

Global Comments: Separation of this type from sand barrens, *Schizachyrium scoparium - Carex tonsa* var. *rugosperma - Carex muehlenbergii - Lithospermum caroliniense - Opuntia humifusa* Herbaceous Vegetation (CEGL005099), may be difficult, and they may represent a temporal sequence after exposure of sandy substrates, either by wind or human clearing. In general sand barrens occur on more dune-like habitats or on formerly plowed sand prairies, and sands may still move. Sand prairies occur on more stable sandy soils. A proposed descriptive revision to the name of this type, presuming it is combined with CEGL005099, is *Schizachyrium scoparium - Koeleria macrantha - (Aristida* spp.) *- Carex (umbellata*, *muehlenbergii) - Viola pedata* Herbaceous Vegetation (Prairie-Forest Border Ecoregional Planning Team pers. comm. 1999). Potential diagnostic species for sand prairies may be *Lithospermum canescens* (hoary puccoon) and *Viola pedata* (birdfoot violet). Potential diagnostic species for sand barrens are *Cyperus lupulinus* ssp. *lupulinus* (Great Plains flatsedge), *Cyperus schweinitzii* (Schweinitz's flatsedge), *Carex muehlenbergii* (Muhlenberg's sedge), *Lithospermum caroliniense* (Carolina puccoon), *Opuntia humifusa* (devil's-tongue), and *Sporobolus cryptandrus* (sand dropseed). In Minnesota, the dry-mesic stands of this type may better fit with *Schizachyrium scoparium - Sorghastrum nutans - Andropogon gerardii - Lespedeza capitata* Sand Herbaceous Vegetation (CEGL002210). In Illinois distinction of sand prairie and sand hill prairie needs review, but for now they are combined into this type [see also CEGL005099]. In Indiana *Koeleria macrantha* (prairie Junegrass) and *Hesperostipa spartea* (porcupinegrass) may be common (Jackson 1979).

Global Similar Associations:

- *Corylus americana - Salix humilis / Schizachyrium scoparium* Shrubland (CEGL005072)
- *Pteridium aquilinum - Bromus kalmii* Herbaceous Vegetation (CEGL005142)
- *Schizachyrium scoparium - Carex tonsa* var. *rugosperma - Carex muehlenbergii - Lithospermum caroliniense - Opuntia humifusa* Herbaceous Vegetation (CEGL005099) This type is more typical on disturbed sand prairies.
- *Schizachyrium scoparium - Hesperostipa spartea - Bouteloua (curtipendula, gracilis)* Sand Herbaceous Vegetation (CEGL005204)

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- *Schizachyrium scoparium - Sorghastrum nutans - Andropogon gerardii - Lespedeza capitata* Sand Herbaceous Vegetation (CEGL002210)
- *Schizachyrium scoparium - Sorghastrum nutans - Aristida lanosa - Polypremum procumbens* Herbaceous Vegetation (CEGL002397)

Global Related Concepts:

- Dry Prairie (Central Section) Barrens Subtype (MNNHP 1993) ><
- Dry Prairie (Southeast Section) Barrens Subtype (MNNHP 1993) ><
- Dry Sand Prairie (Nelson 1985) >
- Dry Sand Prairie (Faber-Langendoen 2001) =

ELEMENT DISTRIBUTION

Global Range: This dry sand prairie community is widespread throughout the midwestern region of the United States and adjacent Canada, extending from Indiana, Michigan and southern Ontario, west to Iowa and east-central Minnesota.
Nations: CA, US
States/Provinces: IA:S2?, IL, IN, MI:S2, MN, MO, ON, WI
TNC Ecoregions: 35:C, 36:C, 44:C, 46:C, 47:C, 48:C, 64:C
USFS Ecoregions (1994/95): 212Hq:CCC, 212Hr:CCP, 212Ht:CCP, 212Hu:CCC, 212Hv:CCP, 212Hx:CCC, 212Hy:CCP, 212Ka:CCC, 222Ge:CCC, 222Jb:CCC, 222Jh:CCC, 222Ji:CCC, 222Jj:CCC, 222Kb:CCC, 222Ke:CCC, 222Kg:CCC, 222Lb:CCC, 222Lc:CCC, 222Lf:CCC, 222Me:CCC, 234Ac:???, 251Be:CCC, 251Cc:CCC, 251Cf:CCC, 251Ch:CCC, 251Da:CCC, 251Df:CCC, 251Dg:CCC, 251Dh:CCC
Federal Lands: NPS (Saint Croix); USFS (Huron, Huron-Manistee, Manistee)

ELEMENT SOURCES

Saint Croix National Scenic Riverway Map Code: HDP
Saint Croix National Scenic Riverway Plots: SACN.4, SACN.19, SACN.120, SACN.124, SACN.0663, SACN.0669, SACN.3522, SACN.3524, SACN.5359, SACN.5360, SACN.5484, SACN.6867.
Local Description Authors: M.J. Russo
Global Description Authors: D. Faber-Langendoen
References: Chapman et al. 1989, Curtis 1959, Faber-Langendoen 2001, Homoya et al. 1985, INAI unpubl. data, Jackson 1979, MNNHP 1993, Midwestern Ecology Working Group n.d., Nelson 1985, WNHIP unpubl. data, White and Madany 1978

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Midwest Dry-Mesic Sand Prairie

***Schizachyrium scoparium - Sorghastrum nutans - Andropogon gerardii - Lespedeza capitata* Sand Herbaceous Vegetation**
Little Bluestem - Yellow Indiangrass - Big Bluestem - Round-head Bushclover Sand Herbaceous Vegetation
Identifier: CEGL002210

NVC CLASSIFICATION

Division	Great Plains Grassland & Shrubland (2.C.1.Nb)
Macrogroup	Great Plains Tallgrass Prairie, Savanna & Shrubland (M054)
Group	Sand & Gravel Tallgrass Prairie (G151)
Association (Common name)	Midwest Dry-Mesic Sand Prairie

ELEMENT CONCEPT

Global Summary: This dry-mesic sand bluestem prairie community is found in the upper midwestern United States and adjacent Canada. Stands occur on flat to moderately sloping sites with sand, loamy sand, or, rarely, sandy loam soils. The deep, well-drained soils formed from eolian sand, glacial outwash, old dunes, alluvium, or sandy glacial lakeplains. Sparse to moderately dense mid and tall grasses dominate the community. Forbs do not contribute greatly to vegetation cover but forb diversity is generally moderate to high. The most abundant species in this community are *Andropogon gerardii* (big bluestem), *Carex* (sedge) spp., *Schizachyrium scoparium* (little bluestem), *Sorghastrum nutans* (Indiangrass), and *Hesperostipa spartea* (porcupinegrass). Other common species include *Liatris aspera* (tall blazing star), *Lespedeza capitata* (roundhead lespedeza), *Lithospermum caroliniense* (Carolina puccoon), *Symphyotrichum ericoides* (white heath aster), and *Dalea villosa* (silky prairie clover). Woody species tolerant of dry conditions, such as *Salix humilis* (prairie willow), *Populus tremuloides* (quaking aspen), and *Acer rubrum* (red maple), are sometimes found in this community.

ENVIRONMENTAL DESCRIPTION

Saint Croix National Scenic Riverway Environment: This sand bluestem prairie community was sampled once in the park on a steep, southwest-facing upper slope. Soil is light-colored sand with some gravel and severely eroded in spots. Evidence of disturbance includes the presence of exotic plants.
Global Environment: This community is found on flat to moderately sloping sites with sand, loamy sand, or, rarely, sandy loam soils (White and Madany 1978, MNNHP 1993). The deep, well-drained soils formed from eolian or alluvial sand south of the limit of glaciation and also from glacial outwash, old dunes, alluvium, or sandy glacial lakeplains (Chapman 1984, Nelson 1985).

VEGETATION DESCRIPTION

Saint Croix National Scenic Riverway Vegetation: No strata height or cover data were provided. The herbaceous layer is dominated by graminoids *Andropogon gerardii* (big bluestem), *Schizachyrium scoparium* (little bluestem), *Sporobolus heterolepis* (prairie dropseed), and *Poa pratensis* (Kentucky bluegrass) (exotic). Additional herbs include *Ambrosia psilostachya* (Cuman ragweed), *Antennaria plantaginifolia* (woman's tobacco), *Conyza canadensis* (Canadian horseweed), *Coreopsis palmata* (stiff tickseed), *Helianthus pauciflorus* ssp. *pauciflorus* (stiff sunflower), *Solidago nemoralis* (gray goldenrod), *Symphyotrichum sericeum* (western silver aster), and many others.
Global Vegetation: Sparse to moderately dense mid and tall grasses dominate this community. Forbs do not contribute greatly to vegetation cover, but forb diversity is generally moderate to high (MNNHP 1993). The most abundant species in this community are *Andropogon gerardii* (big bluestem), *Carex* (sedge) spp., *Schizachyrium scoparium* (little bluestem), *Sorghastrum nutans* (Indiangrass), and *Hesperostipa spartea* (porcupinegrass). Other common species include *Liatris aspera* (tall blazing star), *Lespedeza capitata* (roundhead lespedeza), *Lithospermum caroliniense* (Carolina puccoon), *Symphyotrichum ericoides* (white heath aster), and *Dalea villosa* (silky prairie clover). Woody species tolerant of dry conditions, such as *Salix humilis* (prairie willow), *Populus tremuloides* (quaking aspen), and *Acer rubrum* (red maple), are sometimes found in this community.

MOST ABUNDANT SPECIES

Saint Croix National Scenic Riverway

Stratum	Lifeform	Species
Herb (field)	Graminoid	*Andropogon gerardii* (big bluestem), *Schizachyrium scoparium* (little bluestem), *Sporobolus heterolepis* (prairie dropseed)

CHARACTERISTIC SPECIES

Saint Croix National Scenic Riverway: *Andropogon gerardii* (big bluestem), *Schizachyrium scoparium* (little bluestem), *Sporobolus heterolepis* (prairie dropseed)

OTHER NOTEWORTHY SPECIES

Saint Croix National Scenic Riverway: Exotic/Invasive: *Pennisetum glaucum* (pearl millet, invasive/exotic), *Poa pratensis* (Kentucky bluegrass, invasive/exotic, Medium), *Salsola tragus* (prickly Russian thistle, invasive/exotic), *Setaria viridis* (green bristlegrass, invasive/exotic)

CONSERVATION STATUS RANK

Global Rank & Reasons: G3 (22-Jun-1998). There are probably fewer than 100 occurrences rangewide. Sixty-three have been documented: 35 in Indiana (where the community is ranked S3), 19 in Illinois (S2), and 9 in Minnesota (S1,S2,S1). Although no other

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occurrences have been documented, the community is also reported from Michigan (S1), Ontario (S?), and possibly Wisconsin (SP) and has been virtually extirpated from Missouri (database record as SX, but there is now one site - Steyermark sand prairie - that contains this type). It occurs in 13 ecoregional subsections. There are probably fewer than 10,000 acres rangewide. Sizes are known for 40 occurrences, totaling 2600 acres. Lack of fire may permit more woody species to invade this community.

CLASSIFICATION

Status: Standard
Classification Confidence: 2 - Moderate
Global Comments: In Minnesota, the distinction between a dry versus dry-mesic sand prairie is not clear; thus their dry prairie, barrens subtype is listed here and with *Schizachyrium scoparium - Danthonia spicata - Carex pensylvanica - (Viola pedata)* Herbaceous Vegetation (CEGL002318). In Minnesota, the NW and Central barrens subtypes are also placed with *Schizachyrium scoparium - Hesperostipa spartea - Bouteloua (curtipendula*, *gracilis)* Sand Herbaceous Vegetation (CEGL005204). Finally, this type should be compared with *Schizachyrium scoparium - Sorghastrum nutans - Hypoxis hirsuta - Baptisia tinctoria* Herbaceous Vegetation (CEGL006187), found on Long Island, New York. This type could be in northern Missouri in the upper Mississippi River region.
Global Similar Associations:
- *Quercus alba - (Quercus velutina) / Lespedeza virginica - Eupatorium hyssopifolium* Woodland (CEGL006433)
- *Schizachyrium scoparium - Danthonia spicata - Carex pensylvanica - (Viola pedata)* Herbaceous Vegetation (CEGL002318)
- *Schizachyrium scoparium - Hesperostipa spartea - Bouteloua (curtipendula, gracilis)* Sand Herbaceous Vegetation (CEGL005204)
- *Schizachyrium scoparium - Sorghastrum nutans - Hypoxis hirsuta - Baptisia tinctoria* Herbaceous Vegetation (CEGL006187)

Global Related Concepts:
- Dry Prairie (Southeast Section) Barrens Subtype (MNNHP 1993) >
- Dry-Mesic Sand Prairie (Nelson 1985) >
- Dry-Mesic Sand Prairie (Faber-Langendoen 2001) =
- Dry-mesic Sand Prairie (Chapman et al. 1989) =
- Mesic Sand Prairie (Chapman 1984) =

ELEMENT DISTRIBUTION

Global Range: This dry-mesic sand bluestem prairie community is found in the upper midwestern United States.
Nations: CA, US
States/Provinces: IL:S2, IN:S3, MI:S1, MN, MO, OH, ON:S1, WI
TNC Ecoregions: 36:C, 45:C, 46:C, 47:C, 48:C, 49:C
USFS Ecoregions (1994/95): 212Hu:CPP, 212Hy:CPP, 212Jg:CCC, 212Kb:CCC, 212Mb:C??, 212Nc:CCC, 221Eg:CCC, 221Fa:CCC, 222If:CCC, 222Jh:CCC, 222Ji:CCC, 222Jj:CCC, 222Kg:CCC, 222Kh:CCC, 222Ki:CCC, 222Kj:CCC, 222La:CCC, 222Lb:CCC, 222Lc:CCC, 222Lf:CCC, 222Mb:CCC, 222Mc:CCC, 222Md:CCC, 232:?, 251Cf:CCC, 251Ci:CCC, 251Da:CCC, 251Dd:CCC, 251Df:CCC, 251Dg:CCC, 251Dh:CCC
Federal Lands: NPS (Indiana Dunes, Saint Croix); USFS (Huron-Manistee, Manistee)

ELEMENT SOURCES

Saint Croix National Scenic Riverway Map Code: HMP
Saint Croix National Scenic Riverway Plots: SACN.0089.
Local Description Authors: M.J. Russo
Global Description Authors: J. Drake
References: Anderson 1982, Anderson 1996, Chapman 1984, Chapman et al. 1989, Curtis 1959, Faber-Langendoen 2001, Homoya et al. 1988, Hop et al. 2009, MNNHP 1993, Midwestern Ecology Working Group n.d., Nelson 1985, WNHIP unpubl. data, White and Madany 1978

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2.C.1.Nc. Eastern North American Grassland, Meadow & Shrubland

M123. Eastern North American Ruderal Shrubland & Grassland

G059. Northern & Central Ruderal Meadow & Shrubland

Hazelnut - Serviceberry Ruderal Shrubland

***Corylus cornuta - Amelanchier* spp. Ruderal Shrubland**
Beaked Hazelnut - Serviceberry species Ruderal Shrubland
Identifier: CEGL005562

NVC CLASSIFICATION

Division	Eastern North American Grassland, Meadow & Shrubland (2.C.1.Nc)
Macrogroup	Eastern North American Ruderal Shrubland & Grassland (M123)
Group	Northern & Central Ruderal Meadow & Shrubland Group (G059)
Association (Common name)	Hazelnut - Serviceberry Ruderal Shrubland

Global Summary: Information not available.

ENVIRONMENTAL DESCRIPTION

Saint Croix National Scenic Riverway Environment: This hazelnut shrubland was sampled at three locations in the park. Sites are flat to gently sloping uplands with well-drained sand and loamy sand soils. The unvegetated surface is dominated by leaf litter (64-82% cover) with some wood (15-35%) and dead plant stems (1-3%). Evidence of disturbance includes recent logging and the presence of exotic plants.
Global Environment: Information not available.

VEGETATION DESCRIPTION

Saint Croix National Scenic Riverway Vegetation: The moderate to dense (40-80%) short-shrub layer (0.5-1 m tall) of *Corylus americana* (American hazelnut) or *Corylus cornuta* (beaked hazelnut) is the dominant stratum; additional shrubs include *Amelanchier sanguinea* (roundleaf serviceberry), *Carpinus caroliniana* (American hornbeam), *Crataegus chrysocarpa* (fireberry hawthorn), *Diervilla lonicera* (northern bush honeysuckle), *Populus tremuloides* (quaking aspen), *Prunus serotina* (black cherry), *Rubus allegheniensis* (Allegheny blackberry), *Toxicodendron radicans* ssp. *radicans* (eastern poison-ivy), *Zanthoxylum americanum* (common pricklyash), and others. One of the sampled stands also has a very sparse (5%) tree canopy (5-10 m) of *Quercus rubra* (northern red oak) and moderately dense (70%) tall-shrub layer (2-5 m) of *Populus tremuloides* (quaking aspen). *Vaccinium angustifolium* (lowbush blueberry) and *Vaccinium myrtilloides* (velvetleaf huckleberry) may form a very sparse (5%) dwarf-shrub layer. The sparse (10-30%) herbaceous layer may include *Achillea millefolium* (common yarrow), *Andropogon gerardii* (big bluestem), *Anemone quinquefolia* (wood anemone), *Carex siccata* (dryspike sedge), *Carex pensylvanica* (Pennsylvania sedge), *Danthonia spicata* (poverty oatgrass), *Eurybia macrophylla* (bigleaf aster), *Fragaria vesca* (woodland strawberry), *Galium circaezans* (licorice bedstraw), *Lysimachia quadriflora* (fourflower yellow loosestrife), *Maianthemum canadense* (Canada mayflower), *Monarda fistulosa* (wild bergamot), *Oryzopsis asperifolia* (roughleaf ricegrass), *Polygonatum pubescens* (hairy Solomon's seal), *Pteridium aquilinum* (western brackenfern), and others.
Global Vegetation: Information not available.

MOST ABUNDANT SPECIES

Saint Croix National Scenic Riverway

Stratum	Lifeform	Species
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Populus tremuloides* (quaking aspen)
Tall shrub/sapling	Broad-leaved deciduous shrub	*Corylus americana* (American hazelnut), *Corylus cornuta* (beaked hazelnut)
Herb (field)	Graminoid	*Andropogon gerardii* (big bluestem), *Carex siccata* (dryspike sedge), *Danthonia spicata* (poverty oatgrass)

CHARACTERISTIC SPECIES

Saint Croix National Scenic Riverway: *Andropogon gerardii* (big bluestem), *Carex siccata* (dryspike sedge), *Corylus americana* (American hazelnut), *Corylus cornuta* (beaked hazelnut), *Danthonia spicata* (poverty oatgrass), *Populus tremuloides* (quaking aspen), *Rubus allegheniensis* (Allegheny blackberry)

OTHER NOTEWORTHY SPECIES

Saint Croix National Scenic Riverway: Exotic/Invasive: *Linaria vulgaris* (butter and eggs, invasive/exotic, High/Low), *Lonicera xylosteum* (dwarf honeysuckle, invasive/exotic), *Lotus corniculatus* (bird's-foot trefoil, invasive/exotic, Medium/Low), *Poa pratensis* (Kentucky bluegrass, invasive/exotic, Medium), *Potentilla recta* (sulphur cinquefoil, invasive/exotic, High/Medium), *Rosa rugosa* (rugosa rose, invasive/exotic, Low), *Tragopogon dubius* (yellow salsify, invasive/exotic, Medium/Low), *Trifolium repens* (white clover, invasive/exotic, Medium/Low)

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CONSERVATION STATUS RANK

Global Rank & Reasons: GNR (17-Jun-2009).

CLASSIFICATION

Status: Standard

ELEMENT DISTRIBUTION

Global Range: Information not available.
Nations: US
States/Provinces: MN, WI
Federal Lands: NPS (Saint Croix)

ELEMENT SOURCES

Saint Croix National Scenic Riverway Map Code: SHZ
Saint Croix National Scenic Riverway Plots: SACN.207, SACN.254, SACN.3519.
Local Description Authors: M. Russo
Global Description Authors:
References: Midwestern Ecology Working Group n.d.

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2.C.3. Temperate & Boreal Scrub & Herb Coastal Vegetation

2.C.3.Na. Eastern North American Dune & Coastal Grassland & Shrubland

M176. Eastern North American Beach, Shoreline & Flat

G343. Eastern North American River Shoreline [Placeholder]

Riverine Igneous - Metamorphic Cobble - Gravel Shore

Igneous - Metamorphic Cobble - Gravel River Shore Sparse Vegetation
Igneous - Metamorphic Cobble - Gravel River Shore Sparse Vegetation
Identifier: CEGL002304

NVC CLASSIFICATION

Division	Eastern North American Dune & Coastal Grassland & Shrubland (2.C.3.Na)
Macrogroup	Eastern North American Beach, Shoreline & Flat (M176)
Group	Eastern North American River Shoreline [Placeholder] (G343)
Association (Common name)	Riverine Igneous - Metamorphic Cobble - Gravel Shore

ELEMENT CONCEPT

Global Summary: This igneous - metamorphic cobble - gravel bedrock rivershore community is found in the upper Great Lakes region of the United States and Canada and perhaps elsewhere. Stands are found on rivers where scouring by ice or flooding creates a sparsely vegetated zone along the river. Substrate is cobble-gravel and may be composed of either basalt/diabase or granite/metamorphic rocks. The vegetation of this type has not yet been characterized.

ENVIRONMENTAL DESCRIPTION

Saint Croix National Scenic Riverway Environment: This cobble rivershore community was sampled once in the park. The site is a flat backshore terrace along the St. Croix River. Plants are growing on wet, poorly drained sand in between the rocks. The unvegetated surface is dominated by small rocks (97% cover) with some bare sand (2%) and dead plant stems (1%). Evidence of disturbance includes fluctuations in the water level.
Global Environment: Stands are found on rivers where scouring by ice or flooding creates a sparsely vegetated zone along the river. Substrate is cobble-gravel, and may be composed of either basalt/diabase or granite/metamorphic rocks.

VEGETATION DESCRIPTION

Saint Croix National Scenic Riverway Vegetation: This very sparsely vegetated community (5% cover) has an herbaceous layer made up of trace amounts of *Carex emoryi* (Emory's sedge), *Cyperus squarrosus* (bearded flatsedge), *Eleocharis palustris* (common spikerush), *Eragrostis hypnoides* (teal lovegrass), *Eupatorium perfoliatum* (common boneset), *Heteranthera dubia* (grassleaf mudplantain), *Iva xanthifolia* (giant sumpweed), *Juncus nodosus* (knotted rush), *Leersia oryzoides* (rice cutgrass), *Lindernia dubia* (yellowseed false pimpernel), *Mimulus ringens* (Allegheny monkeyflower), *Mollugo verticillata* (green carpetweed), *Phalaris arundinacea* (reed canarygrass), *Polygonum hydropiperoides* (swamp smartweed), *Polygonum punctatum* (dotted smartweed), and *Scutellaria lateriflora* (blue skullcap).
Global Vegetation: The vegetation of this type has not yet been characterized.

CHARACTERISTIC SPECIES

Saint Croix National Scenic Riverway: *Carex emoryi* (Emory's sedge), *Cyperus squarrosus* (bearded flatsedge), *Eleocharis palustris* (common spikerush), *Eragrostis hypnoides* (teal lovegrass), *Eupatorium perfoliatum* (common boneset), *Heteranthera dubia* (grassleaf mudplantain), *Iva xanthifolia* (giant sumpweed), *Juncus nodosus* (knotted rush), *Leersia oryzoides* (rice cutgrass), *Lindernia dubia* (yellowseed false pimpernel), *Mimulus ringens* (Allegheny monkeyflower), *Mollugo verticillata* (green carpetweed), *Phalaris arundinacea* (reed canarygrass), *Polygonum hydropiperoides* (swamp smartweed), *Polygonum punctatum* (dotted smartweed), *Scutellaria lateriflora* (blue skullcap)

CONSERVATION STATUS RANK

Global Rank & Reasons: G4G5 (7-Apr-2000).

CLASSIFICATION

Status: Standard
Classification Confidence: 3 - Weak
Global Comments: This type needs further characterization. Substrate may be either basalt/diabase or granite/metamorphic.
Global Similar Associations:
- Igneous - Metamorphic Cobble - Gravel Inland Lake Shore Sparse Vegetation (CEGL002303)

Global Related Concepts:
- Cobble Beach (Chapman et al. 1989) >
- River Beach Gravel - Cobble Subtype (MNNHP 1993) =

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ELEMENT DISTRIBUTION

Global Range: This igneous/metamorphic cobble-gravel bedrock rivershore community type is found in the upper Great Lakes region of the United States and Canada, and perhaps elsewhere, ranging from Minnesota to Michigan and north into central Canada, from Saskatchewan east to Quebec.
Nations: CA, US
States/Provinces: MB:S3, MI, MN, ON, QC, SK, WI?
TNC Ecoregions: 47:C, 48:C, 64:C
USFS Ecoregions (1994/95): 212Ha:CPP, 212Hb:CPP, 212He:CPP, 212Hh:CPP, 212Hi:CPP, 212Hj:CPP, 212Hk:CPP, 212Ja:CPP, 212Jb:CPP, 212Jc:CPP, 212Jk:CPP, 212Jl:CPP, 212Jn:CPP, 212Jo:CPP, 212Jr:CPP, 212Kb:CCC, 212Mb:CPP, 212Na:CPP, 212Nb:CPP, 212Nc:CPP
Federal Lands: NPS (Saint Croix); USFS (Chippewa)

ELEMENT SOURCES

Saint Croix National Scenic Riverway Map Code: VSB
Saint Croix National Scenic Riverway Plots: SACN.84.
Local Description Authors: M.J. Russo
Global Description Authors: D. Faber-Langendoen
References: Chapman et al. 1989, Greenall 1996, MNNHP 1993, Midwestern Ecology Working Group n.d.

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Riverine Sand Flats

Riverine Sand Flats - Bars Sparse Vegetation
Riverine Sand Flats - Bars Sparse Vegetation
Identifier: CEGL002049

NVC CLASSIFICATION

Division	Eastern North American Dune & Coastal Grassland & Shrubland (2.C.3.Na)
Macrogroup	Eastern North American Beach, Shoreline & Flat (M176)
Group	Eastern North American River Shoreline [Placeholder] (G343)
Association (Common name)	Riverine Sand Flats

ELEMENT CONCEPT

Global Summary: This community ranges from the western Great Plains to the eastern parts of the midwestern United States and Canada. It is a sparsely vegetated community that occurs along river shorelines, islands, pointbars, and flats. These sandbars form when receding floodwaters deposit sand and lesser amounts of clay, silt, and cobbles in the stream bed. Soils are often undeveloped due to the ephemeral nature of the stands. Drainage depends on depth above the water level. Herbaceous species shared in Missouri and Nebraska include *Cyperus* (flatsedge) spp. (*Cyperus erythrorhizos* (redroot flatsedge), *Cyperus odoratus* (fragrant flatsedge), *Cyperus squarrosus)*, *Eragrostis hypnoides* (teal lovegrass), *Eragrostis trichodes* (sand lovegrass), *Leptochloa fusca* ssp. *fascicularis* (bearded sprangletop), *Polygonum* (knotweed) spp. (including *Polygonum lapathifolium)*, *Rorippa sinuata* (spreading yellowcress), *Sporobolus cryptandrus* (sand dropseed), and *Xanthium strumarium* (rough cocklebur).

ENVIRONMENTAL DESCRIPTION

Saint Croix National Scenic Riverway: This community is found on riparian areas on sandy alluvial soils. Sites are adjacent to rivers and are frequently flooded during high water events. Soils are coarse, low in nutrients, and frequently moved by scouring or alluvial deposition.

Global Environment: This community is a sparsely vegetated community that occurs along river shorelines, islands, pointbars, and flats. These sandbars form when receding floodwaters deposit sand and lesser amounts of clay, silt, gravel, and cobbles in the stream bed. Soils are often undeveloped due to the ephemeral nature of the stands. Drainage depends on depth above the water level (Nelson 1985, Steinauer and Rolfsmeier 2000).

VEGETATION DESCRIPTION

Saint Croix National Scenic Riverway: Vegetation is very sparse in this community. Species able to survive the highly dynamic nature of this community include seedlings of riparian trees, annuals such as *Xanthium strumarium* (rough cocklebur) and *Cenchrus* spp. (sandbur spp.), and water-tolerant species such as *Salix* spp. (willows), *Carex lacustris* (hairy sedge), *Vitis* spp. (grape spp.), and *Panicum virgatum* (switchgrass).

Global Vegetation: Vegetation is very sparse, highly dynamic and irregular in structure because of constantly changing conditions on the river. Herbaceous species shared in Missouri and Nebraska include *Cyperus* (flatsedge) spp. (*Cyperus erythrorhizos* (redroot flatsedge), *Cyperus odoratus* (fragrant flatsedge), *Cyperus squarrosus)*, *Eragrostis hypnoides* (teal lovegrass), *Eragrostis trichodes* (sand lovegrass), *Leptochloa fusca* ssp. *fascicularis* (bearded sprangletop), *Polygonum* (knotweed) spp. (including *Polygonum lapathifolium)*, *Rorippa sinuata* (spreading yellowcress), *Sporobolus cryptandrus* (sand dropseed), and *Xanthium strumarium* (rough cocklebur). Other species listed for Nebraska and Missouri alone can be found in Nelson (1985) and Steinauer and Rolfsmeier (2000). Woody cover is generally absent in the first year of establishment but can increase if the site does not flood. A broader description including other Midwest and Great Plains sites is needed.

MOST ABUNDANT SPECIES

Global Stratum	Lifeform	Species
Herb (field)	Forb	*Polygonum lapathifolium* (curlytop knotweed)
Herb (field)	Graminoid	*Cenchrus longispinus* (mat sandbur), *Eragrostis trichodes* (sand lovegrass), *Sporobolus cryptandrus* (sand dropseed)

CHARACTERISTIC SPECIES

Global: *Cyperus erythrorhizos* (redroot flatsedge), *Cyperus odoratus* (fragrant flatsedge), *Cyperus squarrosus* (bearded flatsedge), *Eragrostis hypnoides* (teal lovegrass), *Eragrostis trichodes* (sand lovegrass), *Leptochloa fusca* ssp. *fascicularis* (bearded sprangletop), *Polygonum lapathifolium* (curlytop knotweed), *Rorippa sinuata* (spreading yellowcress), *Sporobolus cryptandrus* (sand dropseed), *Xanthium strumarium* (rough cocklebur)

CONSERVATION STATUS RANK

Global Rank & Reasons: G4G5 (22-Jun-1998).

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CLASSIFICATION

Status: Standard
Classification Confidence: 3 - Weak
Global Comments: This type will need to be separated into at least a Great Plains versus a Midwest type. The current description is based primarily on work available in Missouri (Nelson 1985) and Nebraska (Steinauer and Rolfsmeier 2000). See also the Riverine Gravel Flats Great Plains Sparse Vegetation (CEGL005223).
Global Similar Associations:
- Great Plains Riverine Gravel Flats Sparse Vegetation (CEGL005223)
- *Salix exigua* / Mesic Graminoids Shrubland (CEGL001203)

Global Related Concepts:
- Annual mudflat (Currier 1982) =
- River Beach Sand Subtype (MNNHP 1993) =
- Sand Bar (Nelson 1985) =
- Sandbar/Mudflat (Steinauer and Rolfsmeier 2000) =
- Sandbar/Mudflat (Steinauer and Rolfsmeier 2003) =

ELEMENT DISTRIBUTION

Global Range: This community is found from the western Great Plains to the eastern parts of the midwestern United States and Canada, ranging from Indiana northwest to Saskatchewan, and south to Kansas.
Nations: CA, US
States/Provinces: IL, IN, KS:SU, MB:S3, MN:SU, MO:S3, ND, NE:S5, ON, QC, SK?, WY
TNC Ecoregions: 26:C, 36:C, 37:C, 38:C, 46:C, 47:C, 48:C, 64:C
USFS Ecoregions (1994/95): 212Mb:CPP, 212Na:CPP, 212Nb:CPP, 212Nc:CPP, 222Ad:CC?, 222Ae:CC?, 222Af:CC?, 222Ak:CC?, 222Ap:CCC, 222Md:CCC, 251Cg:CCC, 251D:CC, 331:C, 332C:CC, 332E:CC
Federal Lands: NPS (Fort Laramie, Fort Union Trading Post, Ozark Riverways, Saint Croix, Scotts Bluff, Theodore Roosevelt); USFS (Chippewa)

ELEMENT SOURCES

Saint Croix National Scenic Riverway Map Code: VSB
Saint Croix National Scenic Riverway Plots: No plots.
Local Description Authors: J. Drake
Global Description Authors: D. Faber-Langendoen
References: Chastain et al. 2006, Currier 1982, Greenall 1996, Lauver et al. 1999, MNNHP 1993, Midwestern Ecology Working Group n.d., Nelson 1985, Nigh et al. 2000, Salas and Pucherelli 2002a, Steinauer and Rolfsmeier 2000, Steinauer and Rolfsmeier 2003, TNC 1998e

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2.C.4. Temperate & Boreal Bog & Fen

2.C.4.Na. North American Bog & Fen

M061. Appalachian, Interior Plateau & Prairie Fen

G183. North-Central Appalachian, Interior & Prairie Fen

Skunk-cabbage Seepage Meadow
***Symplocarpus foetidus* Herbaceous Vegetation**
Skunk-cabbage Herbaceous Vegetation
Identifier: CEGL002385

NVC CLASSIFICATION

Division	North American Bog & Fen (2.C.4.Na)
Macrogroup	Appalachian, Interior Plateau & Prairie Fen (M061)
Group	North-Central Appalachian, Interior & Prairie Fen (G183)
Association (Common name)	Skunk-cabbage Seepage Meadow

ELEMENT CONCEPT

Global Summary: This community is found throughout the upper midwestern region of the United States and adjacent Canada, ranging to the Northeast, where it develops around spring heads and in broader areas of groundwater discharge. The peat layer is typically less than 0.4 m deep. Tree and shrub cover may vary, particularly from overhanging upland trees, but trees and shrubs rooted in the stand are less than 25% cover. Forbs dominate the community. *Symplocarpus foetidus* (skunk-cabbage) and *Angelica atropurpurea* (purplestem angelica) are the dominant and indicative species in the Midwest; *Impatiens capensis* (jewelweed) is characteristic in the East. Other forbs and ferns present include *Caltha palustris* (yellow marsh-marigold), *Chelone glabra* (white turtlehead), *Epilobium coloratum* (purpleleaf willowherb), *Impatiens capensis* (jewelweed), *Pedicularis lanceolata* (swamp lousewort), *Pilea pumila* (Canadian clearweed), *Saxifraga pensylvanica* (eastern swamp saxifrage), *Solidago patula* (roundleaf goldenrod), and *Thelypteris palustris* (eastern marsh fern). Graminoid cover is generally low, less than 25%, and may include *Carex bromoides* (bromelike sedge), *Carex comosa* (longhair sedge), *Carex lacustris* (hairy sedge), *Carex stricta* (upright sedge), and *Carex trichocarpa* (hairyfruit sedge).

ENVIRONMENTAL DESCRIPTION

Saint Croix National Scenic Riverway Environment: This skunk-cabbage seepage meadow was sampled at four locations in the park. Sites are gently to moderately sloping, north-, west- and southeast-facing seepage areas. Soils are saturated, poorly drained muck. The unvegetated surface of one plot is dominated by bare soil (60% cover) with some leaf litter (25%), large rocks (1%), wood (2%), standing water (2%), and dead plant stems (10%). Evidence of disturbance includes downed wood and the presence of exotic plants.

Global Environment: This community develops around spring heads and in broader areas of groundwater discharge, where water flows to the surface in a diffuse rather than concentrated flow. Peat may be present in some areas, and perhaps locally can be as deep as 1 m, but it is typically less than 0.4 m deep. Stands can occur along the lower slopes of glacial moraines, ravines and in deep glacial meltwater-cut river valleys at the bases of slopes separating stream terraces. Soils are seasonally to more-or-less permanently saturated (MNNHP 1993).

VEGETATION DESCRIPTION

Saint Croix National Scenic Riverway Vegetation: Strata height or cover data were provided for only one of the sample plot. It has a very sparse (5% cover) tall-shrub layer (2-5 m tall), very sparse (5%) short-shrub layer (1-2 m), and solid (100%) herbaceous layer. Trees include *Betula alleghaniensis* (yellow birch) and *Fraxinus nigra* (black ash), and shrubs include tree species as well as *Alnus incana* (gray alder), *Carpinus caroliniana* (American hornbeam), *Ribes* (currant) sp., and *Rubus* (blackberry) sp. *Symplocarpus foetidus* (skunk-cabbage) dominates the herb layer which may also include substantial amounts of *Carex bromoides* (bromelike sedge) and *Myosotis scorpioides* (true forget-me-not) (exotic) and lesser amounts of *Calamagrostis canadensis* (bluejoint), *Caltha palustris* (yellow marsh-marigold), *Carex crinita* (fringed sedge), *Carex gracillima* (graceful sedge), *Carex lacustris* (hairy sedge), *Carex stipata* (awlfruit sedge), *Equisetum sylvaticum* (woodland horsetail), *Galium aparine* (stickywilly), *Glyceria striata* (fowl mannagrass), *Hydrocotyle americana* (American marshpennywort), *Impatiens capensis* (jewelweed), *Phalaris arundinacea* (reed canarygrass), *Poa paludigena* (bog bluegrass), *Polygonum arifolium* (halberdleaf tearthumb), *Polygonum sagittatum* (arrowleaf tearthumb), *Sagittaria latifolia* (broadleaf arrowhead), *Thalictrum dasycarpum* (purple meadowrue), *Viola labradorica* (alpine violet), and *Viola cucullata* (marsh blue violet). Nonvascular species (mosses) may cover up to 15% of the ground surface. In addition, this community may support Minnesota state-imperiled *Poa paludigena* (bog bluegrass) (also Wisconsin state-vulnerable), and Wisconsin state-vulnerable *Hydrocotyle americana* (American marshpennywort).

Global Vegetation: This is an herbaceous-dominated community. Tree and shrub cover may vary, particularly from overhanging upland trees, but trees and shrubs rooted in the stand are less than 25% cover. Forbs dominate the community. *Symplocarpus foetidus*

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(skunk-cabbage) and *Angelica atropurpurea* (purplestem angelica) are the leading dominant and indicator species. Other forbs and ferns present include *Caltha palustris* (yellow marsh-marigold), *Chelone glabra* (white turtlehead), *Epilobium coloratum* (purpleleaf willowherb), *Impatiens capensis* (jewelweed), *Impatiens capensis* (jewelweed), *Pedicularis lanceolata* (swamp lousewort), *Pilea pumila* (Canadian clearweed), *Saxifraga pensylvanica* (eastern swamp saxifrage), *Solidago patula* (roundleaf goldenrod), and *Thelypteris palustris* (eastern marsh fern). Graminoid cover is generally low, less than 25%, and may include *Carex bromoides* (bromelike sedge), *Carex comosa* (longhair sedge), *Carex lacustris* (hairy sedge), *Carex stricta* (upright sedge), and *Carex trichocarpa* (hairyfruit sedge) (White and Madany 1978, MNNHP 1993).

MOST ABUNDANT SPECIES

Saint Croix National Scenic Riverway

Stratum	Lifeform	Species
Herb (field)	Forb	*Impatiens capensis* (jewelweed), *Symplocarpus foetidus* (skunk-cabbage)
Herb (field)	Graminoid	*Carex bromoides* (bromelike sedge)

Global

Stratum	Lifeform	Species
Herb (field)	Forb	*Symplocarpus foetidus* (skunk-cabbage)

CHARACTERISTIC SPECIES

Saint Croix National Scenic Riverway: *Carex bromoides* (bromelike sedge), *Impatiens capensis* (jewelweed), *Symplocarpus foetidus* (skunk-cabbage)
Global: *Caltha palustris* (yellow marsh-marigold), *Thelypteris palustris* (eastern marsh fern)

OTHER NOTEWORTHY SPECIES

Saint Croix National Scenic Riverway: Vulnerable: *Hydrocotyle americana* (American marshpennywort, MN state-vulnerable, G5), *Poa paludigena* (bog bluegrass, MN & WI state-imperiled, G3); **Exotic/Invasive**: *Frangula alnus* (glossy buckthorn, invasive/exotic, High/Medium), *Humulus lupulus* (common hop, invasive/exotic), *Myosotis scorpioides* (true forget-me-not, invasive/exotic), *Taraxacum officinale* (common dandelion, invasive/exotic), *Urtica dioica* (stinging nettle, invasive/exotic)
Global: Vulnerable: *Poa paludigena* (bog bluegrass, In MN, this state rare species appears to be endemic to this community (MN DNR 1993)., G3); **Other**: *Floerkea proserpinacoides* (false mermaidweed, G5), *Hydrocotyle americana* (American marshpennywort, G5)

CONSERVATION STATUS RANK

Global Rank & Reasons: G4? (3-Oct-1996).

CLASSIFICATION

Status: Standard
Classification Confidence: 2 - Moderate
Global Comments: This community is defined as an herbaceous community, thereby excluding many closed canopy seepage meadows with trees or shrubs rooted in the stand. However, some herbaceous seepage meadows could be quite shaded because of surrounding upland forests. This type is not always separated out by state heritage programs, since it can be a zone in other wetland types. *Carex lacustris* (hairy sedge) may occur in this type. The presence of coarse-leaved sedges may be a structural difference as compared to fens, which typically have fine-leaved sedges (MNNHP 1993).
Global Similar Associations:
- *Acer rubrum* - *Fraxinus* spp. - *Betula papyrifera* / *Cornus canadensis* Forest (CEGL002071) may have a similar composition.
- *Carex crinita* - *Osmunda* spp. / *Physocarpus opulifolius* Seep Herbaceous Vegetation (CEGL002392)
- *Carex crinita* - *Osmunda* spp. / *Sphagnum* spp. Herbaceous Vegetation (CEGL002263)
- *Cornus sericea* - *Salix* spp. - (*Rosa palustris*) Shrubland (CEGL002186) may have a similar composition.
- *Fraxinus nigra* - Mixed Hardwoods - Conifers / *Cornus sericea* / *Carex* spp. Forest (CEGL002105) may have a similar composition.

Global Related Concepts:
- Seepage Meadow (MNNHP 1993) =
- Southern Swamp (Chapman et al. 1989) >

ELEMENT DISTRIBUTION

Global Range: This community is found throughout the upper midwestern region of the United States and adjacent Canada, where it develops around spring heads and in broader areas of groundwater discharge. The type extends from Indiana and possibly Ontario and Ohio, west to Minnesota and Iowa.
Nations: CA, US
States/Provinces: IA, IL:S2, IN, MA, MI, MN:S3, NJ, OH, ON, PA, WI:S2
TNC Ecoregions: 36:C, 44:C, 45:C, 46:C, 47:C, 48:C, 49:C, 61:C, 62:C
USFS Ecoregions (1994/95): 212He:CPP, 212Hl:CP?, 212Hm:CPP, 212Hq:CPP, 212Hr:CPP, 212Ht:CPP, 212Hu:CPP, 212Hv:CP?, 212Hw:CP?, 212Hx:CP?, 212Kb:CCC, 221D:CC, 221Ec:CCC, 221Fa:CCC, 222Em:CPP, 222Ff:CCC, 222Gc:CCC, 222Ge:CCC,

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222Ha:CCC, 222Hb:CCC, 222Hf:CCC, 222I:CP, 222Jb:CCC, 222Jj:CCC, 222Kg:CCC, 222Kh:CCC, 222Lc:CCC, 222Lf:CCC, 222Md:CCC, 251Cf:CCC, 251Dd:CCC, M221:?

Federal Lands: NPS (Cuyahoga Valley, Indiana Dunes, Saint Croix, Valley Forge); USFS (Huron, Huron-Manistee, Manistee); USFWS (Erie)

ELEMENT SOURCES

Saint Croix National Scenic Riverway Map Code: Not mapped separately.

Saint Croix National Scenic Riverway Plots: SACN.62, SACN.0164, SACN.0355, SACN.4024.

Local Description Authors: M.J. Russo

Global Description Authors: D. Faber-Langendoen, mod. L.A. Sneddon

References: Chapman et al. 1989, Fike 1999, Hop et al. 2009, INAI unpubl. data, MNNHP 1993, Midwestern Ecology Working Group n.d., Newbold 1993, Newbold 1996, Podniesinski et al. 2005b, White and Madany 1978

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M062. North American Boreal Bog & Fen

G386. Eastern North American Boreal Acidic Bog & Poor Fen

Bog Birch - Leatherleaf Rich Fen

***Betula pumila / Chamaedaphne calyculata / Carex lasiocarpa* Shrubland**
Bog Birch / Leatherleaf / Woolly-fruit Sedge Shrubland
Identifier: CEGL002494

NVC CLASSIFICATION

Division	North American Bog & Fen (2.C.4.Na)
Macrogroup	North American Boreal Bog & Fen (M062)
Group	Eastern North American Boreal Acidic Bog & Poor Fen (G386)
Association (Common name)	Bog Birch - Leatherleaf Rich Fen

ELEMENT CONCEPT

Global Summary: This bog birch - leatherleaf shrub, moderately rich to poor fen is found in the northern Great Lakes region of the United States and Canada, and probably elsewhere. Stands are found on the margins of water tracks of large peatlands, or in the interior of small basins that are relatively isolated from runoff. The shrub cover is at least 25%, dominated by a combination of *Betula pumila* (bog birch) and ericaceous shrubs, including *Andromeda polifolia* (bog rosemary), *Chamaedaphne calyculata* (leatherleaf), *Ledum groenlandicum* (bog Labrador-tea), and *Vaccinium oxycoccos* (small cranberry). Other minerotrophic shrubs include *Lonicera villosa* (mountain fly honeysuckle), *Rhamnus alnifolia* (alderleaf buckthorn), *Rubus arcticus* ssp. *acaulis* (dwarf raspberry), *Rubus pubescens* (dwarf red blackberry), and *Salix pedicellaris* (bog willow). Scattered, small (2-10 m) tree stems of *Larix laricina* (tamarack), *Picea mariana* (black spruce), and *Thuja occidentalis* (northern white-cedar) are present at low cover. There is a diverse forb, graminoid, and moss cover, at least in the richer examples of this type. The graminoids include *Carex chordorrhiza* (creeping sedge), *Carex lasiocarpa* (woollyfruit sedge), *Carex leptalea* (bristly-stalked sedge), and *Eriophorum viridicarinatum* (thinleaf cottonsedge). Forbs include *Drosera rotundifolia* (roundleaf sundew), *Equisetum fluviatile* (water horsetail), *Maianthemum trifolium* (threeleaf false lily of the valley), *Menyanthes trifoliata* (buckbean), *Comarum palustre* (purple marshlocks), *Sarracenia purpurea* (purple pitcherplant), and *Solidago uliginosa* (bog goldenrod). The moss layer contains *Aulacomnium palustre* (aulacomnium moss), *Pleurozium schreberi* (Schreber's big red stem moss), *Sphagnum angustifolium* (sphagnum), and *Sphagnum capillifolium* (sphagnum). Less frequent are *Campylium stellatum* (star campylium moss), *Sphagnum fuscum* (sphagnum), and *Tomentypnum nitens* (tomentypnum moss). Diagnostic features include the combination of *Betula pumila* (bog birch) and ericaceous shrubs in the shrub layer, and both minerotrophic and oligotrophic graminoid and forb species.

ENVIRONMENTAL DESCRIPTION

Saint Croix National Scenic Riverway Environment: This bog birch - leatherleaf shrubland was sampled at nine locations in the park. Sites include flat floodplains and swamps with very poorly drained peat soils. The unvegetated surface (for one sampled plot) is dominated by leaf litter (84% cover) with some wood (7%), bare soil (5%), and dead plant stems (4%). No evidence of disturbance was reported except the occurrence of one exotic plant species.
Global Environment: Stands are found on the margins of water tracks of large peatlands, or in the interior of small basins that are relatively isolated from run-off (Harris et al. 1996).

VEGETATION DESCRIPTION

Saint Croix National Scenic Riverway Vegetation: Strata height or cover data were provided for only one plot. It has a dense (80% cover) shrub layer (0.5-1 m tall), typical of the other sampled plots. The dominant shrubs are *Betula pumila* var. *glandulifera* (bog birch) and *Chamaedaphne calyculata* (leatherleaf); additional shrubs include *Alnus incana* (gray alder), *Andromeda polifolia* var. *glaucophylla* (bog rosemary), *Kalmia polifolia* (bog laurel), *Salix pyrifolia* (balsam willow), and *Spiraea tomentosa* (steeplebush). The herbaceous layer may be dominated by *Calamagrostis canadensis* (bluejoint), *Carex lasiocarpa* (woollyfruit sedge), *Carex oligosperma* (fewseed sedge), *Carex stricta* (upright sedge), and/or *Carex utriculata* (Northwest Territory sedge); additional herbs include *Carex chordorrhiza* (creeping sedge), *Maianthemum Trifolium* (threeleaf false lily of the valley), *Menyanthes trifoliata* (buckbean), *Osmunda cinnamomea* (cinnamon fern), *Thelypteris palustris* (eastern marsh fern), and *Vaccinium oxycoccos* (small cranberry). Nonvascular species (sphagnum mosses) cover up to 95% of the ground surface. In addition, this community may support Wisconsin state-critically imperiled and Minnesota state-vulnerable *Salix pellita* (satiny willow).
Global Vegetation: The shrub cover is at least 25%, dominated by a combination of *Betula pumila* (bog birch) and ericaceous shrubs, including *Andromeda polifolia* (bog rosemary), *Chamaedaphne calyculata* (leatherleaf), *Ledum groenlandicum* (bog Labrador-tea), and *Vaccinium oxycoccos* (small cranberry). Other minerotrophic shrubs include *Lonicera villosa* (mountain fly honeysuckle), *Rhamnus alnifolia* (alderleaf buckthorn), *Rubus arcticus* ssp. *acaulis* (dwarf raspberry), *Rubus pubescens* (dwarf red blackberry), and *Salix pedicellaris* (bog willow). Scattered, small (2-10 m) tree stems of *Larix laricina* (tamarack), *Picea mariana* (black spruce), and *Thuja occidentalis* (northern white-cedar) are present at low cover. There is a diverse forb, graminoid, and moss cover, at least in the richer examples of this type. The graminoids include *Carex chordorrhiza* (creeping sedge), *Carex lasiocarpa* (woollyfruit sedge), *Carex leptalea* (bristly-stalked sedge), and *Eriophorum viridicarinatum* (thinleaf cottonsedge). Forbs include *Drosera rotundifolia* (roundleaf sundew), *Equisetum fluviatile* (water horsetail), *Maianthemum trifolium* (threeleaf false lily of the

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valley), *Menyanthes trifoliata* (buckbean), *Comarum palustre* (purple marshlocks), *Sarracenia purpurea* (purple pitcherplant), and *Solidago uliginosa* (bog goldenrod). The moss layer contains *Aulacomnium palustre* (aulacomnium moss), *Pleurozium schreberi* (Schreber's big red stem moss), *Sphagnum angustifolium* (sphagnum), and *Sphagnum capillifolium* (sphagnum). Less frequent are *Campylium stellatum* (star campylium moss), *Sphagnum fuscum* (sphagnum), and *Tomentypnum nitens* (tomentypnum moss) (Harris et al. 1996).

MOST ABUNDANT SPECIES

Saint Croix National Scenic Riverway

Stratum	Lifeform	Species
Tall shrub/sapling	Broad-leaved deciduous shrub	*Betula pumila* var. *glandulifera* (bog birch)
Short shrub/sapling	Dwarf-shrub	*Chamaedaphne calyculata* (leatherleaf)
Herb (field)	Graminoid	*Calamagrostis canadensis* (bluejoint), *Carex lasiocarpa* (woollyfruit sedge), *Carex oligosperma* (fewseed sedge), *Carex stricta* (upright sedge), *Carex utriculata* (Northwest Territory sedge)

CHARACTERISTIC SPECIES

Saint Croix National Scenic Riverway: *Betula pumila* var. *glandulifera* (bog birch), *Calamagrostis canadensis* (bluejoint), *Carex lasiocarpa* (woollyfruit sedge), *Carex oligosperma* (fewseed sedge), *Carex stricta* (upright sedge), *Carex utriculata* (Northwest Territory sedge), *Chamaedaphne calyculata* (leatherleaf)

OTHER NOTEWORTHY SPECIES

Saint Croix National Scenic Riverway: Vulnerable: *Salix pellita* (satiny willow, WI state-critically imperiled & MN state-vulnerable, G5); **Exotic/Invasive**: *Frangula alnus* (glossy buckthorn, invasive/exotic, High/Medium)

CONSERVATION STATUS RANK

Global Rank & Reasons: G4G5 (3-Oct-1996).

CLASSIFICATION

Status: Standard

Classification Confidence: 2 - Moderate

Global Comments: This "moderately rich" to somewhat poor (or medium) fen is intermediate between the rich bog birch - shrubby-cinquefoil fen, *Betula pumila - Dasiphora fruticosa* ssp. *floribunda / Carex lasiocarpa - Trichophorum alpinum* Shrubland (CEGL002495) and both the Tamarack Scrub Poor Fen, *Larix laricina / Chamaedaphne calyculata / Carex lasiocarpa* Shrubland (CEGL005226), and the Leatherleaf Shrub Poor Fen, *Chamaedaphne calyculata / Carex oligosperma / Sphagnum* spp. Poor Fen Dwarf-Shrubland (CEGL005277). This parallels the work in northern Ontario (Harris et al. 1996), but field-based survey is needed to assist in establishing the practicality of these splits. In Wisconsin, this type is known from extensive areas in the Bad River - Kakogan Sloughs along Lake Superior. Otherwise, it is usually a minimal zone or inclusion. Note that some Heritage program names refer to this type as a poor fen.

Global Similar Associations:

- *Alnus incana - Salix* spp. - *Betula pumila / Chamaedaphne calyculata* Shrubland (CEGL005227)
- *Betula pumila - Dasiphora fruticosa* ssp. *floribunda / Carex lasiocarpa - Trichophorum alpinum* Shrubland (CEGL002495)
- *Betula pumila - Salix* spp. Prairie Fen Shrubland (CEGL002189)
- *Carex lasiocarpa - Carex oligosperma / Sphagnum* spp. Herbaceous Vegetation (CEGL002265)
- *Chamaedaphne calyculata / Carex oligosperma / Sphagnum* spp. Poor Fen Dwarf-shrubland (CEGL005277)
- *Larix laricina / Chamaedaphne calyculata / Carex lasiocarpa* Shrubland (CEGL005226)

Global Related Concepts:

- Moderately rich fen: tamarack-black spruce / ericaceous shrub (W18) (Harris et al. 1996) =
- Northern Rich Fen (Chapman et al. 1989) >
- Poor Fen Shrub Subtype (MNNHP 1993) =
- Rich Fen Bog Birch-Leatherleaf Subtype (Faber-Langendoen 2001) =
- Sweetgale Mixed Shrub Fen (Gawler 2002) >

ELEMENT DISTRIBUTION

Global Range: This bog birch - leatherleaf shrub fen is found in the northern Great Lakes region of the United States and Canada, and probably elsewhere, ranging from Minnesota east to possibly Maine, and northward into Canada in Manitoba eastward to possibly Quebec.

Nations: CA, US

States/Provinces: MB:S5, ME, MI, MN:S4, ON, QC:S4?, WI:S3

TNC Ecoregions: 35:C, 46:C, 47:C, 48:C

USFS Ecoregions (1994/95): 212Hb:CC?, 212Hh:CCP, 212Hj:CCC, 212Hp:CCP, 212Hq:CCP, 212Ja:CCP, 212Jc:CCP, 212Jh:CCC, 212Jj:CCP, 212Jl:CCP, 212Jm:CCC, 212Ka:CC?, 212Kb:CCC, 212La:CCC, 212Ma:CCP, 212Mb:CCC, 212Na:CCC, 212Nb:CCP, 212Nc:CCC, 222Ka:CCC, 222Kf:CCC, 222Mc:CCC, 222Md:CCC, 222Na:CCC

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Federal Lands: NPS (Saint Croix, Voyageurs); USFS (Chequamegon-Nicolet, Chequamegon?, Chippewa, Hiawatha, Huron, Huron-Manistee, Manistee?, Nicolet, Superior?)

ELEMENT SOURCES

Saint Croix National Scenic Riverway Map Code: SMW

Saint Croix National Scenic Riverway Plots: SACN.277, SACN.0074, SACN.0167, SACN.0202, SACN.0209, SACN.0389, SACN.4098, SACN.7453, SACN.7597.

Local Description Authors: M.J. Russo

Global Description Authors: D. Faber-Langendoen

References: Chapman et al. 1989, Faber-Langendoen 2001, Gawler 2002, Greenall 1996, Harris et al. 1996, MNNHP 1993, Midwestern Ecology Working Group n.d., WNHIP unpubl. data

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Northern Sedge Poor Fen

***Carex lasiocarpa - Carex oligosperma / Sphagnum* spp. Herbaceous Vegetation**
Woolly-fruit Sedge - Few-seed Sedge / Peatmoss species Herbaceous Vegetation
Identifier: CEGL002265

NVC CLASSIFICATION

Division	North American Bog & Fen (2.C.4.Na)
Macrogroup	North American Boreal Bog & Fen (M062)
Group	Eastern North American Boreal Acidic Bog & Poor Fen (G386)
Association (Common name)	Northern Sedge Poor Fen

ELEMENT CONCEPT

Global Summary: This graminoid poor fen community is found in the Great Lakes region of the United States and Canada, as well as elsewhere in central Canada. Stands are found in peatlands with low exposure to mineral-rich groundwater, including basin fens, shores above the level of seasonal flooding and larger peatlands. Water hydrology is saturated, and surface water is slightly acidic and nutrient poor. The vegetation is dominated by graminoids, with up to 25% shrub cover, and scattered trees. The dominant graminoid is *Carex lasiocarpa* (woollyfruit sedge), and typical associates include *Carex chordorrhiza* (creeping sedge), *Carex limosa* (mud sedge), *Carex oligosperma* (fewseed sedge), *Rhynchospora alba* (white beaksedge), *Trichophorum caespitosum* (tufted bulrush), and *Scheuchzeria palustris* (rannoch-rush). Forbs include *Arethusa bulbosa* (dragon's mouth), *Symphyotrichum boreale* (northern bog aster), *Calopogon tuberosus* (tuberous grasspink), *Pogonia ophioglossoides* (snakemouth orchid), *Sarracenia purpurea* (purple pitcherplant), and *Solidago uliginosa* (bog goldenrod). The low-shrub layer contains *Andromeda polifolia* (bog rosemary), *Betula pumila* (bog birch), *Chamaedaphne calyculata* (leatherleaf), *Larix laricina* (tamarack), *Salix discolor* (pussy willow), *Salix pedicellaris* (bog willow), and *Vaccinium oxycoccos* (small cranberry). The moss layer is virtually continuous, and is dominated by *Sphagnum capillifolium* (sphagnum), *Sphagnum fuscum* (sphagnum), and *Sphagnum magellanicum* (Magellan's sphagnum). Diagnostic features include the dominance of graminoids, particularly *Carex lasiocarpa* (woollyfruit sedge), the almost continuous layer of Sphagnum peat, and few minerotrophic indicators.

ENVIRONMENTAL DESCRIPTION

Saint Croix National Scenic Riverway Environment: This northern sedge poor fen community was sampled at four locations in the park. The sites are flat depressions and wet meadows with very poorly to poorly drained peat soils. Some of the sites were dry at the time of sampling, possibly due to drought conditions. The unvegetated surface is dominated by leaf litter (90-93% cover) with some bare soil (0-1%) and dead plant stems (7-9%). Evidence of disturbance includes the presence of one exotic plant species.
Global Environment: Stands are found in peatlands with low exposure to mineral-rich groundwater, including basin fens, shores above the level of seasonal flooding and larger peatlands. Water hydrology is saturated (Harris et al. 1996). The surface water is slightly acidic (pH 4.1-5.9) and nutrient-poor (calcium <13 mg/l) (MNNHP 1993).

VEGETATION DESCRIPTION

Saint Croix National Scenic Riverway Vegetation: The very dense (80-90% cover) herbaceous layer dominates this community. However, there may also be a scattering (5%) of shrubs, including *Betula pumila* var. *glandulifera* (bog birch), *Chamaedaphne calyculata* (leatherleaf), *Salix bebbiana* (Bebb willow), *Salix petiolaris* (meadow willow), and *Spiraea tomentosa* (steeplebush). Dominants in the herb layer include sedges *Carex lacustris* (hairy sedge), *Carex oligosperma* (fewseed sedge), and *Carex utriculata* (Northwest Territory sedge). Additional herbs include *Calamagrostis canadensis* (bluejoint), *Comarum palustre* (purple marshlocks), *Galium boreale* (northern bedstraw), *Galium labradoricum* (northern bog bedstraw), *Lycopus americanus* (American water horehound), *Onoclea sensibilis* (sensitive fern), *Polygonum sagittatum* (arrowleaf tearthumb), *Rumex orbiculatus* (greater water dock), *Scirpus cyperinus* (woolgrass), *Thelypteris palustris* (eastern marsh fern), and *Triadenum fraseri* (Fraser's marsh St. Johnswort). Nonvascular species (sphagnum and other mosses) cover up to 70% of the ground surface.
Global Vegetation: The vegetation is dominated by graminoids, with up to 25% shrub cover, and scattered trees. The dominant graminoid is *Carex lasiocarpa* (woollyfruit sedge), and typical associates include *Carex chordorrhiza* (creeping sedge), *Carex limosa* (mud sedge), *Carex oligosperma* (fewseed sedge), *Rhynchospora alba* (white beaksedge), *Trichophorum caespitosum* (tufted bulrush), and *Scheuchzeria palustris* (rannoch-rush). Forbs include *Sarracenia purpurea* (purple pitcherplant). The low-shrub layer contains *Andromeda polifolia* (bog rosemary), *Betula pumila* (bog birch), *Chamaedaphne calyculata* (leatherleaf), *Larix laricina* (tamarack), *Salix discolor* (pussy willow), *Salix pedicellaris* (bog willow), and *Vaccinium oxycoccos* (small cranberry). The moss layer is virtually continuous and is dominated by *Sphagnum capillifolium* (sphagnum), *Sphagnum fuscum* (sphagnum), and *Sphagnum magellanicum* (Magellan's sphagnum) (Chapman et al. 1989, MNNHP 1993, Harris et al. 1996).

MOST ABUNDANT SPECIES

Saint Croix National Scenic Riverway

Stratum	Lifeform	Species
Herb (field)	Graminoid	*Carex lacustris* (hairy sedge), *Carex oligosperma* (fewseed sedge), *Carex utriculata* (Northwest Territory sedge)

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CHARACTERISTIC SPECIES

Saint Croix National Scenic Riverway: *Carex lacustris* (hairy sedge), *Carex oligosperma* (fewseed sedge), *Carex utriculata* (Northwest Territory sedge)

OTHER NOTEWORTHY SPECIES

Saint Croix National Scenic Riverway: Exotic/Invasive: *Agrostis gigantea* (redtop, invasive/exotic, Medium/Low)

CONSERVATION STATUS RANK

Global Rank & Reasons: G3G4 (3-Oct-1996). The type has a moderately wide distribution, but is not common anywhere in its range within the United States. It is ranked between S1 and S3 by individual state Heritage programs. The global rank remains somewhat uncertain because the distribution and conservation status of the type in Canada is not known.

CLASSIFICATION

Status: Standard
Classification Confidence: 2 - Moderate
Global Comments: Isolated stands can occur in central/southern Minnesota, Wisconsin, Michigan, and even northern Iowa and Illinois. The description may not adequately characterize these stands. These graminoid poor fens may overlap into shrubby poor fens, such as a *Chamaedaphne* (leatherleaf) dwarf-shrub poor fen (undescribed, but see *Chamaedaphne calyculata / Carex oligosperma / Sphagnum* spp. Poor Fen Dwarf-shrubland (CEGL005277) and *Chamaedaphne calyculata - Ledum groenlandicum - Kalmia polifolia* Bog Dwarf-shrubland (CEGL005278)), and they should perhaps be treated as one type, with a variable shrub cover (see Harris et al. 1996). In addition, a poor fen type or subtype dominated by *Carex oligosperma* (fewseed sedge) and *Carex rostrata* (beaked sedge) may exist in the central sandplains of Minnesota and Wisconsin; other characteristic species include *Spiraea tomentosa* (steeplebush), *Lysimachia terrestris* (earth loosestrife), *Sphagnum* (sphagnum) spp., and *Hypericum kalmianum* (Kalm's St. Johnswort). They usually have low ericad cover (*Chamaedaphne calyculata* (leatherleaf), *Vaccinium oxycoccos* (small cranberry)) (Eric Epstein pers. comm. 1999). The type may be thought of as a counterpart to the central tamarack poor swamps. Finally, this type may overlap with the prairie transition rich fen *Carex lasiocarpa - Calamagrostis* spp. - (*Eleocharis rostellata* (beaked spikerush)) Herbaceous Vegetation (CEGL002383).

Global Similar Associations:
- *(Carex oligosperma) - Carex lasiocarpa - (Carex michauxiana) - Rhynchospora alba* Herbaceous Vegetation (CEGL002547)
- *Betula pumila / Chamaedaphne calyculata / Carex lasiocarpa* Shrubland (CEGL002494) This is the poor shrub fen equivalent.
- *Carex lasiocarpa - Calamagrostis* spp. - (*Eleocharis rostellata*) Herbaceous Vegetation (CEGL002383) This is a prairie transition rich fen.
- *Carex lasiocarpa - Carex buxbaumii - Trichophorum caespitosum* Boreal Herbaceous Vegetation (CEGL002500) This is the boreal rich fen.
- *Carex oligosperma - Carex pauciflora - Eriophorum vaginatum / Sphagnum* spp. Herbaceous Vegetation (CEGL005256) This is a graminoid bog type, more acidic.
- *Dasiphora fruticosa* ssp. *floribunda / Carex sterilis - Andropogon gerardii - Arnoglossum plantagineum* Shrub Herbaceous Vegetation (CEGL005139) This is a rich prairie calcareous seepage fen.

Global Related Concepts:
- Poor Fen Sedge Subtype (MNNHP 1993) =
- Poor Fen Sedge Subtype (Faber-Langendoen 2001) =
- Sphagnum lawn poor fen, flark? (Glaser 1992b) **?**
- poor fen: ericaceous shrub / wire sedge / *Sphagnum* (W20) (Harris et al. 1996) **>**

ELEMENT DISTRIBUTION

Global Range: This graminoid poor fen community is found in the Great Lakes region of the United States and Canada, as well as elsewhere in central Canada, ranging from Ontario to Manitoba, south to Iowa, and east to Illinois.
Nations: CA, US
States/Provinces: IA:S1, IL?, MB:SU, MI, MN, ND:S1, ON, QC, WI:S3
TNC Ecoregions: 34:C, 35:C, 36:C, 46:C, 47:C, 48:C
USFS Ecoregions (1994/95): 212Hh:CCP, 212Hi:CCC, 212Hj:CCP, 212Hp:CCC, 212Hq:CCC, 212Hu:CCP, 212Hv:CCP, 212Hy:CCC, 212Ja:CCP, 212Jc:CCC, 212Jd:CCC, 212Jf:CCP, 212Jg:CCC, 212Jj:CCC, 212Jl:CCC, 212Jm:CCC, 212Ka:CCC, 212Kb:CCC, 212La:CCC, 212Lc:CCP, 212Ma:CPP, 212Mb:CPP, 212Na:CCC, 212Nb:CCC, 212Nc:CCC, 212Nd:CCP, 222Ka:CCC, 222Kd:CCC, 222Kf:CCC, 222Ma:CCC, 222Mc:CCC, 222Me:CCC, 251Be:CCC, 251Cf:CCC
Federal Lands: NPS (Isle Royale, Pictured Rocks, Saint Croix, Voyageurs); USFS (Chequamegon, Chequamegon-Nicolet, Chippewa, Hiawatha, Huron, Huron-Manistee, Manistee, Nicolet, Ottawa?, Superior?)

ELEMENT SOURCES

Saint Croix National Scenic Riverway Map Code: HSP
Saint Croix National Scenic Riverway Plots: SACN.96, SACN.119, SACN.7486, SACN.7498.
Local Description Authors: M.J. Russo
Global Description Authors: D. Faber-Langendoen

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References: Chapman et al. 1989, Faber-Langendoen 2001, Glaser 1992b, Greenall 1996, Harris et al. 1996, Hop et al. 2010c, INAI unpubl. data, MNNHP 1993, Midwestern Ecology Working Group n.d., NDNHI unpubl. data, TNC 1999b, WNHIP unpubl. data

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Leatherleaf Poor Fen

***Chamaedaphne calyculata / Carex oligosperma / Sphagnum* spp. Poor Fen Dwarf-shrubland**
Leatherleaf / Few-seed Sedge / Peatmoss species Poor Fen Dwarf-shrubland
Identifier: CEGL005277

NVC CLASSIFICATION

Division	North American Bog & Fen (2.C.4.Na)
Macrogroup	North American Boreal Bog & Fen (M062)
Group	Eastern North American Boreal Acidic Bog & Poor Fen (G386)
Association (Common name)	Leatherleaf Poor Fen

ELEMENT CONCEPT

Global Summary: This dwarf-shrub poor fen community is found in the northern Great Lakes region and across much of central Canada. Sites are found on peatlands with low exposure to mineral-rich groundwater, including basin fens, shores above the level of seasonal flooding, and margins of larger peatlands. Stands have a saturated hydrology with a fibric *Sphagnum* (sphagnum) spp. peat soil and a pH usually <4.5. Vegetation is dominated by an open dwarf-shrub/scrub conifer layer with very scattered trees (<10% cover). Microtopography is high to intermediate hummocks with hollows or a flat lawn of *Sphagnum* (sphagnum) spp. Ericaceous dwarf-shrubs are dominant, including *Chamaedaphne calyculata* (leatherleaf), *Kalmia polifolia* (bog laurel), and *Ledum groenlandicum* (bog Labrador-tea), and the creeping dwarf-shrubs *Andromeda polifolia* (bog rosemary) and *Vaccinium oxycoccos* (small cranberry). *Betula pumila* (bog birch) has low cover but is fairly constant. Scrub conifers include *Larix laricina* (tamarack) and *Picea mariana* (black spruce). They also occur as scattered trees (>3 m). The herb layer is species-poor, containing *Carex oligosperma* (fewseed sedge), *Carex limosa* (mud sedge), *Equisetum fluviatile* (water horsetail), *Menyanthes trifoliata* (buckbean), *Sarracenia purpurea* (purple pitcherplant), and *Scheuchzeria palustris* (rannoch-rush). The moss layer forms a continuous hummocky mat dominated by *Sphagnum angustifolium* (sphagnum), *Sphagnum fuscum* (sphagnum), and *Sphagnum magellanicum* (Magellan's sphagnum). Diagnostic features include the dominance of a dwarf-shrub ericaceous layer, absence of a tree layer (<10%), species-poor herbaceous layer, and a low abundance of minerotrophic indicators, such as *Betula pumila* (bog birch), *Carex aquatilis* (water sedge) and *Carex stricta* (upright sedge).

ENVIRONMENTAL DESCRIPTION

Saint Croix National Scenic Riverway Environment: This leatherleaf shrubland was sampled at six locations in the park. Sites are flat depressions and bogs with very poorly drained peat soils that may be seasonally flooded. the ground surface is dominated by mosses (up to 90% cover), with some leaf litter, wood, and dead plant stems. No evidence of disturbance was reported.
Global Environment: Sites are found on peatlands with low exposure to mineral-rich groundwater, including basin fens, shores above the level of seasonal flooding, and margins of larger peatlands. Stands have a saturated hydrology with a fibric *Sphagnum* (sphagnum) spp. peat soil and a pH usually <4.5. (Harris et al. 1996).

VEGETATION DESCRIPTION

Saint Croix National Scenic Riverway Vegetation: The sparse to very dense (20-90%) short-shrub layer (0.5-2 m tall) is dominated by *Chamaedaphne calyculata* (leatherleaf); additional shrubs may include *Andromeda polifolia* var. *glaucophylla* (bog rosemary), *Kalmia polifolia* (bog laurel), *Spiraea tomentosa* (steeplebush), and others. *Ledum groenlandicum* (bog Labrador-tea), *Vaccinium angustifolium* (lowbush blueberry) and *Vaccinium oxycoccos* (small cranberry) may form a very sparse (<5%) dwarf-shrub layer. The sparse to very dense (20-90%) herbaceous layer may be dominated by *Carex oligosperma* (fewseed sedge) and/or *Eriophorum vaginatum* var. *spissum* (tussock cottongrass) and include small amounts of *Carex chordorrhiza* (creeping sedge), *Comarum palustre* (purple marshlocks), *Maianthemum trifolium* (threeleaf false lily of the valley), *Menyanthes trifoliata* (buckbean), *Thelypteris palustris* (eastern marsh fern), and insectivores *Drosera rotundifolia* (roundleaf sundew) and *Sarracenia purpurea* (purple pitcherplant). Nonvascular species (sphagnum and other mosses) cover up to 90% of the ground surface.
Global Vegetation: The vegetation is dominated by an open dwarf-shrub/scrub conifer layer with very scattered trees (<10% cover). Microtopography is high to intermediate hummocks with hollows or a flat lawn of *Sphagnum* (sphagnum) spp. Ericaceous dwarf-shrubs are dominant, including *Chamaedaphne calyculata* (leatherleaf), *Kalmia polifolia* (bog laurel), and *Ledum groenlandicum* (bog Labrador-tea), and the creeping dwarf-shrubs *Andromeda polifolia* (bog rosemary) and *Vaccinium oxycoccos* (small cranberry). *Betula pumila* (bog birch) has low cover but is fairly constant. Scrub conifers include *Larix laricina* (tamarack) and *Picea mariana* (black spruce). They also occur as scattered trees (>3 m). The herb layer is species-poor, containing *Carex oligosperma* (fewseed sedge), *Carex limosa* (mud sedge), *Equisetum fluviatile* (water horsetail), *Menyanthes trifoliata* (buckbean), *Sarracenia purpurea* (purple pitcherplant), and *Scheuchzeria palustris* (rannoch-rush). Minerotrophic indicators include *Carex aquatilis* (water sedge), *Carex rostrata* (beaked sedge), and *Carex stricta* (upright sedge). The moss layer forms a continuous hummocky mat dominated by *Sphagnum angustifolium* (sphagnum), *Sphagnum fuscum* (sphagnum), and *Sphagnum magellanicum* (Magellan's sphagnum) (Harris et al. 1996).

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MOST ABUNDANT SPECIES

Saint Croix National Scenic Riverway

Stratum	Lifeform	Species
Short shrub/sapling	Dwarf-shrub	*Chamaedaphne calyculata* (leatherleaf), *Ledum groenlandicum* (bog Labrador-tea)
Herb (field)	Graminoid	*Carex oligosperma* (fewseed sedge), *Carex utriculata* (Northwest Territory sedge), *Eriophorum vaginatum* var. *spissum* (tussock cottongrass)

CHARACTERISTIC SPECIES

Saint Croix National Scenic Riverway: *Carex oligosperma* (fewseed sedge), *Carex utriculata* (Northwest Territory sedge), *Chamaedaphne calyculata* (leatherleaf), *Eriophorum vaginatum* var. *spissum* (tussock cottongrass), *Ledum groenlandicum* (bog Labrador-tea)

CONSERVATION STATUS RANK

Global Rank & Reasons: G5 (29-Mar-2000).

CLASSIFICATION

Status: Standard

Classification Confidence: 2 - Moderate

Global Comments: It is difficult to distinguish this leatherleaf poor fen from leatherleaf bogs in the field, but conceptually this type has somewhat more minerotrophic influence and a corresponding set of minerotrophic indicators. When minerotrophic indicators are absent or "very low", the type is placed in *Chamaedaphne calyculata - Ledum groenlandicum - Kalmia polifolia* Bog Dwarf-shrubland (CEGL005278) (Harris et al. 1996). Stands with sparse black spruce-tamarack layer (<10% tree cover) are part of this type. Stands with 10-25% black spruce and tamarack cover are placed in black spruce/leatherleaf semi-treed bog, *Picea mariana / Chamaedaphne calyculata / Sphagnum* spp. Dwarf-shrubland (CEGL005218). This type also overlaps closely with a "scrubby poor fen type" *Larix laricina / Chamaedaphne calyculata / Carex lasiocarpa* Shrubland (CEGL005226). There are intermediates between this poor fen and sedge meadows, such as when *Sphagnum* (sphagnum) spp. and *Chamaedaphne calyculata* (leatherleaf) have invaded a *Carex rostrata* (beaked sedge) meadow and the *Carex rostrata* (beaked sedge) is hanging on because it still has deep rooting in the underlying minerotrophic peat or mineral soil (N. Aaseng pers. comm. 2000).

Global Similar Associations:

- *Betula pumila / Chamaedaphne calyculata / Carex lasiocarpa* Shrubland (CEGL002494)
- *Carex oligosperma - Carex pauciflora - Eriophorum vaginatum / Sphagnum* spp. Herbaceous Vegetation (CEGL005256)
- *Chamaedaphne calyculata - Ledum groenlandicum - Kalmia polifolia* Bog Dwarf-shrubland (CEGL005278)
- *Chamaedaphne calyculata - Myrica gale / Carex lasiocarpa* Dwarf-shrubland (CEGL005228)
- *Chamaedaphne calyculata / Carex oligosperma - Eriophorum virginicum* Dwarf-shrubland (CEGL005092)
- *Chamaedaphne calyculata / Carex oligosperma / Sphagnum* spp. Dwarf-shrubland (CEGL005091) This type can form in seepy areas of "burned out" bogs.
- *Chamaedaphne calyculata / Eriophorum virginicum / Sphagnum rubellum* Dwarf-shrubland (CEGL006513)
- *Picea mariana / Chamaedaphne calyculata / Sphagnum* spp. Dwarf-shrubland (CEGL005218) This type is a leatherleaf bog with a scattered tree layer (10-25%), or muskeg.

Global Related Concepts:

- Bog (Chapman et al. 1989) >
- Open Bog Leatherleaf Subtype (Faber-Langendoen 2001) =
- Open Sphagnum Bog Intermediate Subtype (MNNHP 1993) =
- Poor fen: black spruce - tamarack / ericaceous shrub / Sphagnum (W22) (Harris et al. 1996) <
- Poor fen: ericaceous shrub / Sphagnum (W21) (Harris et al. 1996) <

ELEMENT DISTRIBUTION

Global Range: This dwarf-shrub poor fen community is found in the northern Great Lakes region and across much of central Canada, ranging from the eastern lake states west to Minnesota, and northward from Quebec to Manitoba and other parts of Canada.

Nations: CA, US

States/Provinces: MI, MN:S4, ON, QC:S3S4, WI:S4

TNC Ecoregions: 46:?, 47:C, 48:C, 64:C

USFS Ecoregions (1994/95): 212Hi:CCC, 212Ho:CCC, 212Hw:CCC, 212Ia:CCC, 212J:CC, 212K:CC, 212L:CC, 212M:CP, 212N:CP, 212O:CC, 212P:CC, 222J:C?, 222K:C?

Federal Lands: NPS (Apostle Islands, Isle Royale, Pictured Rocks, Saint Croix, Sleeping Bear Dunes, Voyageurs); USFS (Chequamegon, Chequamegon-Nicolet, Chippewa, Hiawatha, Huron, Huron-Manistee, Manistee, Nicolet, Ottawa, Superior)

ELEMENT SOURCES

Saint Croix National Scenic Riverway Map Code: DLF

Saint Croix National Scenic Riverway Plots: SACN.238, SACN.0168, SACN.0489, SACN.4711, SACN.4725, SACN.7484.

Local Description Authors: M.J. Russo

Global Description Authors: D. Faber-Langendoen

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References: Chapman et al. 1989, Faber-Langendoen 2001, Harris et al. 1996, Hop et al. 2010a, Hop et al. 2010c, MNNHP 1993, Midwestern Ecology Working Group n.d., TNC 1999b, WNHIP unpubl. Data

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Tamarack Scrub Poor Fen

***Larix laricina / Chamaedaphne calyculata / Carex lasiocarpa* Shrubland**
Tamarack / Leatherleaf / Woolly-fruit Sedge Shrubland
Identifier: CEGL005226

NVC CLASSIFICATION

Division	North American Bog & Fen (2.C.4.Na)
Macrogroup	North American Boreal Bog & Fen (M062)
Group	Eastern North American Boreal Acidic Bog & Poor Fen (G386)
Association (Common name)	Tamarack Scrub Poor Fen

ELEMENT CONCEPT

Global Summary: This tamarack / ericaceous scrub poor fen is found in the northern Great Lakes region of the United States and into central Canada. Stands occur on peatlands with low exposure to minerotrophic groundwater including basin fens, shores above the level of the seasonal flooding, and larger peatlands. The water regime is saturated, and the substrate is fibric to mesic peat. The microtopography is low to intermediate hummocks with hollows. The vegetation is an open fen dominated by ericaceous shrubs, sedges, and *Sphagnum* (sphagnum) spp. The scattered tree layer of *Larix laricina* (tamarack) and *Picea mariana* (black spruce) >2 m is less than 10%. The low-shrub layer is dominated by *Betula pumila* (bog birch), *Chamaedaphne calyculata* (leatherleaf), *Larix laricina* (tamarack), *Salix discolor* (pussy willow), and *Salix pedicellaris* (bog willow). The herb layer is somewhat low in diversity, with graminoids including the dominant *Carex lasiocarpa* (woollyfruit sedge), as well as *Carex chordorrhiza* (creeping sedge) and *Carex limosa* (mud sedge). *Carex oligosperma* (fewseed sedge) may also occur. Forbs include *Sarracenia purpurea* (purple pitcherplant), *Maianthemum trifolium* (threeleaf false lily of the valley), and *Menyanthes trifoliata* (buckbean). Mosses include *Sphagnum capillifolium* (sphagnum), *Sphagnum fuscum* (sphagnum) and *Sphagnum magellanicum* (Magellan's sphagnum). Diagnostic features include the ericaceous and tree scrub cover, the somewhat lower species diversity compared to richer fens, and *Carex lasiocarpa* (woollyfruit sedge) more common than *Carex oligosperma* (fewseed sedge).

ENVIRONMENTAL DESCRIPTION

Saint Croix National Scenic Riverway Environment: This tamarack / leatherleaf swamp shrubland was sampled once in the park near Namekagon Lake Dam. The site is a flat depression with very poorly drained, saturated peat soil and mossy hummocks. The ground surface is dominated by mosses (70% cover) with some leaf litter (25%) and bare soil (5%). No evidence of disturbance was reported.

Global Environment: Stands occur on peatlands with low exposure to minerotrophic groundwater including basin fens, shores above the level of the seasonal flooding, and larger peatlands. The water regime is saturated, and the substrate is fibric to mesic peat. The microtopography is low to intermediate hummocks with hollows (Harris et al. 1996).

VEGETATION DESCRIPTION

Saint Croix National Scenic Riverway Vegetation: *Larix laricina* (tamarack) forms a very sparse (10% cover) tall-shrub layer (2-5 m tall). The sparse (20%) short-shrub layer (0.5-1 m) is made up of *Alnus incana* (gray alder), *Betula pumila* (bog birch), *Larix laricina* (tamarack), *Photinia melanocarpa* (black chokeberry), and *Spiraea alba* (white meadowsweet). *Andromeda polifolia* var. *glaucophylla* (bog rosemary), *Chamaedaphne calyculata* (leatherleaf), *Ledum groenlandicum* (bog Labrador-tea), and *Vaccinium oxycoccos* (small cranberry) form a sparse (30%) dwarf-shrub layer. The sparse (20%) herbaceous layer includes *Carex pauciflora* (fewflower sedge), *Comarum palustre* (purple marshlocks), *Drosera rotundifolia* (roundleaf sundew), *Equisetum arvense* (field horsetail), *Iris versicolor* (harlequin blueflag), *Lysimachia terrestris* (earth loosestrife), *Maianthemum trifolium* (threeleaf false lily of the valley), *Menyanthes trifoliata* (buckbean), and *Osmunda regalis* (royal fern). Nonvascular species (sphagnum mosses) cover 70% of the ground surface.

Global Vegetation: The vegetation is an open fen dominated by ericaceous shrubs, sedges, and *Sphagnum* (sphagnum). The scattered tree layer of *Larix laricina* (tamarack) and *Picea mariana* (black spruce) >2 m is less than 10%. The low-shrub layer is dominated by *Betula pumila* (bog birch), *Chamaedaphne calyculata* (leatherleaf), *Larix laricina* (tamarack), *Salix discolor* (pussy willow), and *Salix pedicellaris* (bog willow). The herb layer is somewhat low in diversity, with graminoids including the dominant *Carex lasiocarpa* (woollyfruit sedge), as well as *Carex chordorrhiza* (creeping sedge) and *Carex limosa* (mud sedge). *Carex oligosperma* (fewseed sedge) may also occur. Forbs include *Sarracenia purpurea* (purple pitcherplant), *Maianthemum trifolium* (threeleaf false lily of the valley), and *Menyanthes trifoliata* (buckbean). Mosses include *Sphagnum capillifolium* (sphagnum), *Sphagnum fuscum* (sphagnum) and *Sphagnum magellanicum* (Magellan's sphagnum). Diagnostic features include the ericaceous and tree scrub cover, the somewhat lower species diversity compared to richer fen, and *Carex lasiocarpa* (woollyfruit sedge) more common than *Carex oligosperma* (fewseed sedge) (Harris et al. 1996).

MOST ABUNDANT SPECIES

Saint Croix National Scenic Riverway

Stratum	Lifeform	Species
Short shrub/sapling	Dwarf-shrub	*Ledum groenlandicum* (bog Labrador-tea)

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CHARACTERISTIC SPECIES

Saint Croix National Scenic Riverway: *Andromeda polifolia* var. *glaucophylla* (bog rosemary), *Betula pumila* (bog birch), *Chamaedaphne calyculata* (leatherleaf), *Iris versicolor* (harlequin blueflag), *Larix laricina* (tamarack), *Ledum groenlandicum* (bog Labrador-tea)

CONSERVATION STATUS RANK

Global Rank & Reasons: G4G5 (24-Mar-2000). Type is expected to be common in Canada.

CLASSIFICATION

Status: Standard
Classification Confidence: 2 - Moderate
Global Comments: Type concept is that of a scrub poor fen, where tree height does not exceed 2 m, as defined by the MNNHP type - poor fen, scrub tamarack subtype (MNNHP 1993), and the poor fen type (W20) in Harris et al. (1996) (with perhaps some elements of W22). Rangewide review is still needed. The type is similar to the Bog Birch - Leatherleaf Rich Fen, *Betula pumila / Chamaedaphne calyculata / Carex lasiocarpa* Shrubland (CEGL002494), but is less rich, and contains substantially more minerotrophic indicators when compared to the Leatherleaf Poor Fen, *Chamaedaphne calyculata - Ledum groenlandicum - Kalmia polifolia* Bog Dwarf-shrubland (CEGL005278).
Global Similar Associations:
- *Betula pumila / Chamaedaphne calyculata / Carex lasiocarpa* Shrubland (CEGL002494)
- *Chamaedaphne calyculata - Ledum groenlandicum - Kalmia polifolia* Bog Dwarf-shrubland (CEGL005278)

Global Related Concepts:
- Muskeg Poor Fen Scrub Subtype (Faber-Langendoen 2001) =
- Poor Fen Scrub Tamarack Subtype (MNNHP 1993) =
- poor fen: ericaceous shrub / wire sedge / *Sphagnum* (W20) (Harris et al. 1996) =

ELEMENT DISTRIBUTION

Global Range: This tamarack and ericaceous scrub poor fen is found in the northern Great Lakes region of the United States and into central Canada, ranging from Minnesota into Ontario and elsewhere in Canada.
Nations: CA, US
States/Provinces: MI, MN:S4, ON, QC, WI
TNC Ecoregions: 47:C
USFS Ecoregions (1994/95): 212La:CCC
Federal Lands: NPS (Saint Croix, Voyageurs)

ELEMENT SOURCES

Saint Croix National Scenic Riverway Map Code: STS
Saint Croix National Scenic Riverway Plots: SACN.249.
Local Description Authors: M.J. Russo
Global Description Authors: D. Faber-Langendoen
References: Faber-Langendoen 2001, Harris et al. 1996, MNNHP 1993, Midwestern Ecology Working Group n.d., WNHIP unpubl. data

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G185. Eastern North American Boreal Alkaline Fen

Woolly-fruit Sedge Shore Fen

***Carex lasiocarpa - (Carex rostrata) - Equisetum fluviatile* Herbaceous Vegetation**
Woolly-fruit Sedge - (Beaked Sedge) - Water Horsetail Herbaceous Vegetation
Identifier: CEGL005229

NVC CLASSIFICATION

Division	North American Bog & Fen (2.C.4.Na)
Macrogroup	North American Boreal Bog & Fen (M062)
Group	Eastern North American Boreal Alkaline Fen (G185)
Association (Common name)	Woolly-fruit Sedge Shore Fen

ELEMENT CONCEPT

Global Summary: This community is found typically on floating (or occasionally grounded) mats on the edges of lakes and streams in the Great Lakes region of the United States and Canada. Lakes and streams have low wave and current energy and seasonally flood the mat. Permanent surface pools and small hummocks with *Sphagnum* (sphagnum) spp. and ericaceous shrubs may be present. The substrate is a mat of fibric to mesic peat held together by roots and rhizomes. Graminoids dominate the stand, with shrub cover typically much less than 25%. *Myrica gale* (sweetgale) can be among the more common shrubs. The graminoid *Carex lasiocarpa* (woollyfruit sedge) can form extensive "lawns." Other herbaceous species present include *Carex rostrata* (beaked sedge), *Eleocharis elliptica* (elliptic spikerush), *Equisetum fluviatile* (water horsetail), *Comarum palustre* (purple marshlocks), *Rhynchospora alba* (white beaksedge), *Triadenum fraseri* (Fraser's marsh St. Johnswort), *Utricularia intermedia* (flatleaf bladderwort), and *Utricularia minor* (lesser bladderwort). *Menyanthes trifoliata* (buckbean) can occur at high cover, especially at the outer edge of the floating mat.

ENVIRONMENTAL DESCRIPTION

Saint Croix National Scenic Riverway Environment: This wiregrass sedge shore fen community was sampled at five locations in the park. Sites are small fens and wetland meadows with peat or muck soils. No other environmental data were provided.
Global Environment: This community is found typically on floating (or occasionally grounded) mats on the edges of lakes and streams. Lakes and streams have low wave and current energy and seasonally flood the mat. Permanent surface pools and small hummocks with *Sphagnum* (sphagnum) spp. and ericaceous shrubs may be present. The substrate is a mat of fibric to mesic peat held together by roots and rhizomes.

VEGETATION DESCRIPTION

Saint Croix National Scenic Riverway Vegetation: The herbaceous layer defines this community. However, there may also be a sparse to moderate shrub layer that could include *Alnus incana* (gray alder), *Betula pumila* var. *glandulifera* (bog birch), *Cornus sericea* ssp. *sericea* (red-osier dogwood), *Salix discolor* (pussy willow), *Salix pedicellaris* (bog willow), *Salix petiolaris* (meadow willow), *Spiraea alba* (white meadowsweet), and/or *Spiraea tomentosa* (steeplebush). The herbaceous layer is dominated by *Carex lasiocarpa* (woollyfruit sedge); additional common and/or abundant species include *Calamagrostis canadensis* (bluejoint), *Campanula aparinoides* (marsh bellflower), *Carex chordorrhiza* (creeping sedge), *Carex diandra* (lesser panicled sedge), *Carex lacustris* (hairy sedge), *Carex utriculata* (Northwest Territory sedge), *Comarum palustre* (purple marshlocks), *Equisetum fluviatile* (water horsetail), *Iris versicolor* (harlequin blueflag), *Lysimachia thyrsiflora* (tufted loosestrife), *Polygonum sagittatum* (arrowleaf tearthumb), *Rumex orbiculatus* (greater water dock), *Thelypteris palustris* (eastern marsh fern), *Triadenum fraseri* (Fraser's marsh St. Johnswort), *Typha latifolia* (broadleaf cattail), and *Utricularia intermedia* (flatleaf bladderwort). Nonvascular species (sphagnum mosses) cover up to 15% of the ground surface. In addition, this community may support Wisconsin state-critically imperiled and Minnesota state-vulnerable *Salix pellita* (satiny willow).
Global Vegetation: Graminoids dominate the stand, with shrub cover typically much less than 25%. *Myrica gale* (sweetgale) can be among the more common shrubs. The graminoid *Carex lasiocarpa* (woollyfruit sedge) can form extensive 'lawns.' Other herbaceous species present include *Carex rostrata* (beaked sedge), *Eleocharis elliptica* (elliptic spikerush), *Equisetum fluviatile* (water horsetail), *Comarum palustre* (purple marshlocks), *Rhynchospora alba* (white beaksedge), *Triadenum fraseri* (Fraser's marsh St. Johnswort), *Utricularia intermedia* (flatleaf bladderwort), and *Utricularia minor* (lesser bladderwort). *Menyanthes trifoliata* (buckbean) can occur at high cover, especially at the outer edge of the floating mat (Harris et al. 1996).

MOST ABUNDANT SPECIES

Saint Croix National Scenic Riverway

Stratum	Lifeform	Species
Tall shrub/sapling	Broad-leaved deciduous shrub	*Alnus incana* (gray alder), *Betula pumila* var. *glandulifera* (bog birch), *Salix pedicellaris* (bog willow), *Salix petiolaris* (meadow willow), *Spiraea alba* (white meadowsweet), *Spiraea tomentosa* (steeplebush)
Herb (field)	Forb	*Comarum palustre* (purple marshlocks), *Lysimachia thyrsiflora* (tufted loosestrife), *Utricularia intermedia* (flatleaf bladderwort)
Herb (field)	Graminoid	*Calamagrostis canadensis* (bluejoint), *Carex lasiocarpa* (woollyfruit sedge), *Typha latifolia* (broadleaf cattail)

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CHARACTERISTIC SPECIES

Saint Croix National Scenic Riverway: *Alnus incana* (gray alder), *Betula pumila* var. *glandulifera* (bog birch), *Calamagrostis canadensis* (bluejoint), *Carex lasiocarpa* (woollyfruit sedge), *Comarum palustre* (purple marshlocks), *Lysimachia thyrsiflora* (tufted loosestrife), *Salix pedicellaris* (bog willow), *Salix petiolaris* (meadow willow), *Spiraea alba* (white meadowsweet), *Spiraea tomentosa* (steeplebush), *Typha latifolia* (broadleaf cattail), *Utricularia intermedia* (flatleaf bladderwort)

OTHER NOTEWORTHY SPECIES

Saint Croix National Scenic Riverway: Vulnerable: *Salix pellita* (satiny willow, WI state-critically imperiled & MN state-vulnerable, G5)

CONSERVATION STATUS RANK

Global Rank & Reasons: GNR (1-Dec-1997).

CLASSIFICATION

Status: Standard
Classification Confidence: 2 - Moderate
Global Comments: This type is wetter than low shrub shore fen, *Chamaedaphne calyculata - Myrica gale / Carex lasiocarpa* Dwarf-shrubland (CEGL005228), and has structural similarities to bluejoint meadows, but the mat tends to float and the surface is less frequently flooded (Harris et al. 1996). Shore fens may also resemble Narrow-leaf Sedge Organic meadow marshes in Ontario and the concept of shore fen has not been standardized across the province yet (W. Bakowsky pers. comm. 1999). In the Great Lakes shore fens, a more nutrient-rich type has been described separately, *Calamagrostis canadensis - Carex viridula - Cladium mariscoides - Lobelia kalmii* Herbaceous Vegetation (CEGL005115).
Global Similar Associations:
- *Calamagrostis canadensis - Carex viridula - Cladium mariscoides - Lobelia kalmii* Herbaceous Vegetation (CEGL005115) is a rich graminoid shore fen in the Great Lakes, and may not typically have *Carex lasiocarpa*.
- *Carex lasiocarpa - Calamagrostis* spp. - (*Eleocharis rostellata*) Herbaceous Vegetation (CEGL002383)
- *Carex lasiocarpa* Herbaceous Vegetation (CEGL001810)
- *Chamaedaphne calyculata - Myrica gale / Carex lasiocarpa* Dwarf-shrubland (CEGL005228)
- *Dasiphora fruticosa* ssp. *floribunda - Myrica gale* Rich Shore Fen Shrubland (CEGL005275) is a rich shrub shore fen in the Great Lakes region.

Global Related Concepts:
- Northern Rich Fen (Chapman et al. 1989) **?**
- Open graminoid shore fen: wire sedge (W14) (Harris et al. 1996) **=**
- Rich Fen (Boreal Section) (MNNHP 1993) **>**
- Shore Fen Graminoid Subtype (Faber-Langendoen 2001) **=**

ELEMENT DISTRIBUTION

Global Range: This community is found typically on floating (or occasionally grounded) mats on the edges of lakes and streams in the Great Lakes region of the United States and Canada. It ranges from northern Minnesota and adjacent Ontario eastward to localized areas of Michigan and New York. In New York, one site (Deer Creek) is known along the shores of eastern Lake Ontario.
Nations: CA, US
States/Provinces: MI, MN, NY, ON, QC, WI:S3
TNC Ecoregions: 47:C, 48:C, 64:C
USFS Ecoregions (1994/95): 212Hi:CCC, 212Ho:CCC, 212Hw:CCC, 212La:CCC, 222Ie:CCC
Federal Lands: NPS (Apostle Islands, Pictured Rocks, Saint Croix, Sleeping Bear Dunes, Voyageurs)

ELEMENT SOURCES

Saint Croix National Scenic Riverway Map Code: HSS
Saint Croix National Scenic Riverway Plots: SACN.4097, SACN.4099, SACN.4101, SACN.4699, SACN.5064.
Local Description Authors: M.J. Russo
Global Description Authors: D. Faber-Langendoen
References: Chapman et al. 1989, Edinger et al. 2002, Faber-Langendoen 2001, Harris et al. 1996, Hop et al. 2010a, Hop et al. 2010c, MNNHP 1993, Midwestern Ecology Working Group n.d., WNHIP unpubl. data

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Leatherleaf - Sweetgale Shore Fen

***Chamaedaphne calyculata - Myrica gale / Carex lasiocarpa* Dwarf-shrubland**
Leatherleaf - Sweetgale / Woolly-fruit Sedge Dwarf-shrubland
Identifier: CEGL005228

NVC CLASSIFICATION

Division	North American Bog & Fen (2.C.4.Na)
Macrogroup	North American Boreal Bog & Fen (M062)
Group	Eastern North American Boreal Alkaline Fen (G185)
Association (Common name)	Leatherleaf - Sweetgale Shore Fen

ELEMENT CONCEPT

Global Summary: This leatherleaf - sweetgale dwarf-shrubland is typically found on floating mats on the edges of lakes and streams in the Great Lakes region of the United States and Canada. Stands occur where there is low wave and current energy with seasonal flooding. Hummocks with *Sphagnum* (sphagnum) spp. and ericaceous shrubs are often present but small in area. Shallow surface pools of water may persist throughout the growing season. Low shrubs dominate the stands, generally with over 60%. Dominant species include *Chamaedaphne calyculata* (leatherleaf) and *Myrica gale* (sweetgale). *Salix pedicellaris* (bog willow) is often present. The herbaceous layer is variable in cover and composition, sometimes shaded out by the heavy shrub cover. Species include *Calamagrostis canadensis* (bluejoint), *Carex aquatilis* (water sedge), *Carex lasiocarpa* (woollyfruit sedge), *Carex rostrata* (beaked sedge), and *Comarum palustre* (purple marshlocks). Diagnostic features of the type are high cover of *Chamaedaphne calyculata* (leatherleaf) with one or more of the following minerotrophic species present: *Myrica gale* (sweetgale), *Betula pumila* (bog birch), *Salix* (willow) spp., *Carex lacustris* (hairy sedge), *Carex lasiocarpa* (woollyfruit sedge), *Typha latifolia* (broadleaf cattail), *Calamagrostis canadensis* (bluejoint), and *Iris versicolor* (harlequin blueflag).

ENVIRONMENTAL DESCRIPTION

Saint Croix National Scenic Riverway Environment: This association is found on the edge of lakes and streams, usually on floating mats. Sites are in low-energy water with seasonal flooding.
Global Environment: This community is typically found on floating mats on the edges of lakes and streams. Stands occur where there is low wave and current energy, and where seasonal flooding may be expected (Harris et al. 1996). Seasonal flooding apparently tends to produce somewhat intermediate nutrient conditions, but depending on degree of flooding and water chemistry, individual stands may vary from moderately poor to moderately rich.

VEGETATION DESCRIPTION

Saint Croix National Scenic Riverway Vegetation: This association is dominated by a low shrub canopy dominated by *Myrica gale* (sweetgale) and *Chamaedaphne calyculata* (leatherleaf) and small to moderate amounts of *Alnus incana* (gray alder). Shrub cover can be moderate to dense. The herbaceous strata is varied but typically contains *Carex* spp. (sedges) including *C. lacustris* (hairy sedge), *C. lasiocarpa* (woolyfruit sedge), *C. oligosperma* (few-seeded sedge), and *C. utriculata* (Northwest Territory sedge), and other fen species such as *Eriophorum virginicum* (tawny cottongrass) *Sarracenia purpurea* (purple pitcherplant).
Global Vegetation: Hummocks with *Sphagnum* (sphagnum) spp. and ericaceous shrubs are often present, but small in area. Shallow surface pools of water may persist throughout the growing season. Low shrubs dominate the stands, generally over 60%. Dominant species include *Chamaedaphne calyculata* (leatherleaf) and *Myrica gale* (sweetgale). *Salix pedicellaris* (bog willow) is often present. The herbaceous layer is variable in cover and composition, sometimes shaded out by the heavy shrub cover. Species include *Calamagrostis canadensis* (bluejoint), *Carex aquatilis* (water sedge), *Carex lasiocarpa* (woollyfruit sedge), *Carex rostrata* (beaked sedge), and *Comarum palustre* (purple marshlocks). Diagnostic features of the type are high cover of *Chamaedaphne calyculata* (leatherleaf) with one or more of the following minerotrophic species present: *Myrica gale* (sweetgale), *Betula pumila* (bog birch), *Salix* (willow) spp., *Carex lacustris* (hairy sedge), *Carex lasiocarpa* (woollyfruit sedge), *Typha latifolia* (broadleaf cattail), *Calamagrostis canadensis* (bluejoint), and *Iris versicolor* (harlequin blueflag) (Harris et al. 1996).

MOST ABUNDANT SPECIES

Saint Croix National Scenic Riverway

Stratum	Lifeform	Species
Short shrub/sapling	Broad-leaved deciduous shrub	Myrica gale (sweetgale), *Alnus incana* (gray alder)
Short shrub/sapling	Dwarf-shrub	*Chamaedaphne calyculata* (leatherleaf)
Herb (field)	Graminoid	*Carex lacustris* (hairy sedge), *Carex lasiocarpa* (woolyfruit sedge), *Carex oligosperma* (few-seeded sedge), and *Carex utriculata* (Northwest Territory sedge)

OTHER NOTEWORTHY SPECIES

Global: Vulnerable: *Iris lacustris* (dwarf lake iris, Federally listed threatened, G3)

CONSERVATION STATUS RANK

Global Rank & Reasons: G4G5 (24-Mar-2000). Type is expected to be fairly common in Canada.

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CLASSIFICATION

Status: Standard
Classification Confidence: 2 - Moderate
Global Comments: Diagnostic features of the type are high cover of *Chamaedaphne calyculata* (leatherleaf) with one or more of the following minerotrophic species present: *Myrica gale* (sweetgale), *Betula pumila* var. *glandulifera* (bog birch), *Salix* (willow) spp., *Carex lacustris* (hairy sedge), *Carex lasiocarpa* (woollyfruit sedge), *Typha latifolia* (broadleaf cattail), *Calamagrostis canadensis* (bluejoint), and *Iris versicolor* (harlequin blueflag). Depending on the site, nutrient conditions may vary; however, rich shore fens along the Great Lakes are treated as a separate type, *Dasiphora fruticosa* ssp. *floribunda* - *Myrica gale* Rich Shore Fen Shrubland (CEGL005275). This type differs from the Leatherleaf Bog, *Chamaedaphne calyculata* - *Ledum groenlandicum* - *Kalmia polifolia* Bog Dwarf-shrubland (CEGL005278), and the Leatherleaf Poor Fen, *Chamaedaphne calyculata* / *Carex oligosperma* / *Sphagnum* spp. Poor Fen Dwarf-shrubland (CEGL005277) in that it harbors more minerotrophic indicator species which the Leatherleaf types lack, and tends to have less acidic indicators, such as *Carex oligosperma* (fewseed sedge). When cover of *Betula pumila* var. *glandulifera* (bog birch) and *Salix* (willow) spp. increases, this community can grade into a Bog Birch - Willow Shore Fen, *Alnus incana* - *Salix* spp. - *Betula pumila* / *Chamaedaphne calyculata* Shrubland (CEGL005227), or a Dogwood - Pussy Willow swamp, *Cornus sericea* - *Salix* spp. - (*Rosa palustris* (swamp rose)) Shrubland (CEGL002186). Greater than 25% cover of short (not dwarf) shrubs would warrant placing the stand into one of these other communities. This type is drier than graminoid shore fen, *Carex lasiocarpa* - *(Carex rostrata)* - *Equisetum fluviatile* Herbaceous Vegetation (CEGL005229), and is transitional to saturated rich and poor fens. Shore fens may also resemble organic shrub swamps in Ontario and the concept of shore fen has not been standardized across the province yet (W. Bakowsky pers. comm. 1999).
Global Similar Associations:
- *Alnus incana* - *Salix* spp. - *Betula pumila* / *Chamaedaphne calyculata* Shrubland (CEGL005227)
- *Carex lasiocarpa* - *(Carex rostrata)* - *Equisetum fluviatile* Herbaceous Vegetation (CEGL005229)
- *Chamaedaphne calyculata* - *Ledum groenlandicum* - *Kalmia polifolia* Bog Dwarf-shrubland (CEGL005278)
- *Chamaedaphne calyculata* / *Carex oligosperma* / *Sphagnum* spp. Poor Fen Dwarf-shrubland (CEGL005277)
- *Cornus sericea* - *Salix* spp. - (*Rosa palustris*) Shrubland (CEGL002186)
- *Dasiphora fruticosa* ssp. *floribunda* - *Myrica gale* Rich Shore Fen Shrubland (CEGL005275) is a rich shore fen along the Great Lakes shoreline.
- *Myrica gale* - *Spiraea alba* - *Chamaedaphne calyculata* Shrubland (CEGL006512)
- *Myrica gale* Fen Shrubland (CEGL005141)
- *Myrica gale* Organic Swamp Shrubland (CEGL005077)

Global Related Concepts:
- Low shrub shore fen: leatherleaf - sweet gale / graminoid (W15) (Harris et al. 1996) =
- Northern Rich Fen (Chapman et al. 1989) **?**
- Rich Fen (Boreal Section) (MNNHP 1993) **>**
- Shore Fen Leatherleaf-Sweetgale Low Shrub Subtype (Faber-Langendoen 2001) =

ELEMENT DISTRIBUTION

Global Range: This community is typically found on floating mats on the edges of lakes and streams in the Great Lakes region of the United States and Canada. It ranges from northern Minnesota and adjacent Ontario eastward to localized areas of Michigan and New York. In New York, one site (Deer Creek) is known along the shores of eastern Lake Ontario.
Nations: CA, US
States/Provinces: MI, MN, NY, ON, QC:S4?, WI:S3
TNC Ecoregions: 47:C, 48:C, 64:C
USFS Ecoregions (1994/95): 212Hi:CCC, 212Ia:CCC, 212Ja:CCC, 212La:CCC, 222Ie:CCC
Federal Lands: NPS (Apostle Islands, Isle Royale, Pictured Rocks, Saint Croix, Sleeping Bear Dunes, Voyageurs)

ELEMENT SOURCES

Saint Croix National Scenic Riverway Map Code: DLS
Local Description Authors:
Global Description Authors: D. Faber-Langendoen
References: Chapman et al. 1989, Edinger et al. 2002, Faber-Langendoen 2001, Harris et al. 1996, Hop et al. 2010a, Hop et al. 2010c, MNNHP 1993, Midwestern Ecology Working Group n.d., TNC 1999b, WNHIP unpubl. data

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2.C.5. Temperate & Boreal Freshwater Wet Meadow & Marsh

2.C.5.Na. Eastern North American Freshwater Wet Meadow, Riparian & Marsh

M165. Eastern North American Riverscour Wetland

G194. Northern & Central Riverscour Wetland

Sandbar Willow Shrubland

***Salix interior* Temporarily Flooded Shrubland**
Sandbar Willow Temporarily Flooded Shrubland
Identifier: CEGL008562

NVC CLASSIFICATION

Division	Eastern North American Freshwater Wet Meadow, Riparian & Marsh (2.C.5.Na)
Macrogroup	Eastern North American Riverscour Wetland (M165)
Group	Northern & Central Riverscour Wetland (G194)
Association (Common name)	Sandbar Willow Shrubland

ELEMENT CONCEPT

Global Summary: This willow shrubland community is found scattered along rivers and streams at lower elevations in parts of the midwestern United States, the Mississippi River Alluvial Plain, and the Appalachians. This type represents an early-successional stage of temporarily flooded riparian vegetation that occurs most commonly on alluvial sands. The substrate may also contain silts, clays, and/or gravels. The canopy is dominated by *Salix interior* (sandbar willow), which can form dense stands up to 4 m tall. There are often areas where the shrub layer is absent. Seedlings and small saplings of *Populus deltoides* (eastern cottonwood) or *Platanus occidentalis* (American sycamore) may be present. The herbaceous cover is sparse to moderate, but rarely exceeds 30%. Species present include *Polygonum lapathifolium* (curlytop knotweed), *Eupatorium* (thoroughwort) spp., *Schoenoplectus americanus* (chairmaker's bulrush), and *Xanthium strumarium* (rough cocklebur). The composition of this community, especially the herbaceous layer, varies from year to year with succession or renewed disturbance.

ENVIRONMENTAL DESCRIPTION

Saint Croix National Scenic Riverway Environment: This willow shrubland was sampled once in the park on the relatively undisturbed floodplain of Goose Creek. No other environmental data were provided.
Global Environment: This community is found on recently deposited or disturbed alluvial material. The parent material is alluvial sand, although silt, clay, or gravel may be present. Soil development is poor to absent.

VEGETATION DESCRIPTION

Saint Croix National Scenic Riverway Vegetation: No stratum height or cover data were provided. *Salix interior* (sandbar willow) is the dominant shrub (37.5% cover) and occurs along with lesser amounts of *Cornus sericea* ssp. *sericea* (red-osier dogwood) and *Salix petiolaris* (meadow willow). The herbaceous layer is dominated by the graminoid *Phalaris arundinacea* (reed canarygrass) (87.5% cover); additional species include very small amounts of *Asclepias incarnata* (swamp milkweed), *Boehmeria cylindrica* (small-spike false nettle), *Campanula aparinoides* (marsh bellflower), *Carex stricta* (upright sedge), *Cicuta bulbifera* (bulblet-bearing water hemlock), *Eleocharis erythropoda* (bald spikerush), *Elymus virginicus* (Virginia wildrye), *Eupatorium maculatum* (spotted joepyeweed), *Geum laciniatum* var. *trichocarpum* (rough avens), *Leersia oryzoides* (rice cutgrass), *Lycopus americanus* (American water horehound), *Lysimachia hybrida* (lowland yellow loosestrife), *Onoclea sensibilis* (sensitive fern), *Polygonum sagittatum* (arrowleaf tearthumb), *Sagittaria latifolia* (broadleaf arrowhead), *Scirpus cyperinus* (woolgrass), *Scutellaria galericulata* (marsh skullcap), and *Sparganium eurycarpum* (broadfruit bur-reed).
Global Vegetation: This community is dominated by shrubs, generally between 2 and 4 m tall. The most abundant of these is *Salix interior* (sandbar willow). Saplings of *Populus deltoides* (eastern cottonwood) or *Platanus occidentalis* (American sycamore) are also frequently found in the shrub layer. This stratum can have moderate to high stem density in overall composition of the community. The species in the shrub layer do not form a closed canopy, this allows significant light to reach the ground layer. Patches are also frequently found where the shrub layer is absent. The herbaceous cover is sparse to moderate, but rarely exceeds 30%. Older stands and places with less competition from the shrubs may have greater herbaceous cover. The composition of the herbaceous layer can vary greatly; species that are often found in this community include *Polygonum lapathifolium* (curlytop knotweed), *Eupatorium* (thoroughwort) spp., *Schoenoplectus americanus* (chairmaker's bulrush), and *Xanthium strumarium* (rough cocklebur).

MOST ABUNDANT SPECIES

Saint Croix National Scenic Riverway

Stratum	Lifeform	Species
Tall shrub/sapling	Broad-leaved deciduous shrub	*Salix interior* (sandbar willow)
Herb (field)	Graminoid	*Phalaris arundinacea* (reed canarygrass)

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CHARACTERISTIC SPECIES

Saint Croix National Scenic Riverway: *Phalaris arundinacea* (reed canarygrass), *Salix interior* (sandbar willow)

CONSERVATION STATUS RANK

Global Rank & Reasons: G4G5 (30-Sep-2001). This type is moderately widespread and common throughout its range.

CLASSIFICATION

Status: Standard
Classification Confidence: 2 - Moderate
Global Comments: This type represents an earlier-seral stage of temporarily flooded riparian alluvial shrubland.
Global Similar Associations:
- *Salix exigua* Temporarily Flooded Shrubland (CEGL001197) is a related type from further west dominated by a different nominal *Salix* species.
- *Salix interior* - *Salix eriocephala* Sandbar Shrubland (CEGL005078) of the Great Lakes states/provinces.

Global Related Concepts:
- Gravel Bar Type (Dale and Kuroda 1979) ><
- P4B3cI2a. *Salix exigua* (Foti et al. 1994) **?**
- Sandbar Willow Shrubland (Steinauer and Rolfsmeier 2003) >

ELEMENT DISTRIBUTION

Global Range: This sandbar willow shrubland community is found along rivers and streams at lower elevations in parts of the midwestern United States and parts of the Appalachians, ranging sporadically from South Dakota, Nebraska, Iowa, and Illinois south to Oklahoma and Arkansas, and northeast at least to Kentucky. The species ranges north into Canada (Kartesz 1999), but there is no information indicating that it forms stands worthy of recognition as a community anywhere northeast of Kentucky.
Nations: US
States/Provinces: AR, IA, KY?, MN, NE, OK, TN?, WI?
TNC Ecoregions: 26:C, 27:C, 32:?, 33:?, 35:C, 36:C, 37:C, 38:C, 39:C, 42:C, 46:C, 47:C
USFS Ecoregions (1994/95): 222An:CCP, 222L:CC, 231G:CC, 234A:CC, 251Aa:CCC, 251B:CP, 251C:CC, 251D:CC, 251E:CC, 251F:CP, 311A:??, 315C:??, 315D:??, 331B:PP, 331C:PP, 331F:PP, 331G:P?, 331H:P?, 331I:P?, 331J:P?, 332C:??, 332E:??, M222Aa:PPP
Federal Lands: NPS (Buffalo River?, Effigy Mounds, Saint Croix)

ELEMENT SOURCES

Saint Croix National Scenic Riverway Map Code: SWL
Saint Croix National Scenic Riverway Plots: SACN.3147.
Local Description Authors: M.J. Russo
Global Description Authors: M. Pyne
References: Bellah and Hulbert 1974, Dale and Kuroda 1979, Foti et al. 1994, Hansen et al. 1989, Hansen et al. 1995, Hoagland 2000, Hop et al. 2005, Kartesz 1999, Kittel and Lederer 1993, Shelford 1954, Southeastern Ecology Working Group n.d., Steinauer 1989, Steinauer and Rolfsmeier 2000, Steinauer and Rolfsmeier 2003, TDNH unpubl. data, Wilson 1970

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M303. Eastern North American Ruderal Wet Meadow & Marsh

G556. Northern & Central Ruderal Wet Meadow & Marsh

Reed Canarygrass Eastern Marsh

***Phalaris arundinacea* Eastern Herbaceous Vegetation**
Reed Canarygrass Eastern Herbaceous Vegetation
Identifier: CEGL006044

NVC CLASSIFICATION

Division	Eastern North American Freshwater Wet Meadow, Riparian & Marsh (2.C.5.Na)
Macrogroup	Eastern North American Ruderal Wet Meadow & Marsh (M303)
Group	Northern & Central Ruderal Wet Meadow & Marsh (G556)
Association (Common name)	Reed Canarygrass Eastern Marsh

ELEMENT CONCEPT

Global Summary: This association is found throughout the northeastern United States and Canada, but its distribution as a natural type is complicated elsewhere. *Phalaris arundinacea* is native to the United States and Canada but is now more widely distributed and abundant because of local introductions from both local and European populations. The introduced strains may be more aggressive ecotypes than native strains. Stands are found in both minerotrophic basin wetlands as well as rivershores. *Phalaris arundinacea* has been widely used as a forage and hay crop, especially in marshes and floodplains, and it is used for wildlife food and for shoreline and ditch stabilization. Stands are dominated by *Phalaris arundinacea* (reed canarygrass), a 0.5- to 2-m tall perennial grass, which tends to occur in monocultures or associated with *Calamagrostis canadensis* (bluejoint). Associates in the glaciated Northeast include *Viburnum nudum* (possumhaw), *Alnus incana* (gray alder) or *Alnus serrulata* (hazel alder), *Viburnum dentatum* (southern arrow-wood), and *Agrostis gigantea* (redtop). In Central Appalachian bottomland old fields, characteristic associates include *Verbesina alternifolia* (wingstem) (which may be codominant), *Solidago rugosa* (wrinkleleaf goldenrod), *Boehmeria cylindrica* (small-spike false nettle), and *Euthamia graminifolia* (flat-top goldentop), along with exotic species such as *Glechoma hederacea* (ground ivy), *Coronilla varia* (purple crownvetch), *Rosa multiflora* (multiflora rose), and *Elaeagnus umbellata* (autumn olive). Midwest associates include species characteristic of wet meadows. *Phalaris arundinacea* (reed canarygrass) can displace native species over time. Further work is required to resolve the natural versus introduced nature of this type in the Southeast before a description can be completed.

ENVIRONMENTAL DESCRIPTION

Saint Croix National Scenic Riverway Environment: This reed canarygrass marsh was sampled at five locations in the park. Sites range from flat to somewhat steep floodplains and riverbanks with poorly drained to well-drained muck or sand soils. The unvegetated surface is dominated by leaf litter (65-93% cover) with some wood (0-4%), bare soil (2-15%), and dead plant stems (5-20%). Evidence of disturbance includes the presence of exotic plants.
Global Environment: Stands are found in both minerotrophic basin wetlands as well as rivershores. The dominant species has been widely used as a forage and hay crop, especially in marshes and floodplains, and it is used for wildlife food and for shoreline and ditch stabilization (Barnes 1999).

VEGETATION DESCRIPTION

Saint Croix National Scenic Riverway Vegetation: The moderate to total (70-100% cover) herbaceous layer dominates this community. However, there may also be a scattering (5-10%) of shrubs, including *Amorpha nana*, *Betula papyrifera* (paper birch), *Cornus sericea* ssp. *sericea* (red-osier dogwood), *Salix bebbiana* (Bebb willow), and *Toxicodendron rydbergii* (western poison-ivy). *Phalaris arundinacea* (reed canarygrass) strongly dominates the herbaceous layer; additional species at much lower cover include *Apios americana* (groundnut), *Asclepias incarnata* (swamp milkweed), *Boehmeria cylindrica* (small-spike false nettle), *Calamagrostis canadensis* (bluejoint), *Carex aquatilis* (water sedge), *Carex emoryi* (Emory's sedge), *Eupatorium maculatum* (spotted joepyeweed), *Impatiens capensis* (jewelweed), *Leersia oryzoides* (rice cutgrass), *Onoclea sensibilis* (sensitive fern), *Polygonum sagittatum* (arrowleaf tearthumb), *Typha latifolia* (broadleaf cattail), and many others. In addition, this community supports Wisconsin state-critically imperiled *Galium palustre* (common marsh bedstraw).
Global Vegetation: Stands are dominated by *Phalaris arundinacea* (reed canarygrass), a 0.5- to 2-m tall perennial grass that is native to the United States and Canada, but which has also been introduced from European strains. The introduced strains may be more aggressive ecotypes than native strains (Barnes 1999). It tends to occur in monocultures or associated with *Calamagrostis canadensis* (bluejoint) or, less commonly, with a mixture of forbs equaling the graminoid cover. Associates in the glaciated Northeast include *Viburnum nudum* (possumhaw), *Salix* (willow) spp., *Alnus incana* (gray alder) or *Alnus serrulata* (hazel alder), *Viburnum dentatum* (southern arrow-wood), *Poa palustris* (fowl bluegrass), *Mentha arvensis* (wild mint), *Leersia virginica* (whitegrass), *Lythrum salicaria* (purple loosestrife), and *Agrostis gigantea* (redtop). In Central Appalachian bottomland old fields, characteristic associates include *Verbesina alternifolia* (wingstem) (which may be codominant), *Solidago rugosa* (wrinkleleaf goldenrod), *Boehmeria cylindrica* (small-spike false nettle), and *Euthamia graminifolia* (flat-top goldentop), along with exotic species such as *Glechoma hederacea* (ground ivy), *Coronilla varia* (purple crownvetch), *Rosa multiflora* (multiflora rose), and *Elaeagnus umbellata* (autumn olive). Midwest associates include species characteristic of wet meadows. *Phalaris arundinacea* (reed canarygrass) can displace

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native species over time (Apfelbaum and Sams 1987, Barnes 1999, and references therein). Further work is required to resolve the natural versus introduced nature of this type in the Southeast.

MOST ABUNDANT SPECIES

Saint Croix National Scenic Riverway

Stratum	Lifeform	Species
Herb (field)	Graminoid	*Phalaris arundinacea* (reed canarygrass)

Global

Stratum	Lifeform	Species
Herb (field)	Graminoid	*Phalaris arundinacea* (reed canarygrass)

CHARACTERISTIC SPECIES

Saint Croix National Scenic Riverway: *Phalaris arundinacea* (reed canarygrass)
Global: *Phalaris arundinacea* (reed canarygrass)

OTHER NOTEWORTHY SPECIES

Saint Croix National Scenic Riverway: Vulnerable: *Galium palustre* (common marsh bedstraw, WI state-critically imperiled, G5); **Exotic/Invasive**: *Calystegia sepium* ssp. *sepium* (hedge false bindweed, invasive/exotic), *Poa pratensis* (Kentucky bluegrass, invasive/exotic, Medium), *Polygonum hydropiper* (marshpepper knotweed, invasive/exotic), *Solanum dulcamara* (climbing nightshade, invasive/exotic, Low), *Urtica dioica* (stinging nettle, invasive/exotic)

CONSERVATION STATUS RANK

Global Rank & Reasons: GNA (invasive) (1-Dec-1997). *Phalaris arundinacea* (reed canarygrass) is native to the United States and Canada but is now more widely distributed and abundant because of local introductions from both local and European populations (Apfelbaum and Sams 1987). It can invade a variety of habitats.

CLASSIFICATION

Status: Standard
Classification Confidence: 2 - Moderate
Global Comments: Type has a broad distribution; in fact, it is widespread throughout temperate areas of the northern hemisphere. It is native to the United States and Canada, but is now more widely distributed and abundant because of local introductions from both local and European populations (Apfelbaum and Sams 1987). It can invade a variety of habitats, suggesting that little unites these stands apart from the dominance of *Phalaris arundinacea* (reed canarygrass). However, that may be the only reasonable way to describe this type. This vegetation is documented from Shady Valley TNC Preserve, Johnson County, Tennessee, where it occupies channelized streams, impoundments, and fen restoration sites. In these examples, characteristic associates include *Juncus effusus* (common rush), *Carex lurida* (shallow sedge), *Carex gynandra* (nodding sedge), and *Alnus serrulata* (hazel alder).
Global Similar Associations:
- *Calamagrostis canadensis - Eupatorium maculatum* Herbaceous Vegetation (CEGL005174)
- *Phalaris arundinacea* Western Herbaceous Vegetation (CEGL001474)

Global Related Concepts:
- *Phalaris arundinacea* temporarily flooded grasslands (Metzler and Barrett 2001) >
- Bottomland old fields (Vanderhorst 2001a) =
- Palustrine Persistent Emergent Wetland (PEM1) (Cowardin et al. 1979) **?**
- Reed canary grass riverine grassland (Perles et al. 2004) **?**
- SNE low-energy riverbank community (Rawinski 1984) **?**
- Semi-Natural (MNNHP 1993) >
- Shallow Emergent Marsh (Thompson 1996) **?**
- Southern New England nutrient-poor streamside/lakeside marsh (Rawinski 1984) **?**
- Southern New England nutrient-rich streamside/lakeside marsh (Rawinski 1984) **?**

ELEMENT DISTRIBUTION

Global Range: This association is found throughout the northeastern United States and Canada, but its distribution as a natural type is complicated elsewhere. It currently ranges from Virginia north to Vermont, east to Minnesota and south to Tennessee.
Nations: CA, US
States/Provinces: CT, DE, IA, IN, MA, MD, ME, MN, NH, NJ, NY, OH, ON, PA, QC:S4, RI, TN, VA, VT, WI?, WV
TNC Ecoregions: 46:P, 47:C, 48:C, 49:C, 50:C, 51:C, 59:C, 60:C, 61:C, 62:C
USFS Ecoregions (1994/95): 212Fc:CCC, 212G:CP, 221Aa:CCC, 221Bc:CCC, 221Bd:CCC, 221Da:CCC, 221Fa:CCC, 222Ib:CCC, 222Ic:CCC, 222Jj:CCC, 222L:CC, M221Ac:CCC, M221Ad:CCC, M221Bb:CCC, M221Bf:CCC, M221Dc:CCC
Federal Lands: NPS (Allegheny Portage Railroad, Appalachian Trail (Central Appalachians), Appalachian Trail (Lower New England & Northern Appalachians), C&O Canal, Catoctin Mountain, Cuyahoga Valley, Delaware Water Gap, Effigy Mounds, Eisenhower, Gettysburg, Harpers Ferry, Indiana Dunes, Saint Croix, Saratoga, Saugus Iron Works, Upper Delaware); USFWS (Assabet River?, Erie, Great Meadows?, Great Swamp, Iroquois, Montezuma, Oxbow, Parker River)

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ELEMENT SOURCES

Saint Croix National Scenic Riverway Map Code: HPH and HME
Saint Croix National Scenic Riverway Plots: SACN.73, SACN.97, SACN.280, SACN.3146, SACN.5536.
Local Description Authors: M.J. Russo
Global Description Authors: D. Faber-Langendoen, mod. S.C. Gawler
References: Apfelbaum and Sams 1987, Barnes 1999, Cowardin et al. 1979, Edinger et al. 2002, Fike 1999, Hop et al. 2005, Hop et al. 2009, Largay and Sneddon 2008, MNNHP 1993, Metzler and Barrett 2001, Midwestern Ecology Working Group n.d., NRCS 2004a, Perles et al. 2004, Perles et al. 2006c, Perles et al. 2006d, Perles et al. 2007, Perles et al. 2008, Rawinski 1984, Sperduto 2000a, Swain and Kearsley 2001, TDNH unpubl. data, TNC and WPC 2004, Thompson 1996, Thompson and Sorenson 2000, Vanderhorst 2001a, Vanderhorst and Streets 2006

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Eastern Reed Marsh

***Phragmites australis* Eastern North America Temperate Semi-natural Herbaceous Vegetation**
Common Reed Eastern North America Temperate Semi-natural Herbaceous Vegetation
Identifier: CEGL004141

NVC CLASSIFICATION

Division	Eastern North American Freshwater Wet Meadow, Riparian & Marsh (2.C.5.Na)
Macrogroup	Eastern North American Ruderal Wet Meadow & Marsh (M303)
Group	Northern & Central Ruderal Wet Meadow & Marsh (G556)
Association (Common name)	Eastern Reed Marsh

ELEMENT CONCEPT

Global Summary: This reed marsh type is found across the east-temperate regions of the United States and Canada. Stands occur in semipermanently flooded marshes, ditches, impoundments, etc., that have often been disturbed by human activity. The vegetation is variable, as *Phragmites australis* (common reed) will often invade into existing natural or semi-natural communities present on the site. Once firmly established, this community is usually strongly dominated by *Phragmites australis* (common reed), with few or no other vascular plants present.

ENVIRONMENTAL DESCRIPTION

Saint Croix National Scenic Riverway Environment: This reed marsh type was sampled twice in the park. The sites are flat wetlands with poorly drained muck or peat soils. One is described as a delta-type landform where a prominent seepage area flows in rivulets through peat and silt onto an alluvial fan out to a St. Croix backwater channel. The unvegetated surface is dominated either by leaf litter (1-90% cover) or standing water (0-90%) with some bare soil (0-1%) and dead plant stems (9%). No evidence of disturbance was reported.
Global Environment: Stands occur in semipermanently flooded marshes, ditches, impoundments, etc. that have often been disturbed by human activity.

VEGETATION DESCRIPTION

Saint Croix National Scenic Riverway Vegetation: This community is dominated by a solid (100% cover) herbaceous layer, 1-5 m tall, dominated by *Phragmites australis* (common reed). Additional species include *Boehmeria cylindrica* (small-spike false nettle), *Leersia oryzoides* (rice cutgrass), *Lemna minor* (common duckweed) (floating aquatic), *Phalaris arundinacea* (reed canarygrass), *Sagittaria latifolia* (broadleaf arrowhead), and others.
Global Vegetation: The vegetation is often variable, as *Phragmites australis* (common reed) will often invade into existing natural or semi-natural communities present on the site. Once firmly established, this community is usually strongly dominated by *Phragmites australis* (common reed), with few or no other vascular plants present.

MOST ABUNDANT SPECIES

Saint Croix National Scenic Riverway

Stratum	Lifeform	Species
Herb (field)	Graminoid	*Leersia oryzoides* (rice cutgrass), *Phalaris arundinacea* (reed canarygrass), *Phragmites australis* (common reed)
Floating aquatic	Aquatic herb (floating & submergent)	*Lemna minor* (common duckweed)

Global

Stratum	Lifeform	Species
Herb (field)	Graminoid	*Phragmites australis* (common reed)

CHARACTERISTIC SPECIES

Saint Croix National Scenic Riverway: *Leersia oryzoides* (rice cutgrass), *Lemna minor* (common duckweed), *Phalaris arundinacea* (reed canarygrass), *Phragmites australis* (common reed)
Global: *Phragmites australis* (common reed)

OTHER NOTEWORTHY SPECIES

Saint Croix National Scenic Riverway: Exotic/Invasive: *Urtica dioica* (stinging nettle, invasive/exotic)

CONSERVATION STATUS RANK

Global Rank & Reasons: GNA (invasive) (23-Nov-1997). Although almost always occurring as a naturalized type that arises from human disturbance, some stands in northern Minnesota and further north in Canada may be native. If so, they should be tracked as a separate type.

CLASSIFICATION

Status: Standard
Classification Confidence: 1 - Strong
Global Comments: This is not a native community but is the result of the invasion of alien *Phragmites australis* (common reed) into natural or semi-natural vegetation. The vegetation has variable hydrology and, unless *Phragmites* (reed) is clearly dominant, is often

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treated as part of other marsh and meadow types. The geographic distribution of the type is arbitrarily limited to Bailey's Humid Temperate Domain in eastern North America (Bailey 1997, 1998). Stands in northern Minnesota and farther north in Canada may represent native stands. If so, they should be tracked as a different type. Tidal vegetation of the Gulf Coast of Louisiana and Texas dominated by *Phragmites australis* (common reed) is classified in the *Phragmites australis* (common reed) Tidal Herbaceous Alliance (A.1477).

Global Similar Associations:
- *Phragmites australis* Tidal Herbaceous Vegetation (CEGL004187)
- *Phragmites australis* Western North America Temperate Semi-natural Herbaceous Vegetation (CEGL001475)

Global Related Concepts:
- *Phragmites australis* community (Metzler and Barrett 1992) **?**
- *Phragmites australis* temporarily flooded grasslands (Metzler and Barrett 2001) **>**
- *Phragmites australis* tidal marsh association (Clancy 1993b) **?**
- Inland Emergent Marsh (Chapman et al. 1989) **>**
- Semi-Natural (MNNHP 1993) **>**
- Semi-Natural (Faber-Langendoen 2001) **>**
- Southern New England nutrient-poor streamside/lakeside marsh (Rawinski 1984) **?**
- Southern New England nutrient-rich streamside/lakeside marsh (Rawinski 1984) **?**

ELEMENT DISTRIBUTION

Global Range: This reed marsh type is found across the east-temperate regions of the United States and Canada, ranging from Maine west to the eastern Dakotas and Manitoba, south to Texas and east to Florida.

Nations: CA, US

States/Provinces: AL, AR, CT, DE, FL, GA, IA, IN, LA, MA, MD, ME, MI, MN, MS, NC, NH, NJ:S5, NY, OH, ON, PA, QC:S3?, RI, SC, TX, VA, VT, WI, WV

TNC Ecoregions: 31:C, 40:C, 41:C, 42:P, 47:C, 48:C, 52:P, 53:C, 55:C, 56:C, 57:C, 59:C, 60:C, 61:C, 62:C

USFS Ecoregions (1994/95): 212C:CP, 212Fc:CCC, 212Ho:CCC, 212Hw:CCC, 221Aa:CCP, 221Ab:CCC, 221Ae:CCC, 221Ai:CCC, 221Bc:CCC, 221Da:CCC, 222Ic:CCC, 222Jj:CCC, 231Fb:CCC, 232Ab:CCC, 232Ac:CCC, 232Ch:CCC, 232Dc:CCC, 232E:CC, 232G:CC, 234A:PP, 255Dc:CCC, M212:C, M221:P

Federal Lands: NPS (Assateague Island, Boston Harbor Islands, Cape Cod, Indiana Dunes, Minute Man, Saint Croix, Saratoga, Sleeping Bear Dunes, Upper Delaware, Voyageurs); USFWS (Alligator River, Aransas, Bon Secour, Brazoria, Cape May, E.B. Forsythe, Great Dismal Swamp, Great Meadows, Great Swamp, Matagorda Island, Monomoy, Montezuma, Oxbow, Parker River, Prime Hook, Supawna Meadows)

ELEMENT SOURCES

Saint Croix National Scenic Riverway Map Code: HPG and HME

Saint Croix National Scenic Riverway Plots: SACN.112, SACN.135.

Local Description Authors: M.J. Russo

Global Description Authors: D. Faber-Langendoen

References: Bailey 1997, Bailey 1998, Bell et al. 2002, Chapman et al. 1989, Clancy 1993b, Faber-Langendoen 2001, Harris et al. 1996, Hop et al. 2009, INAI unpubl. data, MNNHP 1993, Metzler and Barrett 1992, Metzler and Barrett 2001, NRCS 2004a, Nelson 1986, Perles et al. 2008, Rawinski 1984, Schafale and Weakley 1990, Schotz pers. comm., Southeastern Ecology Working Group n.d., Swain and Kearsley 2001

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M069. Eastern North American Wet Meadow & Marsh

G125. Eastern North American Freshwater Marsh

Bulrush - Cattail - Bur-reed Shallow Marsh

***Schoenoplectus tabernaemontani - Typha* spp. - (*Sparganium* spp., *Juncus* spp.) Herbaceous Vegetation**
Softstem Bulrush - Cattail species - (Bur-reed species, Rush species) Herbaceous Vegetation
Identifier: CEGL002026

NVC CLASSIFICATION

Division	Eastern North American Freshwater Wet Meadow, Riparian & Marsh (2.C.5.Na)
Macrogroup	Eastern North American Wet Meadow & Marsh (M069)
Group	Eastern North American Freshwater Marsh (G125)
Association (Common name)	Bulrush - Cattail - Bur-reed Shallow Marsh

ELEMENT CONCEPT

Global Summary: This shallow marsh mixed emergent community ranges broadly over the midwestern United States and adjacent Canada. It is found in basin-like depressions, backwater areas of floodplains, and shallow margins of lakes or ponds. Soils are shallow to deep, very poorly drained, consisting of peats, mucks, or mineral materials, often found in alluvium. Vegetation varies from zones dominated by tall emergents 1-2 m tall to those with hydrophytic annual and perennial forbs <1 m tall. In the tall emergent zone, *Schoenoplectus tabernaemontani* (softstem bulrush), *Schoenoplectus fluviatilis* (river bulrush), *Schoenoplectus acutus* (hardstem bulrush), *Typha angustifolia* (narrowleaf cattail), and *Typha latifolia* (broadleaf cattail) may dominate, mixed with a variety of other herbaceous species, such as *Leersia oryzoides* (rice cutgrass), *Eleocharis palustris* (common spikerush), *Juncus* (rush) spp., and *Sparganium* (bur-reed) spp. The hydrophytic annual and perennial forb zone is dominated by *Alisma subcordatum* (American water plantain), *Alisma triviale* (northern water plantain), *Sagittaria latifolia* (broadleaf arrowhead), *Sparganium eurycarpum* (broadfruit bur-reed), *Pontederia cordata* (pickerelweed), along with *Bacopa rotundifolia* (disk water-hyssop) and *Heteranthera limosa* (blue mudplantain). Occasional floating-leaved aquatics are sometimes present, including *Azolla caroliniana* (Carolina mosquitofern), *Lemna* (duckweed) spp., *Spirodela polyrrhiza* (common duckmeat), and *Utricularia macrorhiza* (common bladderwort).

ENVIRONMENTAL DESCRIPTION

Saint Croix National Scenic Riverway Environment: This bulrush - cattail - bur-reed shallow marsh was sampled at 11 locations in the park. Sites are flat to gently sloping streambeds, floodplains and depressions that may be intermittently to permanently flooded and with somewhat poorly to very poorly drained sand or muck soils. The unvegetated surface is dominated either by leaf litter (1-98% cover), bare soil (0-80%) or standing water (0-79%) with some large rocks (0-1%), wood (0-4%) and dead plant stems (2-20%). Evidence of disturbance includes flooding, signs of beaver activity and the presence of exotic plants.
Global Environment: This community ranges broadly over the midwestern United States. It is found in basin-like depressions, backwater areas of floodplains and shallow margins of lakes or ponds. Soils are shallow to deep, very poorly drained, consisting of peats, mucks, or mineral materials, often found in alluvium (Lauver et al. 1999).

VEGETATION DESCRIPTION

Saint Croix National Scenic Riverway Vegetation: The sparse to total (20-100% cover) herbaceous layer (up to 2 m tall) dominates this community. However, there may also be a scattering (5-30%) of shrubs, including *Salix discolor* (pussy willow) and *Spiraea alba* (white meadowsweet). Dominants in the herb layer include *Schoenoplectus fluviatilis* (river bulrush), *Sparganium eurycarpum* (broadfruit bur-reed), and *Typha latifolia* (broadleaf cattail). Additional common and/or abundant species include *Acorus calamus* (calamus), *Calamagrostis canadensis* (bluejoint), *Carex hystericina* (bottlebrush sedge), *Carex utriculata* (Northwest Territory sedge), *Glyceria borealis* (small floating mannagrass), *Glyceria canadensis* (rattlesnake mannagrass), *Leersia oryzoides* (rice cutgrass), *Ludwigia palustris* (marsh seedbox), *Sagittaria latifolia* (broadleaf arrowhead), *Schoenoplectus acutus* (hardstem bulrush), *Schoenoplectus tabernaemontani* (softstem bulrush), *Sparganium androcladum* (branched bur-reed), and *Sparganium erectum* ssp. *stoloniferum* (simplestem bur-reed). In addition, this community supports Wisconsin state-critically imperiled *Galium palustre* (common marsh bedstraw).
Global Vegetation: Vegetation varies from zones dominated by tall emergents 1-2 m tall to those with hydrophytic annual and perennial forbs <1 m tall. In the tall emergent zone, *Schoenoplectus tabernaemontani* (softstem bulrush), *Schoenoplectus fluviatilis* (river bulrush), *Schoenoplectus acutus* (hardstem bulrush), *Typha angustifolia* (narrowleaf cattail), and *Typha latifolia* (broadleaf cattail) may dominate, mixed with a variety of other herbaceous species, such as *Leersia oryzoides* (rice cutgrass), *Eleocharis palustris* (common spikerush), *Juncus* (rush) spp., and *Sparganium* (bur-reed) spp. The hydrophytic annual and perennial forb zone is dominated by *Alisma subcordatum* (American water plantain), *Alisma triviale* (northern water plantain), *Pontederia cordata* (pickerelweed), *Sagittaria latifolia* (broadleaf arrowhead), and *Sparganium eurycarpum* (broadfruit bur-reed), along with *Bacopa rotundifolia* (disk water-hyssop) and *Heteranthera limosa* (blue mudplantain). Other species that may dominate locally include *Polygonum pensylvanicum* (Pennsylvania smartweed), *Polygonum amphibium* var. *emersum* (longroot smartweed), and *Polygonum lapathifolium* (curlytop knotweed). Occasional floating-leaved aquatics are sometimes present, including *Azolla caroliniana* (Carolina mosquitofern), *Lemna* (duckweed) spp., *Spirodela polyrrhiza* (common duckmeat), and *Utricularia macrorhiza* (common bladderwort) (Eggers and Reed 1987, Steinauer and Rolfsmeier 2000).

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MOST ABUNDANT SPECIES

Saint Croix National Scenic Riverway

Stratum	Lifeform	Species
Herb (field)	Forb	*Sagittaria latifolia* (broadleaf arrowhead), *Sparganium eurycarpum* (broadfruit bur-reed)
Herb (field)	Graminoid	*Schoenoplectus fluviatilis* (river bulrush), *Typha latifolia* (broadleaf cattail)

CHARACTERISTIC SPECIES

Saint Croix National Scenic Riverway: *Sagittaria latifolia* (broadleaf arrowhead), *Schoenoplectus fluviatilis* (river bulrush), *Sparganium eurycarpum* (broadfruit bur-reed), *Typha latifolia* (broadleaf cattail)

OTHER NOTEWORTHY SPECIES

Saint Croix National Scenic Riverway: Vulnerable: *Galium palustre* (common marsh bedstraw, WI state-critically imperiled, G5); **Exotic/Invasive**: *Echinochloa muricata* var. *muricata* (rough barnyardgrass, invasive/exotic), *Hieracium caespitosum* (meadow hawkweed, invasive/exotic, Medium/Insignificant), *Mentha aquatica* (water mint, invasive/exotic), *Polygonum hydropiper* (marshpepper knotweed, invasive/exotic)

CONSERVATION STATUS RANK

Global Rank & Reasons: G4G5 (22-Jun-1998).

CLASSIFICATION

Status: Standard

Classification Confidence: 3 - Weak

Global Comments: This is a very broadly defined type that intergrades between wet meadows and deep marshes. Shaw and Fredine (1971) (in Eggers and Reed 1987) define shallow marsh as "soils that are saturated to inundated by standing water up to 15 cm in depth, throughout most of the growing season." Depending on the local topographic context, the type may or may not be extensive. Any number of types could be separated within this coarsely defined type, but it is not yet clear how best to make such distinctions (e.g., the forb-dominated portions, such as *Pontederia cordata* (pickerelweed) or *Sagittaria latifolia* (broadleaf arrowhead)). [See e.g., *Sagittaria latifolia - Leersia oryzoides* Herbaceous Vegetation (CEGL005240).] See also Lee et al. (1998), who separate out a *Sparganium eurycarpum* (broadfruit bur-reed) type. Taxonomically, *Schoenoplectus tabernaemontani* (softstem bulrush) is equivalent to former *Scirpus validus* (Kartesz 1999). In Minnesota, *Schoenoplectus acutus* (hardstem bulrush) may be the more common bulrush (R. Dana pers. comm. 1999). *Eleocharis* (spikerush) spp. can also be typical of this type. Dominant and characteristic plants should always be described from stands to allow for adequate characterization. In Nebraska, the pond marsh extends to south-central Nebraska (Steinauer and Rolfsmeier 2000).

Global Similar Associations:

- *Sagittaria latifolia - Leersia oryzoides* Herbaceous Vegetation (CEGL005240)
- *Schoenoplectus acutus - (Schoenoplectus fluviatilis)* Freshwater Herbaceous Vegetation (CEGL002225)
- *Typha* spp. - *Schoenoplectus acutus* - Mixed Herbs Midwest Herbaceous Vegetation (CEGL002229) This is the deep marsh equivalent of this type.
- *Typha* spp. - *Schoenoplectus* spp. - Mixed Herbs Great Plains Herbaceous Vegetation (CEGL002228)

Global Related Concepts:

- *Scirpus validus* herbaceous association (Hoagland 1997) **?**
- Freshwater Marsh (Nelson 1985) **>**
- Inland Emergent Marsh (Chapman et al. 1989) **>**
- Mixed Emergent Marsh (Forest Section) (MNNHP 1993) **>**
- Pond Marsh (Steinauer and Rolfsmeier 2003) **>**
- Pond Marsh (Steinauer and Rolfsmeier 2000) **>**
- Pond Marsh (Steinauer and Rolfsmeier 1997) **>**
- Shallow Marsh (Faber-Langendoen 2001) **=**

ELEMENT DISTRIBUTION

Global Range: This shallow marsh mixed emergent community ranges broadly over the midwestern United States and adjacent Canada, from Ohio and Ontario west to Manitoba, south to Oklahoma and northern Arkansas, and east to Indiana.

Nations: CA, US

States/Provinces: AR, DC?, IA, IL, IN, KS:S1S2, MB:S4?, MI, MN, MO, ND:S3, NE, NM, OH, OK, ON, PA, QC, SD, SK, WI:S4, WY

TNC Ecoregions: 26:C, 33:C, 34:C, 35:C, 36:C, 37:C, 38:C, 42:?, 44:C, 45:C, 46:C, 47:C, 48:C, 49:C, 50:C

USFS Ecoregions (1994/95): 212Hb:CC?, 212Hm:CCC, 212Hs:CCC, 212Hv:CCC, 212Ib:C??, 212Ja:CCP, 212Jb:CC?, 212Jc:CCP, 212Jd:CCC, 212Je:CC?, 212Jf:CC?, 212Jj:CC?, 212Jk:CC?, 212Jl:CC?, 212Jm:CC?, 212Ka:CP?, 212Kb:CPP, 212La:CPP, 212Lb:CPP, 212Lc:CPP, 212Ld:CPP, 212Ma:CPP, 212Mb:CPP, 212Na:CPP, 212Nb:CPP, 212Nc:CPP, 212Nd:CPP, 221Ea:CCC, 221Ec:CCC, 221Ed:CCP, 221Ef:CCC, 221Fa:CCC, 221He:CCC, 222Ak:CC?, 222An:CCC, 222Ao:CCP, 222Db:CCC, 222Ga:CCC, 222Gb:CCC, 222Ha:CCC, 222Hc:CCC, 222Hf:CCC, 222Ji:CCC, 222Jj:CCC, 222Kf:CCC, 222Kg:CCC, 222Md:CCC, 222Na:CPP, 251Aa:CP?, 251Cc:CCC, 251Cd:CC?, 251Cf:CCC, 251Cj:CCC, 251Co:CCC, 251Dg:CCC, 332E:PP

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Federal Lands: NPS (Buffalo River, C&O Canal, Effigy Mounds, Indiana Dunes, Isle Royale, National Capital-East, Prince William, Saint Croix); USFS (Chequamegon-Nicolet?, Chequamegon?, Chippewa?, Nicolet?, Ottawa?, Wayne); USFWS (Erie)

ELEMENT SOURCES

Saint Croix National Scenic Riverway Map Code: HMM and HME

Saint Croix National Scenic Riverway Plots: SACN.55, SACN.98, SACN.107, SACN.121, SACN.134, SACN.232, SACN.245, SACN.264, SACN.291, SACN.3251, SACN.8370.

Local Description Authors: M.J. Russo

Global Description Authors: D. Faber-Langendoen

References: Baalman 1965, Chapman et al. 1989, Eggers and Reed 1987, Faber-Langendoen 2001, Greenall 1996, Hoagland 1997, Hoagland 2000, Hop et al. 2005, Hop et al. 2009, INAI unpubl. data, Kartesz 1999, Lauver et al. 1999, Lee et al. 1998, MNNHP 1993, Midwestern Ecology Working Group n.d., NDNHI unpubl. data, Nelson 1985, Shaw and Fredine 1971, Steinauer and Rolfsmeier 1997, Steinauer and Rolfsmeier 2000, Steinauer and Rolfsmeier 2003, TNC 1999b, WNHIP unpubl. data

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Midwest Cattail Deep Marsh

***Typha* spp. Midwest Herbaceous Vegetation**
Cattail species Midwest Herbaceous Vegetation
Identifier: CEGL002233

NVC CLASSIFICATION

Division	Eastern North American Freshwater Wet Meadow, Riparian & Marsh (2.C.5.Na)
Macrogroup	Eastern North American Wet Meadow & Marsh (M069)
Group	Eastern North American Freshwater Marsh (G125)
Association (Common name)	Midwest Cattail Deep Marsh

ELEMENT CONCEPT

Global Summary: This community type is found in deep marshes throughout the midwestern United States and Canada. The vegetation is dominated by relatively pure stands of *Typha* (cattail) spp., either *Typha latifolia* (broadleaf cattail) or *Typha angustifolia* (narrowleaf cattail) or both. Many associates could occur. This type may simply be a less diverse variation of *Typha* (cattail) spp. - *Schoenoplectus acutus* (hardstem bulrush) - Mixed Herbs Midwest Herbaceous Vegetation (CEGL002229), or is a semi-natural type resulting from human disturbance to wetlands.

ENVIRONMENTAL DESCRIPTION

Global Environment: These wetlands are found in glacial potholes, river valleys, ponds, and on lakeplains. They are characterized by continuous inundation and are considered a deep marsh. Water depth averages 0.3-0.6 m, ranging from several centimeters to more than one meter for a significant part of the growing season.

VEGETATION DESCRIPTION

Global Vegetation: This deepwater emergent marsh community is dominated by perennial, coarse-leaved graminoid vegetation. Stands may vary from a mosaic of emergents, submergents, and floating-leaved plants interspersed with areas of open water to dense stands of emergents (Harris et al. 1996). They may display substantial areas of open water, but vegetation covers at least 30% of the surface. The vegetation is dominated by relatively pure stands of *Typha* (cattail) spp., either *Typha latifolia* (broadleaf cattail) or *Typha angustifolia* (narrowleaf cattail) or both. Many associates could occur.

CONSERVATION STATUS RANK

Global Rank & Reasons: G5 (3-Oct-1996).

CLASSIFICATION

Status: Standard
Classification Confidence: 2 - Moderate
Global Comments: It is unclear whether a separate *Typha* (cattail)-dominated type is needed in addition to the mixed *Typha* - *Scirpus* type (e.g., *Typha* (cattail) spp. - *Schoenoplectus acutus* (hardstem bulrush) - Mixed Herbs Midwest Herbaceous Vegetation (CEGL002229)), as well as separate *Scirpus* (bulrush)-dominated types (e.g., *Schoenoplectus acutus* - *(Schoenoplectus fluviatilis)* Freshwater Herbaceous Vegetation (CEGL002225)). Pure *Typha* (cattail) stands, depending on site conditions, are also perceived as degraded examples of the mixed type. In western Minnesota, where *Typha* (cattail) spp. form pure stands, the species may be *Typha angustifolia* (narrowleaf cattail) or *Typha X glauca* (blue cattail) in culturally disturbed marshes, and *Typha latifolia* (broadleaf cattail) (mixed with other species, especially Carices) in more undisturbed marshes (R. Dana pers. comm. 1999). Elsewhere, *Typha angustifolia* (narrowleaf cattail) is thought to be more typical of undisturbed marshes.
Global Similar Associations:
- *Schoenoplectus acutus* - *(Schoenoplectus fluviatilis)* Freshwater Herbaceous Vegetation (CEGL002225)
- *Typha (angustifolia, latifolia)* - *(Schoenoplectus* spp.) Eastern Herbaceous Vegetation (CEGL006153)
- *Typha latifolia* - *Caltha palustris* Herbaceous Vegetation (CEGL006245)
- *Typha* spp. - *Schoenoplectus acutus* - Mixed Herbs Midwest Herbaceous Vegetation (CEGL002229)
- *Typha* spp. Great Plains Herbaceous Vegetation (CEGL002389)

Global Related Concepts:
- Cattail Marsh (MNNHP 1993) =
- Deep Marsh Cattail Subtype (Faber-Langendoen 2001) =
- Freshwater Marsh (Nelson 1985) >
- Freshwater Marsh (Steinauer and Rolfsmeier 2003) >
- Inland Emergent Marsh (Chapman et al. 1989) >

ELEMENT DISTRIBUTION

Global Range: This community type is found in deep marshes throughout the midwestern United States, from Ohio and Ontario west to North Dakota, south to Kansas, and east to Indiana.
Nations: CA, US
States/Provinces: IA:S5, IL, IN, KS:SU, MI, MN:S5, MO, ND, NE, OH:S5, ON, SD, WI:S4, WY
TNC Ecoregions: 32:C, 35:C, 36:C, 37:C, 38:C, 44:C, 45:C, 46:C, 47:C, 48:C, 49:C

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USFS Ecoregions (1994/95): 212Ha:CPP, 212Hb:CPP, 212He:CPP, 212Hh:CPP, 212Hi:CPP, 212Hj:CPP, 212Hk:CPP, 212Hl:CPP, 212Hm:CPP, 212Hn:CPP, 212Ho:CPP, 212Hp:CPP, 212Hq:CPP, 212Hr:CPP, 212Hs:CPP, 212Ht:CPP, 212Hv:CPP, 212Hw:CPP, 212Hx:CPP, 212Hy:CPP, 212Ib:C??, 212Ja:CPP, 212Jb:CPP, 212Jc:CPP, 212Jf:CPP, 212Jj:CPP, 212Jk:CPP, 212Jl:CPP, 212Jm:CPP, 212Jn:CPP, 212Jo:CPP, 212Jr:CPP, 212Ka:CCP, 212Kb:CCC, 212La:CPP, 212Mb:CPP, 212Na:CPP, 212Nb:CPP, 212Nc:CPP, 221Ec:CCC, 221Eg:CCC, 221Fa:CCC, 222Am:CCC, 222Ge:CCC, 222Ha:CCC, 222Jc:CCC, 222Jh:CCC, 222Ji:CCC, 222Jj:CCC, 222Kf:CCC, 222Kg:CCC, 222Mb:CCC, 222Mc:CCC, 222Md:CCC, 222Me:CCC, 251Aa:CCC, 251Ba:CCC, 251Bb:CCC, 251Bd:CCC, 251Be:CCC, 251Cc:CCC, 251Cf:CCC, 251Cg:CCC, 251Dc:CCC, 251Dg:CCC, 251Ea:CCC, 251Ed:CCC, 255Aa:CCC

Federal Lands: NPS (Cuyahoga Valley, Indiana Dunes, Saint Croix, Voyageurs); USFS (Chequamegon, Chequamegon-Nicolet, Chippewa, Hiawatha, Nicolet, Ottawa?, Superior?)

ELEMENT SOURCES

Saint Croix National Scenic Riverway Map Code: HMM and HME

Local Description Authors:

Global Description Authors: D. Faber-Langendoen

References: Chapman et al. 1989, Faber-Langendoen 2001, Harris et al. 1996, Hop et al. 2009, INAI unpubl. data, Lauver et al. 1999, MNNHP 1993, Midwestern Ecology Working Group n.d., NDNHI unpubl. data, Nelson 1985, ONHD unpubl. data, Steinauer and Rolfsmeier 2003, WNHIP unpubl. data

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Wild Rice Marsh

***Zizania (aquatica, palustris)* Herbaceous Vegetation**
(Indian Wild Rice, Northern Wild Rice) Herbaceous Vegetation
Identifier: CEGL002382

NVC CLASSIFICATION

Division	Eastern North American Freshwater Wet Meadow, Riparian & Marsh (2.C.5.Na)
Macrogroup	Eastern North American Wet Meadow & Marsh (M069)
Group	Eastern North American Freshwater Marsh (G125)
Association (Common name)	Wild Rice Marsh

ELEMENT CONCEPT

Global Summary: This wild rice marsh community is found in the upper midwestern United States and adjacent Canada. Stands are found in deeper, sheltered waters of slow-moving streams, protected bays, and flowage lakes, particularly at stream mouths. Water depths generally exceed 0.5 m. Substrate is rich sedimentary peat, or mucky, silty soils. A thick mat of rice stalks often covers the bottom. The marsh is dominated almost entirely by the tall emergent graminoids *Zizania aquatica* (annual wildrice) or *Zizania palustris* (northern wildrice). Floating-leaved and submerged aquatic cover can be high, but species composition is variable. Species include *Ceratophyllum demersum* (coon's-tail), *Nuphar variegata* (variegated yellow pond-lily), *Potamogeton natans* (floating pondweed), *Potamogeton zosteriformis* (flatstem pondweed), *Spirodela polyrrhiza* (common duckmeat), *Utricularia macrorhiza* (common bladderwort), and others.

ENVIRONMENTAL DESCRIPTION

Saint Croix National Scenic Riverway Environment: This wild rice marsh community was sampled twice in the park. Sites include a flat channel bed with sand soil and a permanently flooded flat with a half meter of standing water and very poorly drained muck soil. The unvegetated surface is dominated either by leaf litter (0-97% cover) or standing water (0-92%) with some dead plant stems (3-8%). Evidence of disturbance include natural processes of water currents, ice-scouring, and sand deposition.
Global Environment: Stands are found in deeper, sheltered waters of slow-moving streams, protected bays, and flowage lakes, particularly at stream mouths. Water depths generally exceed 0.5 m. Substrate is rich sedimentary peat, or mucky, silty soils. A thick mat of rice stalks often covers the bottom (Voss 1972, Harris et al. 1996).

VEGETATION DESCRIPTION

Saint Croix National Scenic Riverway Vegetation: This community is dominated by a dense (70-80% cover) herbaceous layer, 0.5-1 m tall, dominated by *Zizania aquatica* (annual wildrice). Additional species include *Ceratophyllum demersum* (coon's-tail), *Elodea canadensis* (Canadian waterweed), *Potamogeton nodosus* (longleaf pondweed), *Potamogeton robbinsii* (Robbins' pondweed), *Sagittaria latifolia* (broadleaf arrowhead), *Sagittaria rigida* (sessilefruit arrowhead), *Sparganium erectum* ssp. *stoloniferum* (simplestem bur-reed), *Stuckenia pectinata* (sago pondweed), and *Vallisneria americana* (American eel-grass).
Global Vegetation: This marsh is dominated almost entirely by the tall emergent graminoids *Zizania aquatica* (annual wildrice) or *Zizania palustris* (northern wildrice). Floating-leaved and submerged aquatic cover can be high, but species composition is variable. Species include *Ceratophyllum demersum* (coon's-tail), *Nuphar variegata* (variegated yellow pond-lily), *Potamogeton natans* (floating pondweed), *Potamogeton zosteriformis* (flatstem pondweed), *Spirodela polyrrhiza* (common duckmeat), *Utricularia macrorhiza* (common bladderwort), and others (Harris et al. 1996).

MOST ABUNDANT SPECIES

Saint Croix National Scenic Riverway

Stratum	Lifeform	Species
Herb (field)	Graminoid	*Zizania aquatica* (annual wildrice)

CHARACTERISTIC SPECIES

Saint Croix National Scenic Riverway: *Sagittaria latifolia* (broadleaf arrowhead), *Sagittaria rigida* (sessilefruit arrowhead), *Sparganium erectum* ssp. *stoloniferum* (simplestem bur-reed), *Zizania aquatica* (annual wildrice)

CONSERVATION STATUS RANK

Global Rank & Reasons: G3G4 (21-Jan-2000). In southern Wisconsin, this type has been greatly reduced by drainage of wetlands. Augmentation of the type through planting makes it difficult to distinguish natural stands from cultural stands.

CLASSIFICATION

Status: Standard
Classification Confidence: 3 - Weak
Global Comments: Taxonomy of wild rice is somewhat indeterminate. *Zizania aquatica* (annual wildrice) may be more common in southern stands and *Zizania palustris* (northern wildrice) in more northern stands. Stands of this type may have cultural origins, as wild rice was an important food source for Native Americans (Voss 1972). In northeastern Minnesota and Wisconsin, commercial operators and agency wildlife managers may establish stands by seeding directly into natural open water marsh systems (Chel Anderson pers. comm. 1998, E. Epstein pers. comm. 1999). These *Zizania* (wildrice) species are actually annual grasses, so

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technically they should be placed in a "Permanently flooded temperate annual grassland" formation (V.D.2.N.x), but they are left with their other perennial associates for clarity.

Global Similar Associations:
- *Zizania aquatica* Tidal Herbaceous Vegetation (CEGL004202)

Global Related Concepts:
- Deep Marsh Wild Rice Subtype (Faber-Langendoen 2001) =
- Inland Emergent Marsh (Chapman et al. 1989) >
- Marsh: wild rice: organic substrate (W9) (Harris et al. 1996) =
- Mixed Emergent Marsh (Forest Section) (MNNHP 1993) >

ELEMENT DISTRIBUTION

Global Range: This wild rice marsh community is found in the upper midwestern and northeastern United States and adjacent Canada, ranging from Vermont and New York to Minnesota and Manitoba, south to Iowa and Indiana.
Nations: CA, US
States/Provinces: IA:SU, IN, MB?, MI, MN, NY, ON, VT, WI:S3
TNC Ecoregions: 47:C, 48:C, 61:C, 63:C, 64:C
USFS Ecoregions (1994/95): 212E:CC, 212Hq:CPP, 212Ja:CCC, 212Jb:CC?, 212Jc:CC?, 212Jl:CCP, 212Jm:CCC, 212Jn:CC?, 212Jo:CC?, 212La:CPP, 212Mb:CPP, 212Na:CPP, 212Nb:CPP, 212Nc:CPP, 221Bc:CCC, 222Ji:PPP, M212Ba:CCC, M212Bb:CCC
Federal Lands: NPS (Saint Croix, Saratoga?, Voyageurs); USFS (Chequamegon-Nicolet, Chequamegon?, Chippewa, Nicolet, Ottawa?)

ELEMENT SOURCES

Saint Croix National Scenic Riverway Map Code: HWR and HME
Saint Croix National Scenic Riverway Plots: SACN.130, SACN.270.
Local Description Authors: M.J. Russo
Global Description Authors: D. Faber-Langendoen
References: Chapman et al. 1989, Faber-Langendoen 2001, Greenall 1996, Harris et al. 1996, INAI unpubl. data, MNNHP 1993, Midwestern Ecology Working Group n.d., NRCS 2004a, Thompson and Sorenson 2000, Voss 1972, WNHIP unpubl. data

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G112. Eastern North American Wet Meadow

Bluejoint Wet Meadow

***Calamagrostis canadensis - Eupatorium maculatum* Herbaceous Vegetation**
Bluejoint - Spotted Joe-pyeweed Herbaceous Vegetation
Identifier: CEGL005174

NVC CLASSIFICATION

Division	Eastern North American Freshwater Wet Meadow, Riparian & Marsh (2.C.5.Na)
Macrogroup	Eastern North American Wet Meadow & Marsh (M069)
Group	Eastern North American Wet Meadow (G112)
Association (Common name)	Bluejoint Wet Meadow

ELEMENT CONCEPT

Global 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 joepyeweed), *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 arrow-wood), *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

Saint Croix National Scenic Riverway Environment: This bluejoint wet meadow vegetation was sampled at six locations in the park. Sites are flat to gently sloping floodplains and riverbanks which may be intermittently flooded. Soils are quite variable ranging from poorly drained muck to moderately well-drained silt loam to rapidly drained sand. The unvegetated surface is dominated by leaf litter (85-96% cover) with some large rocks (0-3%), wood (1-5%), bare soil (1-2%), and dead plant stems (2-9%). Evidence of disturbance includes trails and the presence of exotic plants.
Global Environment: 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

Saint Croix National Scenic Riverway Vegetation: This community is defined by the dominant (40-100% cover) herbaceous layer. However, there may also be a very sparse to moderate (5-50%) emergent shrub layer (1-2 m tall) that may include *Cornus racemosa* (gray dogwood), *Rubus allegheniensis* (Allegheny blackberry), and/or *Rubus idaeus* (American red raspberry). *Calamagrostis canadensis* (bluejoint) strongly dominates the herbaceous layer; additional species may include *Carex emoryi* (Emory's sedge), *Fragaria virginiana* (Virginia strawberry), *Galium boreale* (northern bedstraw), *Phalaris arundinacea* (reed canarygrass), *Polygonum punctatum* (dotted smartweed), *Potentilla simplex* (common cinquefoil), *Polygonum sagittatum* (arrowleaf tearthumb), *Scirpus cyperinus* (woolgrass), *Solidago canadensis* (Canada goldenrod), *Spartina pectinata* (prairie cordgrass), and others. A total of 11 exotics were recorded from six sample plots. In addition, this community may support Minnesota state-vulnerable *Lysimachia quadrifolia* (whorled yellow loosestrife) and Wisconsin state-vulnerable *Juncus vaseyi* (Vasey's rush).
Global Vegetation: 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 joepyeweed), *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.

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MOST ABUNDANT SPECIES

Saint Croix National Scenic Riverway

Stratum	Lifeform	Species
Herb (field)	Forb	*Fragaria virginiana* (Virginia strawberry), *Galium boreale* (northern bedstraw), *Potentilla simplex* (common cinquefoil)
Herb (field)	Graminoid	*Calamagrostis canadensis* (bluejoint), *Phalaris arundinacea* (reed canarygrass)

Global

Stratum	Lifeform	Species
Herb (field)	Graminoid	*Calamagrostis canadensis* (bluejoint)

CHARACTERISTIC SPECIES

Saint Croix National Scenic Riverway: *Calamagrostis canadensis* (bluejoint), *Fragaria virginiana* (Virginia strawberry), *Galium boreale* (northern bedstraw), *Leersia oryzoides* (rice cutgrass), *Phalaris arundinacea* (reed canarygrass), *Potentilla simplex* (common cinquefoil)
Global: *Calamagrostis canadensis* (bluejoint)

OTHER NOTEWORTHY SPECIES

Saint Croix National Scenic Riverway: Vulnerable: *Juncus vaseyi* (Vasey's rush, WI state-vulnerable, G5?), *Lysimachia quadrifolia* (whorled yellow loosestrife, MN state-vulnerable, G5); **Exotic/Invasive**: *Agrostis gigantea* (redtop, invasive/exotic, Medium/Low), *Bromus inermis* (smooth brome, invasive/exotic, High/Medium), *Calystegia sepium* ssp. *sepium* (hedge false bindweed, invasive/exotic), *Elymus repens* (quackgrass, invasive/exotic, High/Medium), *Lotus corniculatus* (bird's-foot trefoil, invasive/exotic, Medium/Low), *Lythrum salicaria* (purple loosestrife, invasive/exotic, High), *Pennisetum glaucum* (pearl millet, invasive/exotic), *Poa pratensis* (Kentucky bluegrass, invasive/exotic, Medium), *Salix alba* (white willow, invasive/exotic), *Trifolium repens* (white clover, invasive/exotic, Medium/Low)
Global: Vulnerable: *Polemonium vanbruntiae* (Vanbrunt's polemonium, G3G4)

CONSERVATION STATUS RANK

Global Rank & Reasons: G4G5 (31-Mar-2000). This type is widespread throughout the northeastern and upper midwestern United States and central/southern Canada.

CLASSIFICATION

Status: Standard
Classification Confidence: 2 - Moderate
Global 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.
Global 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)

Global Related Concepts:
- *Calamagrostis canadensis - Phalaris arundinacea* Herbaceous Vegetation (Harrison 2004) =
- *Calamagrostis canadensis* herbaceous community (Walbridge and Lang 1982) =
- *Calamagrostis canadensis* meadow (Walbridge 1982) =
- *Calamagrostis canadensis* wet meadow (Fortney 1975) =
- Bluejoint Meadow (Gawler 2002) >
- Bluejoint Meadow (Faber-Langendoen 2001) =
- 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) **?**
- Wet Meadow (MNNHP 1993) >
- Wet Meadow (Harrison 2004) >

ELEMENT DISTRIBUTION

Global 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.

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Nations: CA, US
States/Provinces: CT, DE, MA, MD:S5, ME, MI, MN, NH, NJ, NY, ON, PA, QC:S4?, RI, VA?, VT, WI, WV:S2
TNC Ecoregions: 35:C, 45:C, 47:C, 48:C, 51:P, 59:C, 60:C, 61:C, 63:C, 64:C
USFS Ecoregions (1994/95): 212Cb:CCC, 212Fa:CCC, 212Fb:CCC, 212Fc:CCC, 212Fd:CCC, 212Ga:CCC, 212Gb:CCC, 212Hi:CCC, 212Hj:CCC, 212Ho:CCC, 212Hs:CCC, 212Hw:CCC, 212Hx:CCC, 212Ia:CCC, 212Ib:CCC, 212La:CCP, 212Lb:CCC, 212Na:CPP, 221Ae:CCP, 221Af:CCC, 221Ag:CCC, 221Ah:CCC, 221Ai:CCC, 221Al:CCC, 221Ba:CCP, 221Bb:CCC, 221Bc:CCP, 221Bd:CCC, 221D:CC, 222Jg:CCC, 222Na:CCC, 251Aa:CCC, M212Bb:CCC, M212Bc:CCC, M212Bd:CCC, M212Cb:CCC, M212Ea:CCC, M212Eb:CCC, M221Ba:CCC, M221Bb:CCC, M221Db:C??, M221Dc:C??, M221Dd:C??
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?)

ELEMENT SOURCES

Saint Croix National Scenic Riverway Map Code: HCC
Saint Croix National Scenic Riverway Plots: SACN.93, SACN.105, SACN.250, SACN.259, SACN.3529, SACN.7452.
Local Description Authors: M.J. Russo
Global 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., Faber-Langendoen 2001, Fike 1999, Fortney 1975, Francl et al. 2004, Gawler 2002, Harris et al. 1996, Harrison 2004, Hop et al. 2010a, Hop et al. 2010b, Hop et al. 2010c, MNNHP 1993, NAP pers. comm. 1998, Podniesinski et al. 2005b, Rawinski 1984, Swain and Kearsley 2001, TNC 1999b, Thompson 1996, Thompson and Sorenson 2000, WNHIP unpubl. data, Walbridge 1982, Walbridge and Lang 1982

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Northern Sedge Wet Meadow

***Carex (rostrata, utriculata) - Carex lacustris - (Carex vesicaria)* Herbaceous Vegetation**
(Beaked Sedge, Northwest Territory Sedge) - Lake Sedge - (Inflated Sedge) Herbaceous Vegetation
Identifier: CEGL002257

NVC CLASSIFICATION

Division	Eastern North American Freshwater Wet Meadow, Riparian & Marsh (2.C.5.Na)
Macrogroup	Eastern North American Wet Meadow & Marsh (M069)
Group	Eastern North American Wet Meadow (G112)
Association (Common name)	Northern Sedge Wet Meadow

ELEMENT CONCEPT

Global Summary: This northern tall sedge community is found in the mixed conifer - hardwood zone of the Great Lakes region and north into Canada, with outliers in the Allegheny Mountains region of West Virginia and Maryland. Sites are found on floodplains, shallow bays of lakes and streams, beaver meadows, ditches, and occasionally in isolated basins, or on semi-floating mats. Hydrology is seasonally to semipermanently flooded. Substrate is mineral soil or well-decomposed peat. Tall coarse-leaved sedges dominate the vegetation layer, often creating a tussocky hummock microtopography. Shrubs can cover up to 25% of the area. Pools with submergents may also be present. Dominant graminoids include a number of Carices, including *Carex aquatilis* (water sedge), *Carex lacustris* (hairy sedge), *Carex lasiocarpa* (woollyfruit sedge), *Carex rostrata* (beaked sedge), *Carex utriculata* (Northwest Territory sedge), *Carex vesicaria* (blister sedge), and locally *Carex stricta* (upright sedge). Other graminoids include *Calamagrostis canadensis* (bluejoint), *Scirpus atrovirens* (green bulrush), *Scirpus cyperinus* (woolgrass), and in wetter areas, *Eleocharis palustris* (common spikerush) and *Equisetum fluviatile* (water horsetail). Forbs include *Acorus calamus* (calamus), *Symphyotrichum lanceolatum* var. *lanceolatum* (white panicle aster), *Campanula aparinoides* (marsh bellflower), *Eupatorium maculatum* (spotted joepyeweed), *Iris virginica* var. *shrevei* (Shreve's iris), *Lycopus uniflorus* (northern bugleweed), *Poa palustris* (fowl bluegrass), *Polygonum amphibium* (water knotweed), *Comarum palustre* (purple marshlocks), and others. Diagnostic features include the general dominance by coarse-leaved sedges, wet, somewhat peaty soil conditions, and the mix of sub-boreal herbs with more temperate herbs.

ENVIRONMENTAL DESCRIPTION

Saint Croix National Scenic Riverway Environment: This northern tall sedge community was sampled at 11 locations in the park. Sites are flat depressions and wet meadows that may be permanently flooded, with very poorly drained muck and peat soils. The unvegetated surface is dominated by leaf litter (59-94% cover) with some standing water (0-20%), bare soil (0-30%), and dead plant stems (6-15%). No evidence of disturbance was reported except the presence of one exotic species.
Global Environment: Sites are found on floodplains, shallow bays of lakes and streams, beaver meadows, ditches, and occasionally in isolated basins, or on semi-floating mats. Hydrology is seasonally to semipermanently flooded. Substrate is mineral soil or well-decomposed peat (Curtis 1959, Harris et al. 1996).

VEGETATION DESCRIPTION

Saint Croix National Scenic Riverway Vegetation: The dense to total (80-100% cover) herbaceous layer dominates this community. However, there may also be a scattering (<5%) of trees and shrubs, including *Salix pyrifolia* (balsam willow), *Spiraea alba* (white meadowsweet), and *Spiraea tomentosa* (steeplebush). Dominants in the herb layer include graminoids *Calamagrostis canadensis* (bluejoint), *Carex lacustris* (hairy sedge), *Carex utriculata* (Northwest Territory sedge), and *Scirpus cyperinus* (woolgrass) and forbs *Acorus americanus* (sweetflag) and *Comarum palustre* (purple marshlocks). Additional herbs include *Calla palustris* (water arum), *Campanula aparinoides* (marsh bellflower), *Carex rostrata* (beaked sedge), *Dryopteris cristata* (crested woodfern), *Eleocharis palustris* (common spikerush), *Lysimachia terrestris* (earth loosestrife), *Sagittaria latifolia* (broadleaf arrowhead), *Thelypteris palustris* (eastern marsh fern), and *Typha latifolia* (broadleaf cattail). Nonvascular species (sphagnum and other mosses) cover up to 95% of the ground surface.
Global Vegetation: Tall coarse-leaved sedges dominate the vegetation layer, often creating a tussocky hummock microtopography. Shrubs can cover up to 25% of the area. Pools with submergents may also be present. Dominant graminoids include a number of Carices, including *Carex aquatilis* (water sedge), *Carex lacustris* (hairy sedge), *Carex lasiocarpa* (woollyfruit sedge), *Carex rostrata* (beaked sedge), *Carex vesicaria* (blister sedge), and locally *Carex stricta* (upright sedge). Other graminoids include *Calamagrostis canadensis* (bluejoint), *Scirpus atrovirens* (green bulrush), *Scirpus cyperinus* (woolgrass), and in wetter areas, *Eleocharis palustris* (common spikerush) and *Equisetum fluviatile* (water horsetail). Forbs include *Acorus calamus* (calamus), *Symphyotrichum lanceolatum* var. *lanceolatum* (white panicle aster), *Campanula aparinoides* (marsh bellflower), *Eupatorium maculatum* (spotted joepyeweed), *Iris virginica* var. *shrevei* (Shreve's iris), *Lycopus uniflorus* (northern bugleweed), *Poa palustris* (fowl bluegrass), *Polygonum amphibium* (water knotweed), *Comarum palustre* (purple marshlocks), and others (Curtis 1959, Harris et al. 1996).

MOST ABUNDANT SPECIES

Saint Croix National Scenic Riverway

Stratum	Lifeform	Species
Herb (field)	Forb	*Comarum palustre* (purple marshlocks)

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Herb (field)	Graminoid	*Calamagrostis canadensis* (bluejoint), *Carex lacustris* (hairy sedge), *Carex rostrata* (beaked sedge), *Carex utriculata* (Northwest Territory sedge), *Scirpus cyperinus* (woolgrass)

CHARACTERISTIC SPECIES

Saint Croix National Scenic Riverway: *Calamagrostis canadensis* (bluejoint), *Carex lacustris* (hairy sedge), *Carex rostrata* (beaked sedge), *Carex utriculata* (Northwest Territory sedge), *Comarum palustre* (purple marshlocks), *Scirpus cyperinus* (woolgrass)

OTHER NOTEWORTHY SPECIES

Saint Croix National Scenic Riverway: Exotic/Invasive: *Frangula alnus* (glossy buckthorn, invasive/exotic, High/Medium)

CONSERVATION STATUS RANK

Global Rank & Reasons: G4G5 (17-Jun-1999).

CLASSIFICATION

Status: Standard

Classification Confidence: 2 - Moderate

Global Comments: Expansion of the range of this type eastward to Massachusetts and West Virginica is based on the ambiguous application of *Carex utriculata* (Northwest Territory sedge) in past studies. Taxonomy and distribution of *Carex utriculata* (Northwest Territory sedge) versus *Carex rostrata* (beaked sedge) needs to be resolved. In Gleason and Cronquist (1991), *Carex rostrata* (beaked sedge) is circumboreal and only occurs in northern Michigan and northern Minnesota, whereas *Carex utriculata* (Northwest Territory sedge) is boreal but extends south to Delaware, Indiana, Nebraska, New Mexico and California. (*Carex vesicaria* (blister sedge) has a similar distribution to *Carex utriculata* (Northwest Territory sedge).) *Carex rostrata* (beaked sedge) has also been reported from extreme northern Wisconsin, e.g., on the Apostle Islands (E. Judziewicz pers. comm. 1999). However, all of the atlases and floras in the Midwest (Voss 1972, Mohlenbrock and Ladd 1978, Ownbey and Morley 1991) do not make such a distinction, so the species are essentially treated as synonymous in this type. Curtis (1959) suggested that differential species for northern sedge meadows in Wisconsin may be *Symphyotrichum puniceum* (purplestem aster), *Campanula aparinoides* (marsh bellflower), *Glyceria canadensis* (rattlesnake mannagrass), *Scirpus atrovirens* (green bulrush), and *Solidago uliginosa* (bog goldenrod), among others, but this list needs further study.

Global Similar Associations:

- *Calamagrostis canadensis - Eupatorium maculatum* Herbaceous Vegetation (CEGL005174) This type is more heavily grass- and forb-dominated, sedges <25%?
- *Carex aquatilis - Carex utriculata* Herbaceous Vegetation (CEGL001803)
- *Carex lacustris* Herbaceous Vegetation (CEGL002256)
- *Carex stricta - Carex* spp. Herbaceous Vegetation (CEGL002258)
- *Chamaedaphne calyculata / Carex oligosperma / Sphagnum* spp. Dwarf-shrubland (CEGL005091)
- *Cornus sericea - Salix (bebbiana, discolor, petiolaris) / Calamagrostis stricta* Shrubland (CEGL002187)
- *Eriophorum virginicum - (Carex folliculata) / Sphagnum* spp. - *Polytrichum* spp. Herbaceous Vegetation (CEGL006570)
- *Myrica gale - Chamaedaphne calyculata / Carex (lasiocarpa, utriculata) - Utricularia* spp. Shrub Herbaceous Vegetation (CEGL006302)

Global Related Concepts:

- *Carex rostrata - Rubus hispidus - Pyrus melanocarpa* community (Edens 1973) =
- *Carex rostrata - Sphagnum* spp. community (Darlington 1943) =
- *Carex rostrata* sedge-meadow community (Robinette 1966) =
- *Polytrichum - Carex (rostrata, stricta)* hummock bog (Fortney 1975) =
- Calcareous Spring Marsh / Muck Fen (Fleming et al. 2001) >
- Meadow marsh: tall sedge (W12) (Harris et al. 1996) =
- Mixed Tall Sedge Fen (Gawler 2002) >
- Northern Sedge Meadow (Curtis 1959) =
- Sedge Meadow Northern Subtype (Faber-Langendoen 2001) =
- Wet Meadow (MNNHP 1993) >

ELEMENT DISTRIBUTION

Global Range: This northern tall sedge community is found in the mixed conifer - hardwood zone of the Great Lakes and northeastern region of the United States and north into Canada, extending from Maine to Manitoba, south to Michigan and Iowa.

Nations: CA, US

States/Provinces: IA, MB:SU, ME, MI, MN, ND:S2S3, ON, QC:S4?, SD, VA?, WI:S3, WV:S2, WY

TNC Ecoregions: 26:C, 34:C, 35:C, 46:C, 47:C, 48:C, 59:C

USFS Ecoregions (1994/95): 212Ha:CCP, 212Hb:CCP, 212He:CCP, 212Hh:CCP, 212Hi:CCC, 212Hj:CCC, 212Hk:CCP, 212Hn:CCP, 212Ho:CCC, 212Hq:CCP, 212Hr:CCP, 212Hs:CCP, 212Ht:CCP, 212Hv:CCC, 212Hw:CCC, 212Hx:CCP, 212Hy:CCP, 212Ia:CCC, 212Ib:CCP, 212Ja:CCP, 212Jb:CCP, 212Jc:CCP, 212Jd:CCC, 212Je:CC?, 212Jf:CCP, 212Jj:CCP, 212Jk:CCP, 212Jl:CCP, 212Jm:CCP, 212Jn:CCP, 212Jo:CCP, 212Jr:CCP, 212Ka:CCC, 212La:CCP, 212Lb:CCC, 212Lc:CCP, 212Ld:CCP, 212Mb:CPP, 212Na:CPP, 212Nb:CPP, 212Nc:CPP, 222Lb:CCC, 251Ab:CCC, 251B:CC, 332:?

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Federal Lands: NPS (Apostle Islands, Grand Portage, Isle Royale, Pictured Rocks, Saint Croix, Sleeping Bear Dunes, Voyageurs); USFS (Chequamegon, Chequamegon-Nicolet, Chippewa, Hiawatha, Huron, Huron-Manistee, Manistee, Monongahela, Nicolet, Ottawa?, Superior?); USFWS (Canaan Valley)

ELEMENT SOURCES

Saint Croix National Scenic Riverway Map Code: HMM and HME

Saint Croix National Scenic Riverway Plots: SACN.3, SACN.23, SACN.37, SACN.95, SACN.125, SACN.0073, SACN.0075, SACN.4100, SACN.5116, SACN.7485, SACN.7496.

Local Description Authors: M.J. Russo

Global Description Authors: D. Faber-Langendoen, mod. E.A. Byers

References: Byers et al. 2007, Curtis 1959, Damman and French 1987, Darlington 1943, Edens 1973, Faber-Langendoen 2001, Fleming and Coulling 2001, Fleming et al. 2001, Fortney 1975, Fortney and Rentch 2003, Francl et al. 2004, Gawler 2002, Gleason and Cronquist 1991, Greenall 1996, Harris et al. 1996, Hop et al. 2010a, Hop et al. 2010b, Hop et al. 2010c, INAI unpubl. data, MNNHP 1993, Midwestern Ecology Working Group n.d., Mohlenbrock and Ladd 1978, NDNHI unpubl. data, Ownbey and Morley 1991, Robinette 1966, TNC 1999b, Voss 1972, WNHIP unpubl. Data

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Upright Sedge Wet Meadow

***Carex stricta* - *Carex* spp. Herbaceous Vegetation**
Upright Sedge - Sedge species Herbaceous Vegetation
Identifier: CEGL002258

NVC CLASSIFICATION

Division	Eastern North American Freshwater Wet Meadow, Riparian & Marsh (2.C.5.Na)
Macrogroup	Eastern North American Wet Meadow & Marsh (M069)
Group	Eastern North American Wet Meadow (G112)
Association (Common name)	Upright Sedge Wet Meadow

ELEMENT CONCEPT

Global Summary: This wet sedge meadow community is found in the southern Great Lakes region and parts of the central midwestern United States. Sites occur in stream valleys, along lake margins, and in depressions and channels in glacial outwash. Soils include wet mineral soils, muck, or shallow peat (<0.5 m), with the water table below the surface for most of the growing season. The vegetation is dominated by sedges and grasses, but the shrub component can be high as 25%. Dominant plants include *Calamagrostis canadensis* (bluejoint) and *Carex stricta* (upright sedge). Associated graminoids include *Carex aquatilis* (water sedge), *Carex pellita* (woolly sedge), *Carex bebbii* (Bebb's sedge), *Carex lacustris* (hairy sedge), *Eleocharis* (spikerush) spp., *Juncus* (rush) spp., *Phalaris arundinacea* (reed canarygrass) (common in more degraded examples), and *Typha latifolia* (broadleaf cattail). Typical forbs include *Anemone canadensis* (Canadian anemone), *Asclepias incarnata* (swamp milkweed), *Symphyotrichum lanceolatum* var. *lanceolatum* (white panicle aster), *Equisetum arvense* (field horsetail), *Eupatorium maculatum* (spotted joepyeweed), *Eupatorium perfoliatum* (common boneset), *Iris versicolor* (harlequin blueflag), *Lycopus americanus* (American water horehound), and *Solidago canadensis* (Canada goldenrod).

ENVIRONMENTAL DESCRIPTION

Saint Croix National Scenic Riverway Environment: This wet sedge meadow community was sampled at seven locations in the park. Sites include flat to gently sloping river channels, floodplains, riverbanks, and wet meadows. Soils are variable, ranging from somewhat poorly to poorly drained muck and peat to moderately well-drained silt loam to rapidly drained sand. The unvegetated surface is dominated by leaf litter (82-95% cover) with some wood (0-2%), bare soil (0-10%), and dead plant stems (3-11%). Evidence of disturbance includes the presence of exotic plants.
Global Environment: Sites occur in stream valleys, along lake margins, and in depressions and channels in glacial outwash. Soils include wet mineral soils, muck, or shallow peat (<0.5 m), with the water table below the surface for most of the growing season (Chapman et al. 1989, MNNHP 1993).

VEGETATION DESCRIPTION

Saint Croix National Scenic Riverway Vegetation: The very dense to total (80-100% cover) herbaceous layer dominates this community. However, there may also be a scattering (5%) of shrubs, including *Salix petiolaris* (meadow willow) and *Spiraea alba* (white meadowsweet). *Carex* (sedge) spp. dominate the herbaceous layer and include *Carex bebbii* (Bebb's sedge), *Carex crinita* (fringed sedge), *Carex haydenii* (Hayden's sedge), *Carex lacustris* (hairy sedge), *Carex lupulina* (hop sedge), *Carex retrorsa* (knotsheath sedge), *Carex stricta* (upright sedge), *Carex tribuloides* (blunt broom sedge), *Carex tuckermanii* (Tuckerman's sedge), *Carex typhina* (cattail sedge) (Minnesota state-vulnerable), *Carex utriculata* (Northwest Territory sedge), and others. Additional herbs include *Artemisia serrata*, *Bidens frondosa* (devil's beggarticks), *Boehmeria cylindrica* (small-spike false nettle), *Elymus virginicus* (Virginia wildrye), *Galium trifidum* (threepetal bedstraw), *Leersia oryzoides* (rice cutgrass), *Leersia virginica* (whitegrass), *Onoclea sensibilis* (sensitive fern), *Polygonum amphibium* (water knotweed), *Polygonum sagittatum* (arrowleaf tearthumb), *Scirpus cyperinus* (woolgrass), *Stachys tenuifolia* (smooth hedgenettle), and *Stellaria longifolia* (longleaf starwort).
Global Vegetation: The vegetation is dominated by sedges and grasses, but the shrub component can be high as 25%. Dominant plants include *Calamagrostis canadensis* (bluejoint) and *Carex stricta* (upright sedge). Associated graminoids include *Carex aquatilis* (water sedge), *Carex pellita* (woolly sedge), *Carex bebbii* (Bebb's sedge), *Carex lacustris* (hairy sedge), *Eleocharis* (spikerush) spp., *Juncus* (rush) spp., *Phalaris arundinacea* (reed canarygrass) (common in more degraded examples), and *Typha latifolia* (broadleaf cattail). Typical forbs include *Anemone canadensis* (Canadian anemone), *Asclepias incarnata* (swamp milkweed), *Symphyotrichum lanceolatum* var. *lanceolatum* (white panicle aster), *Equisetum arvense* (field horsetail), *Eupatorium maculatum* (spotted joepyeweed), *Eupatorium perfoliatum* (common boneset), *Iris versicolor* (harlequin blueflag), *Lycopus americanus* (American water horehound), and *Solidago canadensis* (Canada goldenrod) (Curtis 1959, Chapman et al. 1989, MNNHP 1993).

MOST ABUNDANT SPECIES

Saint Croix National Scenic Riverway

Stratum	Lifeform	Species
Herb (field)	Graminoid	*Calamagrostis canadensis* (bluejoint), *Carex bebbii* (Bebb's sedge), *Carex haydenii* (Hayden's sedge), *Carex lupulina* (hop sedge), *Carex stricta* (upright sedge), *Carex tuckermanii* (Tuckerman's sedge), *Leersia virginica* (whitegrass)

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CHARACTERISTIC SPECIES

Saint Croix National Scenic Riverway: *Calamagrostis canadensis* (bluejoint), *Carex bebbii* (Bebb's sedge), *Carex haydenii* (Hayden's sedge), *Carex lupulina* (hop sedge), *Carex stricta* (upright sedge), *Carex tuckermanii* (Tuckerman's sedge), *Leersia virginica* (whitegrass)

OTHER NOTEWORTHY SPECIES

Saint Croix National Scenic Riverway: Vulnerable: *Carex typhina* (cattail sedge, MN state-vulnerable, G5); **Exotic/Invasive**: *Calystegia sepium* ssp. *sepium* (hedge false bindweed, invasive/exotic), *Cirsium arvense* (Canada thistle, invasive/exotic, High/Medium), *Echinochloa muricata* var. *muricata* (rough barnyardgrass, invasive/exotic), *Hesperis matronalis* (dames rocket, invasive/exotic, Medium/Low), *Humulus lupulus* (common hop, invasive/exotic), *Poa pratensis* (Kentucky bluegrass, invasive/exotic, Medium), *Polygonum hydropiper* (marshpepper knotweed, invasive/exotic), *Urtica dioica* (stinging nettle, invasive/exotic)

CONSERVATION STATUS RANK

Global Rank & Reasons: G4? (3-Oct-1996).

CLASSIFICATION

Status: Standard

Classification Confidence: 2 - Moderate

Global Comments: This type may have some fen characteristics, but stands dominated by *Carex stricta* (upright sedge) with fen associates are better placed in *Carex stricta - Valeriana edulis - Parnassia palustris* Herbaceous Vegetation (CEGL005241), whose concept is strongly based on northeastern Iowa stands (Leoschke and Pearson 1987). The northern limits of this type are not clear with respect to *Carex (rostrata*, *utriculata) - Carex lacustris - (Carex vesicaria)* Herbaceous Vegetation (CEGL002257). Wet meadow stands in the northern parts of Michigan, Wisconsin, and Minnesota are usually placed in CEGL002257, and, although they are more typically dominated by coarse sedges (*Carex rostrata* (beaked sedge), *Carex lacustris* (hairy sedge), *Carex vesicaria* (blister sedge)), they can occasionally have dominance by *Carex stricta* (upright sedge)) (Harris et al. 1996, W12). As a result ecoregion distribution of this type needs review. Ontario stands may have some *Carex lasiocarpa* (woollyfruit sedge) in this type.

Global Similar Associations:

- *Calamagrostis canadensis - Eupatorium maculatum* Herbaceous Vegetation (CEGL005174)
- *Carex (rostrata, utriculata) - Carex lacustris - (Carex vesicaria)* Herbaceous Vegetation (CEGL002257) This types is typically dominated by coarse sedges, but occasionally by *Carex stricta*.
- *Carex lacustris* Herbaceous Vegetation (CEGL002256)
- *Carex* spp. - *(Carex pellita, Carex vulpinoidea)* Herbaceous Vegetation (CEGL005272)
- *Carex stricta - Carex vesicaria* Herbaceous Vegetation (CEGL006412)
- *Carex stricta - Valeriana edulis - Parnassia palustris* Herbaceous Vegetation (CEGL005241) This is the fen equivalent of the sedge meadow type.
- *Chamaedaphne calyculata / Carex oligosperma / Sphagnum* spp. Dwarf-shrubland (CEGL005091)
- *Cornus sericea - Salix (bebbiana, discolor, petiolaris) / Calamagrostis stricta* Shrubland (CEGL002187)

Global Related Concepts:

- Sedge Meadow Tussock Sedge Subtype (Faber-Langendoen 2001) =
- Wet Meadow (MNNHP 1993) >

ELEMENT DISTRIBUTION

Global Range: This wet sedge meadow community is found in the southern Great Lakes region of the United States and Canada, and parts of the central Midwest, ranging from Indiana and Ontario, west to Minnesota and Iowa.

Nations: CA, US

States/Provinces: IA:S3, IL:S2, IN, MI:S3, MN, ND:S2S3, ON, QC, WI:S3

TNC Ecoregions: 26:C, 35:C, 36:C, 45:C, 46:C, 47:C, 48:C

USFS Ecoregions (1994/95): 212Hb:CCC, 212Hl:CCC, 212Hm:CCP, 212Hn:CCP, 212Ho:CCC, 212Hp:CCP, 212Hq:CCP, 212Hr:CCP, 212Ht:CCP, 212Hv:CCC, 212Hw:CCC, 212Hx:CCP, 212Hy:CCC, 212Ib:CPP, 212Ja:CCP, 212Jb:CC?, 212Jc:CCP, 212Je:CCP, 212Jf:CCC, 212Jj:CCP, 212Jk:CCC, 212Jl:CCP, 212Jm:CCC, 212Ka:CPP, 212Mb:CPP, 212Na:CPP, 212Nb:CPP, 212Nc:CPP, 222Ha:CPP, 222Hb:CPP, 222Ja:CCP, 222Jb:CCC, 222Jg:CCC, 222Jh:CCC, 222Ji:CCC, 222Jj:CCC, 222Ka:CCC, 222Kb:CCC, 222Kd:CCC, 222Ke:CCC, 222Kf:CCC, 222Kg:CCC, 222Kh:CCC, 222Ki:CCC, 222Kj:CCC, 222Lb:CCC, 222Lc:CCC, 222Le:CCC, 222Lf:CCC, 222Me:CCC, 251Aa:CCC, 251Ab:CCC, 251Bb:CCC, 251Bd:CCC, 251Ca:CCC, 251Cc:CCC, 251Cf:CCC, 251Ch:CCC, 251Dc:CCC, 251Dd:CCP, 251Dg:CCC, 251Dh:CCP

Federal Lands: NPS (Indiana Dunes, Saint Croix, Sleeping Bear Dunes); USFS (Chequamegon, Chequamegon-Nicolet, Chippewa, Huron, Huron-Manistee, Manistee, Nicolet)

ELEMENT SOURCES

Saint Croix National Scenic Riverway Map Code: HUS

Saint Croix National Scenic Riverway Plots: SACN.45, SACN.66, SACN.102, SACN.106, SACN.246, SACN.276, SACN.3159.

Local Description Authors: M.J. Russo

Global Description Authors: D. Faber-Langendoen

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References: Chapman et al. 1989, Curtis 1959, Faber-Langendoen 2001, Harris et al. 1996, Hop et al. 2009, INAI unpubl. data, Leoschke and Pearson 1987, MNNHP 1993, Midwestern Ecology Working Group n.d., NDNHI unpubl. data, WNHIP unpubl. data, White and Madany 1978

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Dogwood - Mixed Willow Shrub Meadow

***Cornus sericea - Salix (bebbiana, discolor, petiolaris) / Calamagrostis stricta* Shrubland**
Red-osier Dogwood - (Bebb's Willow, Pussy Willow, Meadow Willow) / Western Bluejoint Shrubland
Identifier: CEGL002187

NVC CLASSIFICATION

Division	Eastern North American Freshwater Wet Meadow, Riparian & Marsh (2.C.5.Na)
Macrogroup	Eastern North American Wet Meadow & Marsh (M069)
Group	Eastern North American Wet Meadow (G112)
Association (Common name)	Dogwood - Mixed Willow Shrub Meadow

ELEMENT CONCEPT

Global Summary: This wet shrub meadow type is found in the northern prairie-forest border area of the midwestern United States. Stands may occur along stream courses or adjacent to lakes or in upland depressions. Soils are wet mineral, muck, or shallow peat (<0.5 m). Standing water is present in the spring and after heavy rains, but the water table draws down by mid-summer. Seepage areas may also occur. Shrub cover is at least 25% but does not become thick. Dominant species include *Cornus sericea* (red-osier dogwood), *Salix bebbiana* (Bebb willow), *Salix discolor* (pussy willow), *Salix petiolaris* (meadow willow), and *Spiraea alba* (white meadowsweet). Herbaceous species are typical of wet herbaceous meadows, and include the sedges *Carex aquatilis* (water sedge), *Carex atherodes* (wheat sedge), *Carex haydenii* (Hayden's sedge), *Carex lacustris* (hairy sedge), *Carex pellita* (woolly sedge), *Carex rostrata* (beaked sedge), *Carex stricta* (upright sedge), or grasses *Calamagrostis canadensis* (bluejoint) and *Calamagrostis stricta* (slimstem reedgrass). Forbs include *Asclepias incarnata* (swamp milkweed), *Symphyotrichum lanceolatum* (white panicle aster), *Symphyotrichum lateriflorum* (calico aster), *Symphyotrichum novae-angliae* (New England aster), *Symphyotrichum puniceum* (purplestem aster), *Chelone glabra* (white turtlehead), *Eupatorium maculatum* (spotted joepyeweed), and *Mentha arvensis* (wild mint). In northern Illinois prairie meadow species may include *Asclepias purpurascens* (purple milkweed), *Coreopsis tripteris* (tall tickseed), *Gentianella quinquefolia* (agueweed), and *Heliopsis helianthoides* (smooth oxeye).

ENVIRONMENTAL DESCRIPTION

Saint Croix National Scenic Riverway Environment: This meadow willow shrubland was sampled at eight locations in the park. Sites are flat depressions and floodplains with somewhat poorly drained to very poorly drained muck, peat and silt soils. The unvegetated surface is dominated by leaf litter (87-90% cover) with some wood (0-8%), bare soil (0-1%), and dead plant stems (3-16%). Evidence of disturbance includes possible periodic flooding (hummocks) and the presence of exotic plants.
Global Environment: Stands may occur along stream courses or adjacent to lakes or in upland depressions. Soils are wet mineral, muck, or shallow peat (<0.5 m). Standing water is present in the spring and after heavy rains, but the water table draws down by mid-summer. Seepage areas may also occur (MNNHP 1993).

VEGETATION DESCRIPTION

Saint Croix National Scenic Riverway Vegetation: The sparse to dense (20-80% cover) short-shrub layer (1-5 m) is dominated by *Salix petiolaris* (meadow willow); additional shrubs may include *Alnus incana* (gray alder), *Betula pumila* var. *glandulifera* (bog birch), *Cornus sericea* ssp. *sericea* (red-osier dogwood), *Rhamnus alnifolia* (alderleaf buckthorn), *Salix pyrifolia* (balsam willow), and *Spiraea alba* (white meadowsweet). The sparse to moderate (20-50%) herbaceous layer is dominated by *Carex lasiocarpa* (woollyfruit sedge), *Carex stricta* (upright sedge), and/or *Carex utriculata* (Northwest Territory sedge); additional herbs include *Calamagrostis canadensis* (bluejoint), *Comarum palustre* (purple marshlocks), *Eupatorium maculatum* (spotted joepyeweed), *Muhlenbergia glomerata* (spiked muhly), *Onoclea sensibilis* (sensitive fern), *Solidago canadensis* (Canada goldenrod), and *Thelypteris palustris* (eastern marsh fern). Nonvascular species (sphagnum mosses) may cover up to 35% of the ground surface. In addition, this community may support Minnesota state-critically imperiled *Galium palustre* (common marsh bedstraw) and Wisconsin state-vulnerable *Epilobium palustre* (marsh willowherb).
Global Vegetation: Shrub cover is at least 25% but does not become thick. Dominant species include *Cornus sericea* (red-osier dogwood), *Salix bebbiana* (Bebb willow), *Salix discolor* (pussy willow), *Salix petiolaris* (meadow willow), and *Spiraea alba* (white meadowsweet). Herbaceous species are typical of wet herbaceous meadows, and include the sedges *Carex aquatilis* (water sedge), *Carex atherodes* (wheat sedge), *Carex haydenii* (Hayden's sedge), *Carex lacustris* (hairy sedge), *Carex pellita* (woolly sedge), *Carex rostrata* (beaked sedge), *Carex stricta* (upright sedge), or grasses *Calamagrostis canadensis* (bluejoint) and *Calamagrostis stricta* (slimstem reedgrass). Forbs include *Asclepias incarnata* (swamp milkweed), *Symphyotrichum lanceolatum* (white panicle aster), *Symphyotrichum lateriflorum* (calico aster), *Symphyotrichum novae-angliae* (New England aster), *Symphyotrichum puniceum* (purplestem aster), *Chelone glabra* (white turtlehead), *Eupatorium maculatum* (spotted joepyeweed), and *Mentha arvensis* (wild mint) (MNNHP 1993, E. Epstein pers. comm. 1999). In northern Illinois prairie meadow species may include *Asclepias purpurascens* (purple milkweed), *Coreopsis tripteris* (tall tickseed), *Gentianella quinquefolia* (agueweed), and *Heliopsis helianthoides* (smooth oxeye) (Steffen and Anderson 1997).

MOST ABUNDANT SPECIES

Saint Croix National Scenic Riverway

Stratum	Lifeform	Species
Short shrub/sapling	Broad-leaved deciduous shrub	*Salix petiolaris* (meadow willow)

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Herb (field)	Forb	*Eupatorium maculatum* (spotted joepyeweed), *Solidago canadensis* (Canada goldenrod)
Herb (field)	Graminoid	*Carex lasiocarpa* (woollyfruit sedge), *Carex stricta* (upright sedge), *Carex utriculata* (Northwest Territory sedge)
Herb (field)	Fern or fern ally	*Thelypteris palustris* (eastern marsh fern)

CHARACTERISTIC SPECIES

Saint Croix National Scenic Riverway: *Carex lasiocarpa* (woollyfruit sedge), *Carex stricta* (upright sedge), *Carex utriculata* (Northwest Territory sedge), *Eupatorium maculatum* (spotted joepyeweed), *Salix petiolaris* (meadow willow), *Solidago canadensis* (Canada goldenrod), *Thelypteris palustris* (eastern marsh fern)

OTHER NOTEWORTHY SPECIES

Saint Croix National Scenic Riverway: Vulnerable: *Epilobium palustre* (marsh willowherb, WI state-vulnerable, G5), *Galium palustre* (common marsh bedstraw, WI state-critically imperiled, G5); **Exotic/Invasive**: *Dactylis glomerata* (orchardgrass, invasive/exotic, Medium/Insignificant), *Rhamnus cathartica* (common buckthorn, invasive/exotic, High/Medium), *Salix alba* (white willow, invasive/exotic)

CONSERVATION STATUS RANK

Global Rank & Reasons: G3G4 (3-Oct-1996). Type has been extensively impacted by agricultural drainage and clearing. However, it may be that the type is a result of either fire disruption or hydrologic alteration, rather than forming a natural community (E. Epstein pers. comm. 1999).

CLASSIFICATION

Status: Standard
Classification Confidence: 2 - Moderate
Global Comments: A seepage subtype may be needed. Information in Illinois is taken from a 1998 draft classification document for the Chicago Wilderness area (their wet-mesic fine-textured soil shrubland) (Steffen and Anderson 1997), though stands may better fit under a temporarily flooded hydrology, rather than seasonally flooded. In Wisconsin, this type does occur, but seems intermediate between sedge meadow and shrub swamp, and may result from either fire disruption or hydrologic alteration, rather than forming a natural community (E. Epstein pers. comm. 1999).
Global Similar Associations:
- *Carex (rostrata, utriculata) - Carex lacustris - (Carex vesicaria)* Herbaceous Vegetation (CEGL002257)
- *Carex pellita - Calamagrostis stricta* Herbaceous Vegetation (CEGL002254)
- *Carex stricta - Carex* spp. Herbaceous Vegetation (CEGL002258)
- *Cornus sericea - Salix* spp. - (*Rosa palustris*) Shrubland (CEGL002186)
- *Corylus americana - Malus ioensis - Ceanothus americanus* Shrubland (CEGL005073)
- *Salix petiolaris - (Betula pumila) / Spartina pectinata - Carex pellita* Shrubland (CEGL002434)
- *Spiraea tomentosa - Salix humilis / Andropogon gerardii - Panicum virgatum* Shrubland (CEGL005069)

Global Related Concepts:
- Wet Meadow Shrub Subtype (Faber-Langendoen 2001) =
- Wet Meadow Shrub Subtype (MNNHP 1993) =

ELEMENT DISTRIBUTION

Global Range: This wet shrub meadow type is found in the northern prairie-forest border area of the midwestern United States and Canada, extending from Illinois to Manitoba.
Nations: CA, US
States/Provinces: IA:S3?, IL, MB:SU, MN:S3, ND:S2S3, WI
TNC Ecoregions: 26:C, 34:C, 35:C, 46:C, 47:C
USFS Ecoregions (1994/95): 212Kb:CCC, 212Mb:CCC, 212Na:CCP, 212Nb:CCP, 212Nc:CCC, 222Mc:CCC, 222Md:CCC, 222Na:CCC, 251Aa:CCC, 251Ab:CCC
Federal Lands: NPS (Saint Croix); USFS (Chippewa)

ELEMENT SOURCES

Saint Croix National Scenic Riverway Map Code: SMW
Saint Croix National Scenic Riverway Plots: SACN.24, SACN.49, SACN.268, SACN.0084, SACN.0201, SACN.3160, SACN.5118, SACN.6862.
Local Description Authors: M.J. Russo
Global Description Authors: D. Faber-Langendoen
References: Epstein pers. comm., Faber-Langendoen 2001, Greenall 1996, INAI unpubl. data, MNNHP 1993, Midwestern Ecology Working Group n.d., NDNHI unpubl. data, Steffen and Anderson 1997, WNHIP unpubl. data

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Central Cordgrass Wet Prairie

***Spartina pectinata* - *Carex* spp. - *Calamagrostis canadensis* - *Lythrum alatum* - *(Oxypolis rigidior)* Herbaceous Vegetation**
Prairie Cordgrass - Sedge species - Bluejoint - Winged Loosestrife - (Common Water-dropwort) Herbaceous Vegetation
Identifier: CEGL002224

NVC CLASSIFICATION

Division	Eastern North American Freshwater Wet Meadow, Riparian & Marsh (2.C.5.Na)
Macrogroup	Eastern North American Wet Meadow & Marsh (M069)
Group	Eastern North American Wet Meadow (G112)
Association (Common name)	Central Cordgrass Wet Prairie

ELEMENT CONCEPT

Global Summary: This prairie cordgrass wet prairie community type is found in the central United States. Stands occur on lowland areas that are flooded in spring and saturated for much of the growing season. The soils are typically deep, fine-textured, poorly drained, and have high organic content. On some sites there is an impermeable subsurface layer that impedes soil drainage. A dense layer of graminoids dominates this community. Forbs and small trees or shrubs are also common. The vegetation is typically 1-2 m tall. *Calamagrostis canadensis* (bluejoint) and *Spartina pectinata* (prairie cordgrass) are the two most abundant species in the northern part of the range, but *Calamagrostis canadensis* (bluejoint) is less common southward. Several common *Carex* (sedge) spp. found in this community include *Carex lacustris* (hairy sedge), *Carex aquatilis* (water sedge), *Carex pellita* (woolly sedge), and *Carex atherodes* (wheat sedge). Other species that occur with less frequency in this community include *Andropogon gerardii* (big bluestem), *Symphyotrichum novae-angliae* (New England aster), *Fragaria virginiana* (Virginia strawberry), *Galium boreale* (northern bedstraw), *Helianthus grosseserratus* (sawtooth sunflower), *Iris versicolor* (harlequin blueflag), *Liatris pycnostachya* (prairie blazing star), *Lythrum alatum* (winged lythrum), *Muhlenbergia richardsonis* (mat muhly), *Oxypolis rigidior* (stiff cowbane), *Panicum virgatum* (switchgrass), *Pycnanthemum virginianum* (Virginia mountainmint), *Solidago gigantea* (giant goldenrod), *Thalictrum dasycarpum* (purple meadowrue), and *Veronicastrum virginicum* (Culver's root).

ENVIRONMENTAL DESCRIPTION

Saint Croix National Scenic Riverway Environment: This prairie cordgrass wet prairie community was sampled twice in the park. One site is a somewhat steep, northwest-facing, ice-scoured riverbank on a fast-flowing side channel with rapidly drained sand soil; the other is a gentle, southwest-facing seepage meadow (spring-fed) with very poorly drained sandy peat soil. The unvegetated surface is dominated by leaf litter (88-89% cover) with some wood (0-1%), bare sand (1-2%) and dead plant stems (9-10%). Evidence of disturbance includes ice-scouring and seasonal flooding, signs of beaver activity, and the presence of exotic plants.
Global Environment: This community is found in lowland areas that are flooded in spring and saturated for much of the growing season (White and Madany 1978, Nelson 1985). The soils are typically deep, fine-textured, poorly drained, and have high organic content (Bliss and Cox 1964, Nelson 1985). On some sites there is an impermeable subsurface layer that impedes soil drainage (MNNHP 1993).

VEGETATION DESCRIPTION

Saint Croix National Scenic Riverway Vegetation: This community is defined by the dominant (80-100% cover) herbaceous layer. However, there may also be a very sparse to sparse (5-30%) emergent shrub layer (0.5-5 m tall) that may include *Acer saccharinum* (silver maple), *Cornus amomum* (silky dogwood), *Salix petiolaris* (meadow willow), *Spiraea alba* (white meadowsweet), and others. Dominant herbs include graminoids *Carex emoryi* (Emory's sedge), *Carex stricta* (upright sedge), *Elymus virginicus* (Virginia wildrye), *Phalaris arundinacea* (reed canarygrass), and *Spartina pectinata* (prairie cordgrass). Additional herbs may include *Ageratina altissima* var. *altissima* (white snakeroot), *Artemisia serrata*, *Boehmeria cylindrica* (small-spike false nettle), *Eupatorium maculatum* (spotted joepyeweed), *Polygonum amphibium* (water knotweed), *Typha latifolia* (broadleaf cattail), and others.
Global Vegetation: A dense layer of graminoids dominates this community. Forbs and small trees or shrubs are also common. The vegetation is typically 1-2 m tall. *Calamagrostis canadensis* (bluejoint) and *Spartina pectinata* (prairie cordgrass) are the two most abundant species. Several common *Carex* (sedge) spp. found in this community include *Carex lacustris* (hairy sedge), *Carex aquatilis* (water sedge), *Carex pellita* (woolly sedge), and *Carex atherodes* (wheat sedge) (in the northwest of this community's range). Other species that are less frequent in this community include *Andropogon gerardii* (big bluestem), *Symphyotrichum novae-angliae* (New England aster), *Fragaria virginiana* (Virginia strawberry), *Galium boreale* (northern bedstraw), *Helianthus grosseserratus* (sawtooth sunflower), *Iris versicolor* (harlequin blueflag), *Liatris pycnostachya* (prairie blazing star), *Lythrum alatum* (winged lythrum), *Muhlenbergia richardsonis* (mat muhly), *Oxypolis rigidior* (stiff cowbane), *Panicum virgatum* (switchgrass), *Pycnanthemum virginianum* (Virginia mountainmint), *Solidago gigantea* (giant goldenrod), *Thalictrum dasycarpum* (purple meadowrue), and *Veronicastrum virginicum* (Culver's root) (Curtis 1959, White and Madany 1978, MNNHP 1993). In Missouri, composition may show more of a meadow character, with *Asclepias incarnata* (swamp milkweed), *Leersia oryzoides* (rice cutgrass), *Sium suave* (hemlock waterparsnip), and *Stachys palustris* (marsh hedgenettle) listed as characteristic plants (see Nelson 1985).

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MOST ABUNDANT SPECIES

Saint Croix National Scenic Riverway

Stratum	Lifeform	Species
Herb (field)	Graminoid	*Carex stricta* (upright sedge), *Phalaris arundinacea* (reed canarygrass), *Spartina pectinata* (prairie cordgrass)

CHARACTERISTIC SPECIES

Saint Croix National Scenic Riverway: *Carex emoryi* (Emory's sedge), *Carex stricta* (upright sedge), *Elymus virginicus* (Virginia wildrye), *Phalaris arundinacea* (reed canarygrass), *Spartina pectinata* (prairie cordgrass)

OTHER NOTEWORTHY SPECIES

Saint Croix National Scenic Riverway: Exotic/Invasive: *Agrostis gigantea* (redtop, invasive/exotic, Medium/Low), *Bromus inermis* (smooth brome, invasive/exotic, High/Medium), *Calystegia sepium* ssp. *sepium* (hedge false bindweed, invasive/exotic), *Glechoma hederacea* (ground ivy, invasive/exotic, Low), *Linaria vulgaris* (butter and eggs, invasive/exotic, High/Low), *Poa pratensis* (Kentucky bluegrass, invasive/exotic, Medium), *Polygonum convolvulus* (black bindweed, invasive/exotic)

CONSERVATION STATUS RANK

Global Rank & Reasons: G3? (22-Jun-1998). There are probably fewer than 100 occurrences rangewide. Sixty have been documented: 20 in Missouri (where the community is ranked S1), 16 in Illinois (S1,S1), 8 in Michigan (S2), 4 in Ohio (S3), 4 in Wisconsin (S1), 3 in Minnesota (S1,S2,S1?), and 1 in Iowa (SU). It is also reported in Nebraska (S1). It is found in 26 ecoregional subsections and probably occupies less than 10,000 acres. The 60 occurrences range from 0 to 261 acres, totaling 2200. This community occurs on deep, fine-textured, poorly drained soils with high organic content and is located in lowland areas that experience spring flooding are saturated for much of the growing season.

CLASSIFICATION

Status: Standard

Classification Confidence: 1 - Strong

Global Comments: Distinctions between this type and wet sand prairie, *Spartina pectinata* - *Carex* spp. - *Calamagrostis canadensis* (bluejoint) Sand Herbaceous Vegetation (CEGL005178), are not clear. Wet sand prairies may be more acidic and more likely to become dry in summer; however, floristic characteristics that reflect those factors are not known. This type is found in Ohio at Daumer Savanna. Stands described by Brotherson's (1969) Pothole and Drainage Communities, sections 4 and 5 are located in northwestern Iowa, beyond the main range of this type; however, they appear to fit better in this community than with the Northern Cordgrass Prairie, *Spartina pectinata* - *Calamagrostis stricta* - *Carex* spp. Herbaceous Vegetation (CEGL002027), where they are currently classified.

Global Similar Associations:

- *Cladium mariscoides* - *(Carex lasiocarpa, Hypericum kalmianum, Oligoneuron riddellii, Eleocharis elliptica)* Herbaceous Vegetation (CEGL005104)
- *Spartina pectinata* - *Calamagrostis stricta* - *Carex* spp. Herbaceous Vegetation (CEGL002027) This is the northern wet tallgrass prairie.
- *Spartina pectinata* - *Carex* spp. - *Calamagrostis canadensis* Sand Herbaceous Vegetation (CEGL005178) This is a central wet sand prairie type. Floristic distinctions are not clear.

Global Related Concepts:

- Cordgrass (Bliss and Cox 1964) =
- Eastern Cordgrass Wet Prairie (Steinauer and Rolfsmeier 2000) =
- Eastern Cordgrass Wet Prairie (Steinauer and Rolfsmeier 2003) =
- Inland Wet Prairie (Chapman et al. 1989) =
- Wet Prairie (Faber-Langendoen 2001) =
- Wet Prairie (Nelson 1985) =
- Wet Prairie (Central Section) (MNNHP 1993) ><
- Wet Prairie (Central Section) Seepage Subtype (MNNHP 1993) ><
- Wet Prairie (Southeast Section) (MNNHP 1993) ><

ELEMENT DISTRIBUTION

Global Range: This prairie cordgrass wet prairie community type is found in the central United States, ranging from Ohio west to Minnesota, south to Nebraska and Missouri, and east to Indiana.

Nations: US

States/Provinces: IA:SU, IL, IN:S1, MI:S2, MN, MO:S1, NE:S1, OH, WI:S1

TNC Ecoregions: 35:C, 36:C, 37:C, 38:C, 45:C, 46:C, 47:?, 48:C, 49:C

USFS Ecoregions (1994/95): 212Hu:CCC, 212Hv:CCC, 212Je:C??, 212Jf:C??, 221Fa:CCC, 222Ab:CCC, 222Ha:CCC, 222Hb:CCP, 222Jc:CCC, 222Jg:CCC, 222Jh:CCC, 222Ji:CCP, 222Jj:CCC, 222Kc:CCC, 222Kd:CCC, 222Kf:CCC, 222Kg:CCC, 222Kh:CCC, 222Ki:CCC, 222Mb:CCC, 222Mc:CCC, 222Me:CCC, 251Ba:CCC, 251Cc:CCC, 251Cd:CC?, 251Cf:CCC, 251Cg:CCC, 251Dd:CCC, 251Dg:CCC, 251Dh:CCC, 251Eb:CCC

Federal Lands: NPS (Saint Croix)

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ELEMENT SOURCES

Saint Croix National Scenic Riverway Map Code: Not mapped separately.
Saint Croix National Scenic Riverway Plots: SACN.78, SACN.101.
Local Description Authors: M.J. Russo
Global Description Authors: J. Drake, mod. D. Faber-Langendoen
References: Bliss and Cox 1964, Brotherson 1969, Chapman et al. 1989, Curtis 1959, Faber-Langendoen 2001, Homoya et al. 1988, INAI unpubl. data, MNNHP 1993, Midwestern Ecology Working Group n.d., Nelson 1985, Steinauer and Rolfsmeier 2000, Steinauer and Rolfsmeier 2003, WNHIP unpubl. data, White and Madany 1978

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M071. Great Plains Wet Meadow, Wet Prairie & Marsh

G325. Great Plains Freshwater Marsh

Arrowhead - Rice Cutgrass Marsh

***Sagittaria latifolia - Leersia oryzoides* Herbaceous Vegetation**
Broadleaf Arrowhead - Rice Cutgrass Herbaceous Vegetation
Identifier: CEGL005240

NVC CLASSIFICATION

Division	Eastern North American Freshwater Wet Meadow, Riparian & Marsh (2.C.5.Na)
Macrogroup	Great Plains Wet Meadow, Wet Prairie & Marsh (M071)
Group	Great Plains Freshwater Marsh (G325)
Association (Common name)	Arrowhead - Rice Cutgrass Marsh

ELEMENT CONCEPT

Global Summary: This arrowhead marsh type is found in the midwestern United States mostly along larger floodplains such as the upper Mississippi River and its larger tributaries. Stands occur in semipermanently flooded wetlands dominated by *Sagittaria latifolia* (broadleaf arrowhead) and/or *Leersia oryzoides* (rice cutgrass). In examples of this type, *Leersia oryzoides* (rice cutgrass) typically occurs in more shallow areas or where the water recedes enough to allow it to establish, but not inhibit, *Sagittaria latifolia* (broadleaf arrowhead). Other emergent aquatic species such as *Potamogeton* (pondweed) spp. and *Ceratophyllum demersum* (coon's-tail) are also often present. Although this type can occur naturally, many examples along major waterways can be impacted by dams and/or impoundments. Examples of this community may become monospecific stands of either *Sagittaria latifolia* (broadleaf arrowhead) or *Leersia oryzoides* (rice cutgrass), especially in areas above dams along major rivers where the environment can be more lacustrine in nature. More information is needed to determine the range of this type outside of the upper Midwest.

ENVIRONMENTAL DESCRIPTION

Saint Croix National Scenic Riverway Environment: This arrowhead - cutgrass marsh community was sampled at eight locations in the park. The sites include flat lake drawdowns and gently to moderately sloping streambanks and floodplains. Soils vary from very poorly to poorly drained muck and peat to well-drained sand. The unvegetated surface is dominated either by leaf litter (1-94% cover), bare sand/soil (0-91%) or standing water (0-85%) with some large rocks (0-1%), wood (0-2%), and dead plant stems (4-18%). Evidence of disturbance includes downed wood from higher areas, signs of human activity, and the presence of exotic plants.
Global Environment: Stands occur in semipermanently flooded wetlands.

VEGETATION DESCRIPTION

Saint Croix National Scenic Riverway Vegetation: This community is defined by the dominant (70-100% cover) herbaceous layer. *Sagittaria latifolia* (broadleaf arrowhead) and *Leersia oryzoides* (rice cutgrass) dominate along with graminoids *Carex lacustris* (hairy sedge), *Eleocharis acicularis* (needle spikerush), *Eleocharis palustris* (common spikerush), and *Eragrostis hypnoides* (teal lovegrass). Additional herbs may include *Bidens cernua* (nodding beggarticks), *Dulichium arundinaceum* (threeway sedge), *Echinochloa muricata* (rough barnyardgrass), *Eleocharis ovata* (ovate spikerush), *Galium trifidum* (threepetal bedstraw), *Glyceria grandis* (American mannagrass), *Ludwigia palustris* (marsh seedbox), *Lycopus uniflorus* (northern bugleweed), *Mimulus ringens* (Allegheny monkeyflower), *Polygonum lapathifolium* (curlytop knotweed), *Schoenoplectus tabernaemontani* (softstem bulrush), *Scirpus cyperinus* (woolgrass), and *Spartina pectinata* (prairie cordgrass).
Global Vegetation: Stands are dominated by *Sagittaria latifolia* (broadleaf arrowhead) and *Leersia oryzoides* (rice cutgrass), often with other emergent aquatic species. Little is known about the dynamics, naturalness, or composition of this association.

MOST ABUNDANT SPECIES

Saint Croix National Scenic Riverway

Stratum	Lifeform	Species
Herb (field)	Forb	*Sagittaria latifolia* (broadleaf arrowhead)
Herb (field)	Graminoid	*Carex lacustris* (hairy sedge), *Eleocharis acicularis* (needle spikerush), *Eleocharis palustris* (common spikerush), *Eragrostis hypnoides* (teal lovegrass), *Leersia oryzoides* (rice cutgrass), *Scirpus cyperinus* (woolgrass)

CHARACTERISTIC SPECIES

Saint Croix National Scenic Riverway: *Carex lacustris* (hairy sedge), *Eleocharis acicularis* (needle spikerush), *Eleocharis palustris* (common spikerush), *Eragrostis hypnoides* (teal lovegrass), *Leersia oryzoides* (rice cutgrass), *Sagittaria latifolia* (broadleaf arrowhead), *Scirpus cyperinus* (woolgrass)

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OTHER NOTEWORTHY SPECIES

Saint Croix National Scenic Riverway: Exotic/Invasive: *Echinochloa muricata* (rough barnyardgrass, invasive/exotic), *Echinochloa muricata* var. *muricata* (rough barnyardgrass, invasive/exotic), *Eragrostis cilianensis* (stinkgrass, invasive/exotic, Medium/Insignificant), *Polygonum hydropiper* (marshpepper knotweed, invasive/exotic)

CONSERVATION STATUS RANK

Global Rank & Reasons: GNR (16-Jun-1998).

CLASSIFICATION

Status: Standard
Classification Confidence: 3 - Weak
Global Comments: This type can occur naturally but many examples, especially areas of monospecific or nearly monospecific stands, may be caused by dams or impoundments. Separating natural occurrences from semi-natural ones may be difficult, especially on rivers that have been permanently altered due to dams. Also, this type could be considered a subtype of a more broadly defined shallow marsh type, *Schoenoplectus tabernaemontani* - *Typha* spp. - (*Sparganium* (bur-reed) spp., *Juncus* (rush) spp.) Herbaceous Vegetation (CEGL002026).
Global Similar Associations:

- *Sagittaria cuneata* - *Sagittaria longiloba* Herbaceous Vegetation (CEGL004525) This type contains some southern U.S. species not found in the Midwest.
- *Schoenoplectus tabernaemontani* - *Typha* spp. - (*Sparganium* spp., *Juncus* spp.) Herbaceous Vegetation (CEGL002026) This is a broadly defined shallow marsh type that may include CEGL005240 as a subtype.

ELEMENT DISTRIBUTION

Global Range: This type is found in the midwestern United States. Its range outside of major rivers in the upper Midwest needs further review.
Nations: US
States/Provinces: IA, IL, MN, MT?, SD, WI
TNC Ecoregions: 26:C, 34:P, 35:P, 36:P, 46:C, 47:C
USFS Ecoregions (1994/95): 222K:C?, 222L:CC, 222M:CP, 251B:PP, 251C:PP, 331E:??
Federal Lands: NPS (Effigy Mounds, Saint Croix)

ELEMENT SOURCES

Saint Croix National Scenic Riverway Map Code: HME
Saint Croix National Scenic Riverway Plots: SACN.21, SACN.81, SACN.85, SACN.94, SACN.103, SACN.104, SACN.108, SACN.283.
Local Description Authors: M.J. Russo
Global Description Authors: D. Faber-Langendoen
References: Hop et al. 2005, INAI unpubl. data, Midwestern Ecology Working Group n.d.

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5. AQUATIC WETLAND VEGETATION

5.B.1. Freshwater Aquatic Vegetation

5.B.1.Na. North American Freshwater Aquatic Vegetation

M108. Eastern North American Freshwater Aquatic Vegetation

G114. Eastern North American Freshwater Aquatic Vegetation

Water-lily Aquatic Wetland
***Nuphar advena* - *Nymphaea odorata* Herbaceous Vegetation**
Broadleaf Pond-lily - American White Water-lily Herbaceous Vegetation
Identifier: CEGL002386

NVC CLASSIFICATION

Division	North American Freshwater Aquatic Vegetation (5.B.1.Na)
Macrogroup	Eastern North American Freshwater Aquatic Vegetation (M108)
Group	Eastern North American Freshwater Aquatic Vegetation (G114)
Association (Common name)	Water-lily Aquatic Wetland

ELEMENT CONCEPT

Global 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

Saint Croix National Scenic Riverway Environment: This water-lily aquatic wetland community was sampled once in the park. The site is a lake near North River Road with standing water 1 m deep and very poorly drained muck soil. The unvegetated surface is dominated by bare soil (80% cover) with some leaf litter (16%), wood (2%) and dead plant stems (2%). No evidence of disturbance was reported.
Global Environment: 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 advena* (yellow pond-lily) is rooted in sandy substrate (Schmalzer and DeSelm 1982).

VEGETATION DESCRIPTION

Saint Croix National Scenic Riverway Vegetation: This community is dominated by rooted, floating-leaved aquatic species *Nymphaea odorata* (American white waterlily) (50% cover), *Nuphar lutea* ssp. *variegata* (20%), and *Potamogeton natans* (floating pondweed) (3%). *Elodea canadensis* (Canadian waterweed) (10%) and *Myriophyllum sibiricum* (shortspike watermilfoil) (20%) are submerged aquatics that also occur. In addition, there is a sparse (10% cover) of herbaceous species including *Sagittaria latifolia* (broadleaf arrowhead), *Sparganium angustifolium* (narrowleaf bur-reed), *Sparganium eurycarpum* (broadfruit bur-reed), *Typha latifolia* (broadleaf cattail), and *Zizania aquatica* (annual wildrice).
Global Vegetation: 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).

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MOST ABUNDANT SPECIES

Saint Croix National Scenic Riverway

Stratum	Lifeform	Species
Floating aquatic	Aquatic herb (floating & submergent)	*Nuphar variegata* (variegated yellow pond-lily), *Nymphaea odorata* (American white waterlily)
Submerged aquatic	Aquatic herb (floating & submergent)	*Myriophyllum sibiricum* (shortspike watermilfoil)

Global

Stratum	Lifeform	Species
Floating aquatic	Aquatic herb (floating & submergent)	*Nuphar advena* (yellow pond-lily), *Nymphaea odorata* (American white waterlily)

CHARACTERISTIC SPECIES

Saint Croix National Scenic Riverway: *Elodea canadensis* (Canadian waterweed), *Myriophyllum sibiricum* (shortspike watermilfoil), *Nuphar variegata* (variegated yellow pond-lily), *Nymphaea odorata* (American white waterlily), *Typha latifolia* (broadleaf cattail)
Global: *Nuphar advena* (yellow pond-lily), *Nymphaea odorata* (American white waterlily)

CONSERVATION STATUS RANK

Global Rank & Reasons: G4G5 (15-Oct-2002). 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

Status: Standard
Classification Confidence: 2 - Moderate
Global 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).
Global Similar Associations:
- *Equisetum fluviatile - (Eleocharis palustris)* Herbaceous Vegetation (CEGL005258)
- *Nuphar advena* Tidal Herbaceous Vegetation (CEGL004472)
- *Nuphar polysepala* Herbaceous Vegetation (CEGL002001)
- Semipermanent Impoundment (CEGL006581)

Global Related Concepts:
- *Nuphar advena - Nymphaea odorata* Herbaceous Vegetation (Clancy 1996) =
- *Nuphar lutea* ssp. *advena - Nymphaea odorata* Herbaceous Vegetation (Harrison 2004) =
- Delmarva Bay (Harrison 2004) >
- Floodplain Pond / Pool (Fleming et al. 2001) >
- Freshwater Marsh (Nelson 1985) >
- Inland Emergent Marsh (Chapman et al. 1989) >
- L5D2aI1a. *Nuphar lutea* (Foti et al. 1994) **?**
- Lake Bed (MNNHP 1993) >
- 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) **?**
- Small Depression Pond (Schafale and Weakley 1990) >
- Submerged Aquatic Water Lily Subtype (Faber-Langendoen 2001) =
- Submergent/Floating Vascular Vegetation (Smith 1996a) >
- Water-lily - Macrophyte Aquatic Bed (Gawler 2002) >

ELEMENT DISTRIBUTION

Global 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.
Nations: CA, US
States/Provinces: AL, AR, CT, DE, FL, GA, IA:SU, IL, IN, KY, LA, MA, MD, ME, MI, MN, MO, MS, NC, NH:S4S5, NJ:S4, NY, OH, OK, ON, PA:S4, RI, SC, TN, TX, VA:SU, VT, WI, WV
TNC Ecoregions: 31:C, 32:P, 36:C, 37:C, 39:C, 40:P, 41:C, 42:C, 43:C, 44:C, 45:C, 46:C, 47:C, 48:C, 49:C, 50:C, 51:C, 52:C, 53:C, 55:P, 56:C, 57:C, 58:C, 59:C, 60:C, 61:C, 62:C, 63:C
USFS Ecoregions (1994/95): 212Aa:CCC, 212Ba:CCC, 212Bb:CCC, 212Ca:CCC, 212Cb:CCC, 212Da:CCC, 212Db:CCP, 212Dc:CCC, 212Fa:CCP, 212Fb:CCP, 212Fc:CCP, 212Fd:CCP, 212Ga:CCP, 212Gb:CCP, 212Hb:CPP, 212Ja:CCP, 212Jb:CCP, 212Jc:CCP, 212Je:CCP, 212Jf:CCP, 212Jj:CCP, 212Jl:CCP, 212Jm:CCC, 212Ka:CPP, 221Aa:CCP, 221Ab:CCC, 221Ah:CCC, 221Ai:CCC, 221Al:CCC, 221Am:CCC, 221Bd:CCP, 221Da:CCC, 221Db:CCC, 221Ea:CCC, 221Ed:CC?, 221Ef:CCC, 221Fa:CCC, 221Hc:CCC, 221He:CCC, 222Ch:CCC, 222Db:CCC, 222Gc:C??, 222Ha:CCC, 222Ja:CCC, 222Jb:CCC, 222Ji:CCC, 222Jj:CCC,

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222Kf:CCC, 222Kg:CCC, 222Kh:CCC, 222Kj:CCC, 222L:CC, 231Bc:CCC, 231Bd:CCC, 231Ga:CCC, 231Gb:CCC, 231Gc:CCC, 232Bf:CCC, 232C:CC, 232D:CC, 234Aa:CCC, 234Ac:CCC, 234Ad:CCC, 234Af:CCC, 234Ag:CCC, 234Ai:CCC, 234Al:CCC, 234Am:CCC, 234An:CCC, 251Cf:CCC, 251Dd:CCC, 251Dg:CCC, 251Eb:CCC, M212Af:CCC, M212Bb:CCC, M212Bc:CCC, M212Bd:CCC, M212Cb:CCC, M212Cc:CCC, M212Ea:CCP, M212Eb:CCP, M221Aa:CCC, M221Ab:CCC, M221Ac:CCC, M221Ad:CCC, M221Ba:CCC, M221Bb:CCC, M221Bc:CCC, M221Bd:CCC, M221Be:CCC, M221Bf:CCC, M221Da:CCC, M221Dc:CCC

Federal Lands: DOD (Fort Benning); NPS (Acadia, C&O Canal, Carl Sandburg Home, Cuyahoga Valley, Effigy Mounds, George Washington Parkway, Indiana Dunes, Minute Man, Natchez Trace, Obed River, 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, Monomoy, Reelfoot)

ELEMENT SOURCES

Saint Croix National Scenic Riverway Map Code: HFA and HME

Saint Croix National Scenic Riverway Plots: SACN.274.

Local Description Authors: M.J. Russo

Global 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, Faber-Langendoen 2001, Fike 1999, Fleming 2007, Fleming and Coulling 2001, Fleming et al. 2001, Foti et al. 1994, Gawler 2002, Harrison 2004, Hoagland 2000, Hop et al. 2005, Hop et al. 2009, INAI unpubl. data, Lubinski et al. 2003, MNNHP 1993, Midwestern Ecology Working Group n.d., NAP pers. comm. 1998, NatureServe Ecology - Southeastern U.S. unpubl. data, Nelson 1985, Peet et al. unpubl. data, Penfound 1953, Rawinski 1984, Schafale and Weakley 1990, Schmalzer and DeSelm 1982, Schotz pers. comm., Smith 1996a, Sperduto and Nichols 2004, Swain and Kearsley 2001, TDNH unpubl. data, Thompson and Jenkins 1992, WNHIP unpubl. data, Zanoni et al. 1979

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Midwest Pondweed Submerged Aquatic Wetland

***Potamogeton* spp. - *Ceratophyllum* spp. Midwest Herbaceous Vegetation**
Pondweed species - Hornwort species Midwest Herbaceous Vegetation
Identifier: CEGL002282

NVC CLASSIFICATION

Division	North American Freshwater Aquatic Vegetation (5.B.1.Na)
Macrogroup	Eastern North American Freshwater Aquatic Vegetation (M108)
Group	Eastern North American Freshwater Aquatic Vegetation (G114)
Association (Common name)	Midwest Pondweed Submerged Aquatic Wetland

ELEMENT CONCEPT

Global Summary: This broadly defined submerged aquatic or open marsh type is found throughout the midwestern region of the United States and adjacent Canada. Based on information in the northern parts of the Midwest, several vegetation subgroups can be recognized that may be separate associations. Subgroup A is a shallow (<50 cm), sparsely vegetated, open water marsh found on sand, or organic and mineral material trapped in rocky bottoms. Stands are often exposed to wave action and found in oligotrophic lakes. Dominant plants often have basal rosettes that are resistant to wave action. Typical species include *Elatine minima* (small waterwort), *Eriocaulon aquaticum* (sevenangle pipewort), *Gratiola aurea* (golden hedgehyssop), *Isoetes tenella* (spiny-spore quillwort), *Isoetes lacustris* (lake quillwort), *Juncus pelocarpus* (brownfruit rush), and *Lobelia dortmanna* (Dortmann's cardinalflower). Subgroup B is a shallow (<50 cm) open water marsh with emergent cover <25% and floating-leaved aquatics >25%. Substrate is a mineral soil (often sand), boulders, or a mixture of sedimentary peat and fine mineral soil. Stands can be exposed to waves or are in stream channels. Stands may often be dominated by a single species. Typical dominants include *Eleocharis acicularis* (needle spikerush), *Myriophyllum* (watermilfoil) spp., *Potamogeton amplifolius* (largeleaf pondweed), *Potamogeton gramineus* (variableleaf pondweed), *Potamogeton praelongus* (whitestem pondweed), *Potamogeton robbinsii* (Robbins' pondweed), *Sparganium fluctuans* (floating bur-reed), and *Utricularia macrorhiza* (common bladderwort). Subgroup C includes open water marsh with emergent cover <25% and floating leaved aquatics >25%. Substrate is sedimentary peat and stands are often found in sheltered bays of lakes and streams that do not have high wave energy. Stands may often be dominated by a single species. Typical dominants include *Ceratophyllum demersum* (coon's-tail), *Elodea canadensis* (Canadian waterweed), *Lemna* (duckweed) spp., *Myriophyllum sibiricum* (shortspike watermilfoil), *Myriophyllum verticillatum* (whorl-leaf watermilfoil), *Potamogeton natans* (floating pondweed), *Stuckenia pectinata* (sago pondweed), *Potamogeton richardsonii* (Richardson's pondweed), *Potamogeton zosteriformis* (flatstem pondweed), *Ranunculus aquatilis* (whitewater crowfoot), *Utricularia macrorhiza* (common bladderwort), and *Vallisneria americana* (American eel-grass).

ENVIRONMENTAL DESCRIPTION

Saint Croix National Scenic Riverway Environment: This submerged aquatic wetland community was sampled at three locations in the park. Sites are described as (1) the inside curve of a meander of the Apple River delta with slightly mucky, medium-textured sand soil, (2) a pungent, stagnant pond (10 cm of water) in an old river channel with very poorly drained muck soil, and (3) a slight outer bend of the river with 22 cm of standing water over a sandy-small gravel bottom. The unvegetated surface is dominated by standing water (50-100% cover) with some leaf litter (0-1%), wood (0-1%), bare sand/soil (0-46%), and dead plant stems (0-4%). Evidence of disturbance includes the natural processes of shifting sand and fluctuating water levels and waterflow strengths.
Global Environment: Curtis (1959) [see also Swindale and Curtis (1957)] noted that the major environmental controls on submerged aquatic vegetation are water depth (as it relates to light intensity), water chemistry, water movement, and nature of the substrate. Various combinations of these factors can interact in a variety of ways to influence the local composition of the community. As a result, a single lake may contain a number of relatively homogeneous stands, each with a different species makeup, which depends on depth, nature of adjoining shoreline, degree of protection from waves, etc. Water chemistry may be one of the few constants. Assessment of water conductivity and alkalinity are two measured parameters that can provide some understanding of the influence of water chemistry on species composition.

VEGETATION DESCRIPTION

Saint Croix National Scenic Riverway Vegetation: The sparse to total (30-100% cover) herbaceous layer is dominated by submerged aquatics *Vallisneria americana* (American eel-grass) (90% cover at one site), *Potamogeton natans* (floating pondweed), *Potamogeton nodosus* (longleaf pondweed), *Sagittaria rigida* (sessilefruit arrowhead), and/or *Stuckenia pectinata* (sago pondweed). Additional submerged aquatics may include *Ceratophyllum demersum* (coon's-tail), *Eleocharis acicularis* (needle spikerush), *Elodea canadensis* (Canadian waterweed), *Potamogeton robbinsii* (Robbins' pondweed), *Sagittaria latifolia* (broadleaf arrowhead), and *Zizania aquatica* (annual wildrice). Floating-leaved aquatics include *Lemna minor* (common duckweed), *Nuphar lutea* ssp. *variegata*, and *Nymphaea odorata* ssp. *tuberosa* (American white waterlily).
Global Vegetation: Based on information in the northern parts of the Midwest, several vegetation subgroups can be recognized that may be separate associations. Subgroup A is a shallow (<50 cm), sparsely vegetated, open-water marsh found on sand, or organic and mineral material trapped in rocky bottoms. Stands are often exposed to wave action and found in oligotrophic lakes. Dominant plants often have basal rosettes that are resistant to wave action. Typical species include *Elatine minima* (small waterwort), *Eriocaulon aquaticum* (sevenangle pipewort), *Gratiola aurea* (golden hedgehyssop), *Isoetes tenella* (spiny-spore quillwort), *Isoetes lacustris* (lake quillwort), *Juncus pelocarpus* (brownfruit rush), and *Lobelia dortmanna* (Dortmann's cardinalflower) (Curtis 1959, Harris et al. 1996). Subgroup B is a shallow (<50 cm), open-water marsh with emergent cover <25% and floating-leaved aquatics >25%. Substrate is a

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mineral soil (often sand), boulders, or a mixture of sedimentary peat and fine mineral soil. Stands can be exposed to waves or are in stream channels. Stands may often be dominated by a single species. Typical dominants include *Eleocharis acicularis* (needle spikerush), *Myriophyllum* (watermilfoil) spp., *Potamogeton amplifolius* (largeleaf pondweed), *Potamogeton gramineus* (variableleaf pondweed), *Potamogeton praelongus* (whitestem pondweed), *Potamogeton robbinsii* (Robbins' pondweed), *Sparganium fluctuans* (floating bur-reed), and *Utricularia macrorhiza* (common bladderwort). Subgroup C includes open-water marsh with emergent cover <25% and floating-leaved aquatics >25%. Substrate is sedimentary peat, and stands are often found in sheltered bays of lakes and streams that do not have high wave energy. Stands may often be dominated by a single species. Typical dominants include *Ceratophyllum demersum* (coon's-tail), *Elodea canadensis* (Canadian waterweed), *Lemna* (duckweed) spp., *Myriophyllum sibiricum* (shortspike watermilfoil), *Myriophyllum verticillatum* (whorl-leaf watermilfoil), *Potamogeton natans* (floating pondweed), *Stuckenia pectinata* (sago pondweed), *Potamogeton richardsonii* (Richardson's pondweed), *Potamogeton zosteriformis* (flatstem pondweed), *Ranunculus aquatilis* (whitewater crowfoot), *Utricularia macrorhiza* (common bladderwort), and *Vallisneria americana* (American eel-grass) (Curtis 1959, Harris et al. 1996).

MOST ABUNDANT SPECIES

Saint Croix National Scenic Riverway

Stratum	Lifeform	Species
Submerged aquatic	Aquatic herb (floating & submergent)	*Potamogeton nodosus* (longleaf pondweed), *Vallisneria americana* (American eel-grass)

CHARACTERISTIC SPECIES

Saint Croix National Scenic Riverway: *Ceratophyllum demersum* (coon's-tail), *Potamogeton natans* (floating pondweed), *Potamogeton nodosus* (longleaf pondweed), *Sagittaria rigida* (sessilefruit arrowhead), *Stuckenia pectinata* (sago pondweed), *Vallisneria americana* (American eel-grass)

CONSERVATION STATUS RANK

Global Rank & Reasons: G5 (3-Oct-1996).

CLASSIFICATION

Status: Standard

Classification Confidence: 3 - Weak

Global Comments: This type is based on information in the more northern parts of the range. However, it may need to be split into a boreal/sub-boreal type (subgroup A above) and a Midwestern type (subgroups B and C), and even within the Midwest there may be substantial differences between western and eastern stands (Robert Dana pers. comm. 1999). In Wisconsin, Subgroup A is considered distinctive, and could be ranked an S3 type. It is locally common there in deep, hard-bottomed seepage lakes of the Northern Highlands Pitted Outwash subsection (212Jm of Keys et al. 1995) (E. Epstein pers. comm. 1999).

Global Similar Associations:

- *Stuckenia pectinata* - *Ruppia maritima* Herbaceous Vegetation (CEGL002004) Prairie pothole type.

Global Related Concepts:

- Lake Bed (MNNHP 1993) ><
- Open water marsh: floating-leaved plants (W4) (Harris et al. 1996) ><
- River Bed (MNNHP 1993) <
- Submerged Aquatic Northern Pondweed Subtype (Faber-Langendoen 2001) <
- Submerged Aquatic Pondweed Subtype (Faber-Langendoen 2001) <

ELEMENT DISTRIBUTION

Global Range: This pondweed submerged aquatic type is found widely throughout the midwestern United States and adjacent Canada, ranging from Ohio and Ontario west to North Dakota and south to Iowa.

Nations: CA, US

States/Provinces: IA:SU, IL, IN, MI:S4, MN, ND, OH, ON, SD, WI, WY

TNC Ecoregions: 35:C, 36:C, 44:C, 45:C, 46:C, 47:C, 48:C, 49:C, 50:C

USFS Ecoregions (1994/95): 212Hb:CCP, 212Hi:CCC, 212Ho:CCC, 212Hs:CCC, 212Hv:CCC, 212Hw:CCC, 212Ia:CCC, 212Ib:CCP, 212Ja:CCP, 212Jb:CCP, 212Jc:CCP, 212Je:CCP, 212Jf:CCP, 212Jj:CCP, 212Jl:CCP, 212Jm:CCC, 212Ka:CPP, 212La:CPP, 212Mb:C??, 221Ef:CCC, 221Fc:CCC, 221He:CCC, 222Ao:CPP, 222Ch:CPP, 222Gc:CPP, 222Ha:CCC, 222Jg:CCC, 222Jh:CCC, 222Ji:CCC, 222Jj:CCC, 222Kf:CCC, 222L:CC, 251Aa:???, 251Ba:???

Federal Lands: NPS (Apostle Islands, Effigy Mounds, Grand Portage, Indiana Dunes, Isle Royale, Pictured Rocks, Saint Croix, Sleeping Bear Dunes, Voyageurs); USFS (Chequamegon, Chequamegon-Nicolet, Nicolet, Shawnee, Superior?)

ELEMENT SOURCES

Saint Croix National Scenic Riverway Map Code: HSV and HME

Saint Croix National Scenic Riverway Plots: SACN.122, SACN.131, SACN.137.

Local Description Authors: M.J. Russo

Global Description Authors: D. Faber-Langendoen

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References: Chapman et al. 1989, Curtis 1959, Faber-Langendoen 2001, Harris et al. 1996, Hop et al. 2005, Hop et al. 2009, Hop et al. 2010a, Hop et al. 2010b, Hop et al. 2010c, INAI unpubl. data, Keys et al. 1995, MNNHP 1993, Midwestern Ecology Working Group n.d., NDNHI unpubl. data, Swindale and Curtis 1957, TNC 1999b

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6. ROCK VEGETATION

6.B.2. Temperate & Boreal Cliff, Scree & Rock Vegetation

6.B.2.Na. Eastern North American Temperate Cliff, Scree & Rock Vegetation

M111. Eastern North American Cliff & Rock Vegetation

G106. Eastern North American Temperate Cliff

Northern (Laurentian) Igneous - Metamorphic Dry Cliff
Igneous - Metamorphic Northern Dry Cliff Sparse Vegetation
Igneous - Metamorphic Northern Dry Cliff Sparse Vegetation
Identifier: CEGL002300

NVC CLASSIFICATION

Division	Eastern North American Temperate Cliff, Scree & Rock Vegetation (6.B.2.Na)
Macrogroup	Eastern North American Cliff & Rock Vegetation (M111)
Group	Eastern North American Temperate Cliff (G106)
Association (Common name)	Northern (Laurentian) Igneous - Metamorphic Dry Cliff

ELEMENT CONCEPT

Global Summary: This northern igneous - metamorphic dry cliff community is found in the northern Great Lakes region of the United States and Canada. Stands occur inland from the Great Lakes Shoreline, and do include basalt/diabase cliffs. Other igneous or metamorphic rock types may also be included. These dry cliffs may have <25% total plant cover, excluding crustose lichens. Further characterization of this type is needed.

ENVIRONMENTAL DESCRIPTION

Saint Croix National Scenic Riverway Environment: This northern dry cliff community was sampled three times in the park. Sites are described as (1) a small bedrock outcrop with well-drained sandy loam soil, (2) an east-facing cliff face of the"basalt dalles" with well-drained soil held in place by moss cover, and (3) a moist north-facing, shaded basalt cliff with well-drained organic soil. The unvegetated surface is dominated by exposed bedrock (40-93% cover) with some large rocks (0-1%), leaf litter (1-54%), wood (0-1%), bare soil (0-3%), and dead plant stems (2-6%). Evidence of disturbance includes past grazing, signs of a campfire, and the presence of exotic plants.
Global Environment: At this time little is known of the environmental characteristics of this type. Stands do include inland basalt/diabase cliffs away from the Great Lakes shoreline. Other igneous or metamorphic rock types may also be included.

VEGETATION DESCRIPTION

Saint Croix National Scenic Riverway Vegetation: This community is dominated by the nonvascular layer (mosses and lichens) covering 70-90% of the bedrock surface. In addition, there may be a very sparse (5%) emergent tree and shrub layer that may include *Juniperus virginiana* (eastern red-cedar), *Lonicera tatarica* (Tatarian honeysuckle) (exotic), *Prunus virginiana* (chokecherry), *Ribes cynosbati* (eastern prickly gooseberry), and others. The very sparse to sparse (5-40%) herbaceous layer may include *Ambrosia artemisiifolia* (annual ragweed), *Andropogon gerardii* (big bluestem), *Aquilegia canadensis* (red columbine), *Arabis lyrata* (lyrate rockcress), *Asplenium rhizophyllum* (walking fern), *Carex bicknellii* (Bicknell's sedge), *Carex siccata* (dryspike sedge), *Carex pensylvanica* (Pennsylvania sedge), *Carex umbellata* (parasol sedge), *Danthonia spicata* (poverty oatgrass), *Dichanthelium acuminatum* var. *fasciculatum* (western panicgrass), *Dichanthelium linearifolium* (slimleaf panicgrass), *Houstonia longifolia* (longleaf summer bluet), *Parthenocissus quinquefolia* (Virginia creeper), *Polygonum virginianum* (jumpseed), and many others.
Global Vegetation: At this time little is known of the vegetational characteristics of this type. These dry cliffs may have <25% total plant cover, excluding crustose lichens (MNNHP 1993).

MOST ABUNDANT SPECIES

Saint Croix National Scenic Riverway

Stratum	Lifeform	Species
Herb (field)	Graminoid	*Danthonia spicata* (poverty oatgrass)

CHARACTERISTIC SPECIES

Saint Croix National Scenic Riverway: *Andropogon gerardii* (big bluestem), *Danthonia spicata* (poverty oatgrass), *Dichanthelium acuminatum* var. *fasciculatum* (western panicgrass), *Juniperus virginiana* (eastern red-cedar)

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OTHER NOTEWORTHY SPECIES

Saint Croix National Scenic Riverway: Exotic/Invasive: *Linaria vulgaris* (butter and eggs, invasive/exotic, High/Low), *Lonicera tatarica* (Tatarian honeysuckle, invasive/exotic, High/Medium), *Poa compressa* (Canada bluegrass, invasive/exotic, High/Low), *Poa pratensis* (Kentucky bluegrass, invasive/exotic, Medium), *Polygonum convolvulus* (black bindweed, invasive/exotic)

CONSERVATION STATUS RANK

Global Rank & Reasons: GNR (3-Oct-1996).

CLASSIFICATION

Status: Standard
Classification Confidence: 3 - Weak
Global Comments: More study is needed to characterize this type. The igneous/metamorphic rock type category may be too broad, and perhaps more alkaline rocks such as basalt/diabase should be separated from granite and other more acidic rocks. The Northern (Laurentian) Igneous/Metamorphic Moist Cliff Scrub, *Acer spicatum - Thuja occidentalis - Betula papyrifera / Taxus canadensis* Shrubland (CEGL005251), is the moist counterpart to this type. In Wisconsin, basalt/diabase examples of this type occur along the St. Croix River and at a few other locations in the northwest. Other igneous or metamorphic rock types would also be placed here.
Global Similar Associations:
- *Acer spicatum - Thuja occidentalis - Betula papyrifera / Taxus canadensis* Shrubland (CEGL005251)
- Basalt - Diabase Great Lakes Shore Cliff Sparse Vegetation (CEGL005191)
- Granite - Metamorphic Great Lakes Shore Cliff Sparse Vegetation (CEGL005244)
- Limestone - Dolostone Midwest Moist Cliff Sparse Vegetation (CEGL002292)
- *Polypodium (virginianum, appalachianum)* Cliff Sparse Vegetation (CEGL006528)
- Sandstone Midwest Moist Cliff Sparse Vegetation (CEGL002287) cliffs composed of sedimentary rocks.

Global Related Concepts:
- Dry Acid Cliff (Chapman et al. 1989) **?**
- Dry Cliff (Northeast Section) (MNNHP 1993) **>**
- Open Cliff Basalt/Diabase Subtype (Faber-Langendoen 2001) **=**

ELEMENT DISTRIBUTION

Global Range: This dry igneous/metamorphic cliff community is found in the northern Great Lakes region of the United States and Canada, ranging from Minnesota, Wisconsin, and Michigan into Ontario.
Nations: CA, US
States/Provinces: MI, MN, ON, WI
TNC Ecoregions: 47:C, 48:C
USFS Ecoregions (1994/95): 212Hb:CPP, 212He:CP?, 212Ja:CP?, 212Jb:CPP, 212Jc:CPP, 212Jf:CPP, 212Jj:CPP, 212Jl:CPP, 212Jn:CPP, 212Jo:CPP, 212Jr:CPP, 212L:CC
Federal Lands: NPS (Saint Croix); USFS (Chequamegon, Chequamegon-Nicolet, Nicolet)

ELEMENT SOURCES

Saint Croix National Scenic Riverway Map Code: Not mapped separately.
Saint Croix National Scenic Riverway Plots: SACN.27, SACN.33, SACN.34.
Local Description Authors: M.J. Russo
Global Description Authors: D. Faber-Langendoen
References: Chapman et al. 1989, Faber-Langendoen 2001, MNNHP 1993, Midwestern Ecology Working Group n.d., WNHIP unpubl. data

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Midwest Moist Limestone - Dolostone Cliff

Limestone - Dolostone Midwest Moist Cliff Sparse Vegetation
Limestone - Dolostone Midwest Moist Cliff Sparse Vegetation
Identifier: CEGL002292

NVC CLASSIFICATION

Division	Eastern North American Temperate Cliff, Scree & Rock Vegetation (6.B.2.Na)
Macrogroup	Eastern North American Cliff & Rock Vegetation (M111)
Group	Eastern North American Temperate Cliff (G106)
Association (Common name)	Midwest Moist Limestone - Dolostone Cliff

ELEMENT CONCEPT

Global Summary: This limestone - dolostone cliff community occurs in localized areas throughout the midwestern United States and southern Ontario, Canada. The cliffs are often very steep and found along rivers and strongly dissected hills. The aspect is typically northern and east, but is variable. Soils are generally absent, except on ledges or shelves. The cliff is moist due to seepage or shading due to aspect. The vegetation is generally quite sparse (<25% cover). Trees, when present, are scattered. Shrubs, herbs, and nonvascular species are more often present. Characteristic trees include *Acer saccharum* (sugar maple). Characteristic shrubs include *Hydrangea arborescens* (wild hydrangea) and *Staphylea trifolia* (American bladdernut). Common ferns include *Adiantum pedatum* (northern maidenhair), *Asplenium rhizophyllum* (walking fern), and *Cystopteris bulbifera* (bulblet bladderfern), as well as *Asplenium ruta-muraria* (wallrue) and *Asplenium resiliens* (blackstem spleenwort). Other herbs include *Aquilegia canadensis* (red columbine), *Chenopodium simplex* (mapleleaf goosefoot), *Lysimachia quadriflora* (fourflower yellow loosestrife), *Parnassia grandifolia* (largeleaf grass of Parnassus), *Pilea pumila* (Canadian clearweed), *Selaginella apoda* (meadow spikemoss), *Solidago caesia* (wreath goldenrod), and *Solidago flexicaulis* (zigzag goldenrod). Mosses, liverworts and lichens are also present.

ENVIRONMENTAL DESCRIPTION

Saint Croix National Scenic Riverway Environment: This cliff community was sampled once in the park on a southwest-facing, vertical cutbank cliff of Rock Creek comprised of loosely compacted siltstone with fine sand and occasional thin layers of claystone. The unvegetated surface is dominated by exposed bedrock (88% cover) with some small rocks (1%), bare soil (10%) and dead plant stems (1%). Evidence of disturbance includes the presence of trash and exotic plants.
Global Environment: The cliffs are often very steep and found along rivers and strongly dissected hills. The aspect is typically north and east, but is variable. Soils are generally absent, except on ledges or shelves. The cliff is moist due to seepage or shading due to aspect (Nelson 1985).

VEGETATION DESCRIPTION

Saint Croix National Scenic Riverway Vegetation: There is a very sparse (5%) tall-shrub layer (2-5 m) of *Betula papyrifera* (paper birch) and very sparse (5%) short-shrub layer (1-2 m) of *Cornus rugosa* (roundleaf dogwood), *Prunus serotina* (black cherry), *Rosa* (rose) sp., *Rubus occidentalis* (black raspberry), and *Toxicodendron rydbergii* (western poison-ivy). The very sparse (5%) herbaceous layer is comprised of trace amounts of *Aquilegia canadensis* (red columbine), *Eupatorium maculatum* (spotted joepyeweed), *Fragaria vesca* (woodland strawberry), *Helianthus giganteus* (giant sunflower), *Lactuca serriola* (prickly lettuce) (exotic), *Mimulus ringens* (Allegheny monkeyflower), *Oenothera biennis* (common evening-primrose), *Poa palustris* (fowl bluegrass), *Poa pratensis* (Kentucky bluegrass) (exotic), *Prenanthes alba* (white rattlesnakeroot), *Solidago hispida* (hairy goldenrod), *Sphenopholis obtusata* (prairie wedgescale), *Symphyotrichum ciliolatum* (Lindley's aster), *Symphyotrichum lanceolatum* (white panicle aster), *Taraxacum officinale* (common dandelion) (exotic), and *Thalictrum dioicum* (early meadowrue).
Global Vegetation: The vegetation is generally quite sparse (<25% cover). Trees, when present, are scattered. Shrubs, herbs, and nonvascular species are more often present. Characteristic trees include *Acer saccharum* (sugar maple). Characteristic shrubs include *Hydrangea arborescens* (wild hydrangea) and *Staphylea trifolia* (American bladdernut). Common ferns include *Adiantum pedatum* (northern maidenhair), *Asplenium rhizophyllum* (walking fern), and *Cystopteris bulbifera* (bulblet bladderfern), as well as *Asplenium ruta-muraria* (wallrue) and *Asplenium resiliens* (blackstem spleenwort) in the southern part of the range. Other herbs include *Aquilegia canadensis* (red columbine), *Chenopodium simplex* (mapleleaf goosefoot), *Lysimachia quadriflora* (fourflower yellow loosestrife), *Parnassia grandifolia* (largeleaf grass of Parnassus), *Pilea pumila* (Canadian clearweed), *Selaginella apoda* (meadow spikemoss), *Solidago caesia* (wreath goldenrod), and *Solidago flexicaulis* (zigzag goldenrod). Mosses, liverworts and lichens are also present (Curtis 1959, White and Madany 1978, Homoya et al. 1985, Nelson 1985). In Wisconsin, seepage areas include *Primula mistassinica* (Mistassini primrose) and *Campanula rotundifolia* (bluebell bellflower).

CHARACTERISTIC SPECIES

Saint Croix National Scenic Riverway: *Aquilegia canadensis* (red columbine), *Betula papyrifera* (paper birch), *Cornus rugosa* (roundleaf dogwood), *Eupatorium maculatum* (spotted joepyeweed), *Fragaria vesca* (woodland strawberry), *Helianthus giganteus* (giant sunflower), *Mimulus ringens* (Allegheny monkeyflower), *Oenothera biennis* (common evening-primrose), *Prenanthes alba* (white rattlesnakeroot), *Solidago hispida* (hairy goldenrod), *Sphenopholis obtusata* (prairie wedgescale), *Symphyotrichum ciliolatum* (Lindley's aster), *Symphyotrichum lanceolatum* (white panicle aster), *Thalictrum dioicum* (early meadowrue)

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OTHER NOTEWORTHY SPECIES

Saint Croix National Scenic Riverway: Exotic/Invasive: *Lactuca serriola* (prickly lettuce, invasive/exotic, Low/Insignificant), *Poa pratensis* (Kentucky bluegrass, invasive/exotic, Medium), *Taraxacum officinale* (common dandelion, invasive/exotic)

CONSERVATION STATUS RANK

Global Rank & Reasons: G4G5 (2-Mar-2000). In Missouri many sites have been quarried (M. Leahy pers. comm. 1999). This issue should be examined range-wide. Other sites lack adequate buffers above and below the cliffs. Finally, rock-climbing can be disruptive to vegetation (Larson et al. 1999a).

CLASSIFICATION

Status: Standard
Classification Confidence: 2 - Moderate
Global Comments: This moist cliff type is apparently less common across the region than the Limestone - Dolostone Midwest Dry Cliff Sparse Vegetation (CEGL002291). Definitions of cliff types remain problematic. Curtis (1959) in Wisconsin suggested that substrate was of secondary importance compared to moisture (shading versus open) in determining floristic patterns. Furthermore some cliffs are a combination of layers of sandstone, shale and limestone or dolostone, making classification problematic. Tim Nigh (pers. comm. 1996) has suggested that the Missouri type could be named "*Hydrangea arborescens - Adiantum capillus-veneris - Cystopteris bulbifera - Parnassia grandifolia* Alkaline Cliff". This type should also be compared with *Cystopteris bulbifera - (Asplenium rhizophyllum)* Sparse Vegetation (CEGL004394) in the Southeast. Ozark and southern Illinois and Indiana cliffs may be better placed into a Southeastern/Interior Low Plateau type, separate from a Midwest type, based on such species as *Asplenium ruta-muraria* (wallrue) and *Asplenium resiliens* (blackstem spleenwort). In southeastern Indiana, other rare calciphitic species include *Carex eburnea* (bristleleaf sedge), *Heuchera villosa* (hairy alumroot), *Phlox bifida* ssp. *stellaria* (cleft phlox), *Hylotelephium telephioides* (Allegheny stonecrop), and *Sullivantia sullivantii* (Sullivant's coolwort). Limestone cliffs along the Niagara Escarpment in central Ontario/Bruce Peninsula may be different from those in southern Ontario (Wasyl Bakowsky pers. comm. 1998) and from other Great Lakes Limestone cliffs. More northern examples of these cliffs in the Great Lakes region may also contain the *Thuja occidentalis* (northern white-cedar) Cliff Woodland (CEGL002451), which may overlap in concept with this type.
Global Similar Associations:
- *Cystopteris bulbifera - (Asplenium rhizophyllum)* Sparse Vegetation (CEGL004394) a southeastern type that may be very similar.
- *Cystopteris bulbifera - Asplenium rhizophyllum* Ozark Sparse Vegetation [Provisional] (CEGL008486)
- Igneous - Metamorphic Northern Dry Cliff Sparse Vegetation (CEGL002300)
- Limestone - Dolostone Great Lakes Shore Cliff Sparse Vegetation (CEGL002504) Great Lakes limestone/dolostone cliffs.
- Limestone - Dolostone Midwest Dry Cliff Sparse Vegetation (CEGL002291) the Midwest dry or open limestone/dolostone cliff type.
- Maderate Cliff Sparse Vegetation (CEGL002293)
- *Pellaea atropurpurea* Cliff Sparse Vegetation (CEGL006527)
- Sandstone Midwest Moist Cliff Sparse Vegetation (CEGL002287)
- *Thuja occidentalis* Cliff Woodland (CEGL002451) limestone-dolostone cliffs that contain substantial cover >10% of white cedar.

Global Related Concepts:
- Moist Non-Acid Cliff (Chapman et al. 1989) >
- Shaded Cliff (Curtis 1959) >

ELEMENT DISTRIBUTION

Global Range: This limestone/dolostone cliff community occurs in localized areas throughout the midwestern United States and southern Ontario, Canada, ranging from Ohio and southern Ontario west to Iowa, south to Kansas and possibly Arkansas, and east to Tennessee.
Nations: CA, US
States/Provinces: IA:S3?, IL, IN, KS:SU, KY, MI, MN, MO:S4, OH, ON, TN, WI
TNC Ecoregions: 36:C, 37:C, 38:C, 44:C, 45:C, 46:C, 48:C
USFS Ecoregions (1994/95): 212Ha:CCC, 212Hb:CCC, 212Hh:CCC, 212Hj:CCC, 212Hl:CCC, 212Pa:CCC, 222Ac:CCC, 222Ae:CCC, 222Af:CCC, 222Ag:CCC, 222Ak:CCC, 222Aq:CCC, 222Df:CCC, 222Di:CCP, 222Ek:CCC, 222Fc:CCC, 222Fe:CCC, 222Hb:CCC, 222Hc:CCC, 222Hf:CCC, 222Kf:CCC, 222Kg:CCC, 251Ci:CCC, 251Dd:CCC
Federal Lands: NPS (Ozark Riverways, Saint Croix); USFS (Chequamegon-Nicolet, Chequamegon?, Mark Twain, Nicolet?, Shawnee)

ELEMENT SOURCES

Saint Croix National Scenic Riverway Map Code: Not mapped separately.
Saint Croix National Scenic Riverway Plots: SACN.46.
Local Description Authors: M.J. Russo
Global Description Authors: D. Faber-Langendoen
References: Chapman et al. 1989, Chastain et al. 2006, Curtis 1959, Homoya et al. 1985, INAI unpubl. data, Larson et al. 1999a, Lauver et al. 1999, Midwestern Ecology Working Group n.d., Nelson 1985, TDNH unpubl. data, White and Madany 1978

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Midwest Dry Sandstone Cliff

Sandstone Dry Cliff Sparse Vegetation
Sandstone Dry Cliff Sparse Vegetation
Identifier: CEGL002045

NVC CLASSIFICATION

Division	Eastern North American Temperate Cliff, Scree & Rock Vegetation (6.B.2.Na)
Macrogroup	Eastern North American Cliff & Rock Vegetation (M111)
Group	Eastern North American Temperate Cliff (G106)
Association (Common name)	Midwest Dry Sandstone Cliff

ELEMENT CONCEPT

Global Summary: This dry sandstone cliff community is found throughout the central and upper midwestern United States and adjacent Canada. Stands occur as steep to vertical rock exposures of sandstone bedrock. Aspect is variable, but stands are best developed on south- and west-facing slopes. Vegetation is restricted to shelves, cracks and crevices in the rock, generally averaging less than 20%. Mosses and lichens are common, including crustose lichens. In the Ozarks and Interior Low Plateau, scattered occurrences of woody species, such as *Juniperus virginiana* (eastern red-cedar), *Quercus stellata* (post oak), *Vaccinium arboreum* (farkleberry), and *Vaccinium pallidum* (Blue Ridge blueberry), are found. In the Ozarks and Interior Low Plateau, the herbaceous layer contains the ferns *Asplenium bradleyi* (Bradley's spleenwort), *Asplenium pinnatifidum* (lobed spleenwort), *Cheilanthes lanosa* (hairy lipfern), *Dennstaedtia punctilobula* (eastern hayscented fern), and *Dryopteris marginalis* (marginal woodfern). In Minnesota and Wisconsin the dry cliffs include forbs, such as *Aquilegia canadensis* (red columbine), *Campanula rotundifolia* (bluebell bellflower), *Solidago hispida* (hairy goldenrod), *Solidago sciaphila* (shadowy goldenrod) (Driftless area endemic), *Toxicodendron radicans* (eastern poison-ivy), *Selaginella rupestris* (northern selaginella), *Silene antirrhina* (sleepy silene), and *Tradescantia ohiensis* (bluejacket), and the ferns *Asplenium trichomanes* (maidenhair spleenwort), *Pellaea atropurpurea* (purple cliffbrake), *Pellaea glabella* (smooth cliffbrake), *Polypodium virginianum* (rock polypody), and *Woodsia* (cliff fern) spp. The nonvascular layer in Missouri includes the mosses *Brothera leana*, *Polytrichum* (polytrichum moss) spp., and *Rhodobryum roseum*, and the lichens, *Pleopsidium chlorophanum*, *Cladonia mateocyatha* (cup lichen), *Cladonia strepsilis* (cup lichen), and *Dermatocarpon miniatum* (silverskin lichen).

ENVIRONMENTAL DESCRIPTION

Saint Croix National Scenic Riverway Environment: This dry sandstone cliff community was sampled at three locations in the park. The sites are channel wall overhangs and upper slope cliffs. Soil, when present, is rapidly drained sand. The unvegetated surface is dominated by exposed bedrock (86-99% cover) with some sand (0-2%), leaf litter (0-4%) and dead plant stems (0-10%). Evidence of disturbance includes extensive carving on cliff faces and the presence of trash and exotic plants.
Global Environment: Stands occur as steep to vertical rock exposures of sandstone bedrock, occasionally with dolostone interbedded. Aspect is variable, but stands are best developed on south- and west-facing slopes (Nelson 1985, MNNHP 1993). The geologic formations in Missouri include Channel Sands, St. Peter, Lamotte, Roubidoux, and Gunter formations (M. Leahy pers. comm. 1999).

VEGETATION DESCRIPTION

Saint Croix National Scenic Riverway Vegetation: This community is dominated by the nonvascular layer of lichens and mosses (5-90% cover). In addition, there may be a very sparse (<5%) shrub layer that could include *Betula papyrifera* (paper birch), *Cornus alternifolia* (alternateleaf dogwood), *Corylus cornuta* (beaked hazelnut), *Lonicera dioica* (limber honeysuckle), *Pinus strobus* (eastern white pine), *Rubus occidentalis* (black raspberry), and *Vaccinium angustifolium* (lowbush blueberry). The very sparse (5%) herbaceous layer may include trace amounts of *Ageratina altissima* (white snakeroot), *Amphicarpaea bracteata* (American hogpeanut), *Antennaria plantaginifolia* (woman's tobacco), *Aquilegia canadensis* (red columbine), *Arabis lyrata* (lyrate rockcress), *Athyrium filix-femina* (common ladyfern), *Boehmeria cylindrica* (small-spike false nettle), *Campanula rotundifolia* (bluebell bellflower), *Carex umbellata* (parasol sedge), *Chelone glabra* (white turtlehead), *Clematis virginiana* (devil's darning needles), *Conyza canadensis* (Canadian horseweed), *Cystopteris bulbifera* (bulblet bladderfern), *Epilobium coloratum* (purpleleaf willowherb), *Fragaria virginiana* (Virginia strawberry), *Galium circaezans* (licorice bedstraw), *Heuchera richardsonii* (Richardson's alumroot), *Houstonia longifolia* (longleaf summer bluet), *Impatiens capensis* (jewelweed), *Impatiens pallida* (pale touch-me-not), *Lobelia siphilitica* (great blue lobelia), *Lycopus uniflorus* (northern bugleweed), *Lycopus virginicus* (Virginia water horehound), *Maianthemum canadense* (Canada mayflower), *Mentha arvensis* (wild mint), *Parietaria pensylvanica* (Pennsylvania pellitory), *Parthenocissus quinquefolia* (Virginia creeper), *Parthenocissus vitacea* (woodbine), *Pellaea glabella* (smooth cliffbrake), *Phalaris arundinacea* (reed canarygrass), *Physostegia virginiana* (obedient plant), *Piptatherum pungens* (mountain ricegrass), *Polypodium virginianum* (rock polypody), *Populus tremuloides* (quaking aspen), *Scutellaria lateriflora* (blue skullcap), *Solidago hispida* (hairy goldenrod), *Stachys tenuifolia* (smooth hedgenettle), and *Symphyotrichum lateriflorum* (calico aster).
Global Vegetation: Vegetation is restricted to shelves, cracks and crevices in the rock, generally averaging less than 20%. In the Ozarks and Interior Low Plateau, scattered occurrences of woody species, such as *Juniperus virginiana* (eastern red-cedar), *Quercus stellata* (post oak), *Vaccinium arboreum* (farkleberry), and *Vaccinium pallidum* (Blue Ridge blueberry), are found. In the Ozarks and Interior Low Plateau, the herbaceous layer contains the ferns *Asplenium bradleyi* (Bradley's spleenwort), *Asplenium pinnatifidum* (lobed spleenwort), *Cheilanthes lanosa* (hairy lipfern), *Dennstaedtia punctilobula* (eastern hayscented fern), and *Dryopteris*

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marginalis (marginal woodfern). In Minnesota and Wisconsin the dry cliffs include forbs, such as *Aquilegia canadensis* (red columbine), *Campanula rotundifolia* (bluebell bellflower), *Solidago hispida* (hairy goldenrod), *Solidago sciaphila* (shadowy goldenrod) (Driftless Area endemic), *Toxicodendron radicans* (eastern poison-ivy), *Selaginella rupestris* (northern selaginella), *Silene antirrhina* (sleepy silene), and *Tradescantia ohiensis* (bluejacket), and the ferns *Asplenium trichomanes* (maidenhair spleenwort), *Pellaea atropurpurea* (purple cliffbrake), *Pellaea glabella* (smooth cliffbrake), *Polypodium virginianum* (rock polypody), and *Woodsia* (cliff fern) spp. The nonvascular layer in Missouri includes the mosses *Brothera leana*, *Polytrichum* (polytrichum moss) spp., and *Rhodobryum roseum*, and the lichens *Pleopsidium chlorophanum*, *Cladonia mateocyatha* (cup lichen), *Cladonia strepsilis* (cup lichen), and *Dermatocarpon miniatum* (silverskin lichen) (White and Madany 1978, Homoya et al. 1985, Nelson 1985, MNNHP 1993, Anderson 1996). On some Driftless Area cliffs along major rivers, odd groupings of species can occur, e.g., *Dasiphora fruticosa* ssp. *floribunda* (shrubby-cinquefoil), *Ledum groenlandicum* (bog Labrador-tea), and *Photinia melanocarpa* (black chokeberry). Also, the endemic *Pseudognaphalium obtusifolium* ssp. *saxicola* (rabbit-tobacco) occurs exclusively on dry sandstone cliffs in the Driftless Area (E. Epstein pers. comm. 1999).

CHARACTERISTIC SPECIES

Saint Croix National Scenic Riverway: *Ageratina altissima* var. *altissima* (white snakeroot), *Cornus alternifolia* (alternateleaf dogwood), *Cystopteris bulbifera* (bulblet bladderfern), *Parthenocissus quinquefolia* (Virginia creeper)

OTHER NOTEWORTHY SPECIES

Saint Croix National Scenic Riverway: Exotic/Invasive: *Poa compressa* (Canada bluegrass, invasive/exotic, High/Low), *Taraxacum officinale* (common dandelion, invasive/exotic)
Global: Vulnerable: *Pseudognaphalium obtusifolium* ssp. *saxicola* (rabbit-tobacco, globally imperiled, G5T2)

CONSERVATION STATUS RANK

Global Rank & Reasons: G4G5 (2-Mar-2000). Although the cliffs may be relatively common, sites may lack adequate buffers above and below the cliffs.

CLASSIFICATION

Status: Standard
Classification Confidence: 2 - Moderate
Global Comments: This type could be split into an Ozark/Interior Low Plateau sandstone cliff type and a more northern Midwest sandstone cliff type. Relation of this type to stands in the southeast needs to be resolved. Cliffs are defined as vertical exposures of rock at least 3 m tall. The distinction between open (dry) vs. shaded (moist) may be more important that bedrock type, at least on a local or state level. Curtis (1959) comments that in an effort to group the Wisconsin cliff data into meaningful categories, sites were separated by rock type (dolomite, sandstone, igneous) and exposure (shaded, exposed). He found that type of rock was far less important than exposure. For example, the shaded sandstone community had an index of similarity (based on presence/absence) of 64% with the shaded limestone community, but an index of 29% with the exposed sandstone community. As a result, he lumped the bedrock types together, but this produced some of the lowest indices of homogeneity among stands (approx. 35%) of any type in Wisconsin, though this may also reflect differences among northern and southern Wisconsin cliffs, as well as bedrock type and exposure (Curtis 1959, Table IV-2). In order to continue such comparisons regionwide, it will be necessary to continue grouping types by the combination of bedrock, pH, and exposure. Some cliffs contain multiple types of rocks, typically sandstone mixed with limestone or dolostone. This may complicate assignment of the cliff to a single rock type. In Ohio, Anderson (1996) provides several references to lichen composition on sandstone cliffs. In Kansas, sandstone cliffs occur in the Dakota sandstone region (extending into Nebraska), along several creeks/rivers in eastern Kansas, and in the Chautauqua Hills area in southeastern Kansas (Chris Lauver pers. comm. 1998).
Global Similar Associations:
- Appalachian - Alleghenian Sandstone Dry Cliff Sparse Vegetation (CEGL006435)
- *Juniperus virginiana* - *Corydalis sempervirens* Cliff Sparse Vegetation (CEGL006422)
- Limestone - Dolostone Midwest Dry Cliff Sparse Vegetation (CEGL002291)
- Sandstone Midwest Moist Cliff Sparse Vegetation (CEGL002287)

Global Related Concepts:
- Dry Acid Cliff (Chapman et al. 1989) >
- Dry Cliff (Southeast Section) (MNNHP 1993) >
- Exposed Rock Cliffs (Curtis 1959) >
- Open Cliff Sandstone Subtype (Faber-Langendoen 2001) =
- Sandstone Dry Cliff (Steinauer and Rolfsmeier 2000) =

ELEMENT DISTRIBUTION

Global Range: This dry sandstone cliff community is found throughout the central and upper midwestern United States and adjacent Canada, ranging from Ohio and Ontario west to Minnesota, south to Kansas, and east to Indiana.
Nations: CA, US
States/Provinces: AR?, IA:S3?, IL:S5, IN, KS:SU, MI, MN, MO:S3, NE:S4, OH, ON, WI:S4
TNC Ecoregions: 26:C, 36:C, 37:C, 38:C, 44:C, 46:C, 48:C, 60:C

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USFS Ecoregions (1994/95): 212Hi:CPP, 212Ja:CPP, 212Jn:CPP, 212Jr:CPP, 222Aa:CCC, 222Ac:CCC, 222Aj:CCC, 222Ak:CCC, 222Aq:CCC, 222Dc:CCP, 222De:CCC, 222Df:CCC, 222Dh:CCP, 222Di:CCP, 222Ga:CCC, 222Gb:CCC, 222Gc:CCC, 222Hf:C??, 222Ka:CCC, 222Lc:CCC, 251Cj:CCC, 251Dd:CCC, M221:?

Federal Lands: NPS (Saint Croix); USFS (Hiawatha, Ozark?, Shawnee, Wayne)

ELEMENT SOURCES

Saint Croix National Scenic Riverway Map Code: Not mapped separately.

Saint Croix National Scenic Riverway Plots: SACN.26, SACN.115, SACN.127.

Local Description Authors: M.J. Russo

Global Description Authors: D. Faber-Langendoen

References: Anderson 1996, Chapman et al. 1989, Curtis 1959, Epstein pers. comm., Faber-Langendoen 2001, Homoya et al. 1985, INAI unpubl. data, Lauver et al. 1999, Leahy pers. comm., MNNHP 1993, Midwestern Ecology Working Group n.d., Nelson 1985, Steinauer and Rolfsmeier 2000, WNHIP unpubl. data, White and Madany 1978

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Midwest Moist Sandstone Cliff

Sandstone Midwest Moist Cliff Sparse Vegetation
Sandstone Midwest Moist Cliff Sparse Vegetation
Identifier: CEGL002287

NVC CLASSIFICATION

Division	Eastern North American Temperate Cliff, Scree & Rock Vegetation (6.B.2.Na)
Macrogroup	Eastern North American Cliff & Rock Vegetation (M111)
Group	Eastern North American Temperate Cliff (G106)
Association (Common name)	Midwest Moist Sandstone Cliff

ELEMENT CONCEPT

Global Summary: This moist sandstone cliff community is found throughout the central and upper midwestern United States and adjacent Canada. Stands occur as steep to vertical rock exposures of sandstone bedrock. Aspect is variable, but stands are best developed on north- and east-facing slopes, or under sandstone overhangs. Vegetation is restricted to shelves, cracks and crevices in the rock, generally averaging less than 20%, and often dominated by forbs and ferns, with mats of mosses and lichens. In the Ozarks and Interior Low Plateau, the herbaceous layer contains the forbs *Dicentra canadensis* (squirrel corn), *Dodecatheon frenchii* (French's shootingstar), *Heuchera parviflora* (littleflower alumroot), *Triadenum walteri* (greater marsh St. Johnswort), *Mitchella repens* (partridgeberry), *Mitella diphylla* (twoleaf miterwort), among others, and the ferns *Athyrium filix-femina* (common ladyfern), *Cystopteris bulbifera* (bulblet bladderfern), *Osmunda cinnamomea* (cinnamon fern), *Osmunda regalis* (royal fern), and *Trichomanes boschianum* (Appalachian bristle fern). In the Allegheny region of Ohio, the sandstone cliffs include the forbs *Agrostis perennans* (upland bentgrass), *Aquilegia canadensis* (red columbine), *Mitchella repens* (partridgeberry), and *Viola blanda* (sweet white violet), and the ferns *Asplenium montanum* (mountain spleenwort), *Asplenium pinnatifidum* (lobed spleenwort), *Asplenium rhizophyllum* (walking fern), *Asplenium trichomanes* (maidenhair spleenwort), *Cystopteris fragilis* (brittle bladderfern), *Dennstaedtia punctilobula* (eastern hayscented fern), *Dryopteris intermedia* (intermediate woodfern), *Dryopteris marginalis* (marginal woodfern), *Polypodium virginianum* (rock polypody), and the rare *Asplenium bradleyi* (Bradley's spleenwort). In Minnesota and Wisconsin the moist cliffs include forbs, such as *Aralia nudicaulis* (wild sarsaparilla), *Asarum canadense* (Canadian wildginger) and *Mitella diphylla* (twoleaf miterwort), and the ferns *Cystopteris bulbifera* (bulblet bladderfern) and *Cystopteris fragilis* (brittle bladderfern). The nonvascular layer is poorly described. Seepage areas in Minnesota include *Sullivantia sullivantii* (Sullivant's coolwort) (also found in Missouri) and *Cryptogramma stelleri* (fragile rockbrake).

ENVIRONMENTAL DESCRIPTION

Saint Croix National Scenic Riverway Environment: This cliff community was sampled once on a steep, west-facing talus slope with rapidly drained sand soil. The unvegetated surface is dominated by bare soil (81% cover) with some exposed bedrock (10%), large rocks (1%), leaf litter (1%), wood (1%) and dead plant stems (6%). Evidence of disturbance includes some erosion, carving on exposed bedrock shelves and trampling by people, and the presence of trash and exotic plants.
Global Environment: Stands occur as steep to vertical rock exposures of sandstone bedrock. Aspect is variable, but stands are best developed on north- and east-facing slopes, or under sandstone overhangs (Nelson 1985, MNNHP 1993). The sandstone overhangs are amphitheatre-like cuts in sandstone cliffs. They may recede deeply enough into the cliff face that light levels are very low in the interior of the overhang. The soils beneath the overhang are typically sandy and with little vegetation. Seepage areas may also occur (Homoya et al. 1985). In Missouri, geologic formations include the St. Peter and Lamotte formations.

VEGETATION DESCRIPTION

Saint Croix National Scenic Riverway Vegetation: The very sparse (10% cover) tree canopy, 10-15 m tall, is made up of *Betula papyrifera* (paper birch), and the very sparse (10%) subcanopy (5-10 m) is made up of *Acer rubrum* (red maple) and *Acer saccharinum* (silver maple). The very sparse (10%) short-shrub layer (0.5-1 m) is dominated by *Diervilla lonicera* (northern bush honeysuckle) and includes tree saplings as well as *Rubus flagellaris* (northern dewberry), *Rubus occidentalis* (black raspberry), *Sambucus racemosa* var. *racemosa* (red elderberry), and *Toxicodendron rydbergii* (western poison-ivy). *Vaccinium angustifolium* (lowbush blueberry) forms a very sparse (<5%) dwarf-shrub layer. The sparse (20%) herbaceous layer is dominated by tree seedlings and includes *Calamagrostis canadensis* (bluejoint), *Lycopus virginicus* (Virginia water horehound), *Maianthemum canadense* (Canada mayflower), *Phalaris arundinacea* (reed canarygrass), and many others. Nonvascular species (mosses and liverworts) cover 20% of the ground surface.
Global Vegetation: Vegetation is restricted to shelves, cracks and crevices in the rock, generally averaging less than 20%. In the Ozarks and Interior Low Plateau, the herbaceous layer contains the forbs *Dicentra canadensis* (squirrel corn), *Dodecatheon frenchii* (French's shootingstar), *Heuchera parviflora* (littleflower alumroot), *Triadenum walteri* (greater marsh St. Johnswort), *Mitchella repens* (partridgeberry), *Mitella diphylla* (twoleaf miterwort), among others, and the ferns *Athyrium filix-femina* (common ladyfern), *Cystopteris bulbifera* (bulblet bladderfern), *Osmunda cinnamomea* (cinnamon fern), *Osmunda regalis* (royal fern), and *Trichomanes boschianum* (Appalachian bristle fern). In the Allegheny region of Ohio, the sandstone cliffs include the forbs *Agrostis perennans* (upland bentgrass), *Aquilegia canadensis* (red columbine), *Mitchella repens* (partridgeberry), and *Viola blanda* (sweet white violet), and the ferns *Asplenium montanum* (mountain spleenwort), *Asplenium pinnatifidum* (lobed spleenwort), *Asplenium rhizophyllum* (walking fern), *Asplenium trichomanes* (maidenhair spleenwort), *Cystopteris fragilis* (brittle bladderfern), *Dennstaedtia punctilobula* (eastern hayscented fern), *Dryopteris intermedia* (intermediate woodfern), *Dryopteris marginalis* (marginal woodfern), *Polypodium*

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virginianum (rock polypody), and the rare *Asplenium bradleyi* (Bradley's spleenwort). In Minnesota and Wisconsin the moist cliffs include forbs, such as *Aralia nudicaulis* (wild sarsaparilla), *Asarum canadense* (Canadian wildginger) and *Mitella diphylla* (twoleaf miterwort), and the ferns *Cystopteris bulbifera* (bulblet bladderfern) and *Cystopteris fragilis* (brittle bladderfern). Missouri sites often harbor glacial relicts. The nonvascular layer is poorly described. Seepage areas in Minnesota include *Sullivantia sullivantii* (Sullivant's coolwort) (also found in Missouri) and *Cryptogramma stelleri* (fragile rockbrake) (White and Madany 1978, Homoya et al. 1985, Nelson 1985, MNNHP 1993, Anderson 1996).

CHARACTERISTIC SPECIES

Saint Croix National Scenic Riverway: *Acer saccharinum* (silver maple), *Betula papyrifera* (paper birch), *Calamagrostis canadensis* (bluejoint), *Diervilla lonicera* (northern bush honeysuckle), *Lycopus virginicus* (Virginia water horehound), *Maianthemum canadense* (Canada mayflower), *Phalaris arundinacea* (reed canarygrass), *Toxicodendron rydbergii* (western poison-ivy)

OTHER NOTEWORTHY SPECIES

Saint Croix National Scenic Riverway: Exotic/Invasive: *Poa pratensis* (Kentucky bluegrass, invasive/exotic, Medium), *Taraxacum officinale* (common dandelion, invasive/exotic)
Global: Vulnerable: *Dodecatheon frenchii* (French's shootingstar, G3)

CONSERVATION STATUS RANK

Global Rank & Reasons: G4G5 (3-Oct-1996). Although the cliffs may be relatively common, sites may lack adequate buffers above and below the cliffs.

CLASSIFICATION

Status: Standard
Classification Confidence: 2 - Moderate
Global Comments: In Missouri, a descriptive name for this type could be "*Mitella diphylla - Mitchella repens - Dryopteris goldiana* Cliff" (Tim Nigh pers. comm. 1996), but the name would not work in Wisconsin (E. Epstein pers. comm. 1999). Also present are polypodium ferns and mosses. Differences between sandstone overhang and sandstone cliff need review. In Ontario this type is found as very small occurrences and is very rare. This type could be split into an Ozark/Interior Low Plateau sandstone cliff type and more northern Midwest sandstone cliff type. Cliffs are defined as vertical exposures of rock at least 3 m tall. The distinction between open (dry) versus shaded (moist) may be more important that bedrock type, at least on a local or state level. Curtis (1959) comments that in an effort to group the Wisconsin cliff data into meaningful categories, sites were separated by rock type (dolomite, sandstone, igneous) and exposure (shaded, exposed). He found that type of rock was far less important than exposure. For example, the shaded sandstone community had an index of similarity (based on presence/absence) of 64% with the shaded limestone community, but an index of 29% with the exposed sandstone community. As a result, he lumped the bedrock types together, but this produced some of the lowest indices of homogeneity among stands (approx. 35%) of any type in Wisconsin, though this may also reflect differences among northern and southern Wisconsin cliffs, as well as bedrock type and exposure (Curtis 1959, Table IV-2). In order to continue such comparisons regionwide, it will be necessary to continue grouping types by the combination of bedrock and exposure. Some cliffs contain multiple types of rocks, typically sandstone mixed with limestone or dolostone. This may complicate assignment of the cliff to a single rock type. In Ohio, Anderson (1996) provides several references to lichen composition on sandstone cliffs. In Kansas, sandstone cliffs occur in the Dakota sandstone region (extending into Nebraska), along several creeks/rivers in eastern Kansas, and in the Chautaqua Hills area in southeastern Kansas (Chris Lauver pers. comm. 1998).
Global Similar Associations:
- Appalachian - Alleghenian Sandstone Dry Cliff Sparse Vegetation (CEGL006435)
- Chert Ozark Moist Cliff Sparse Vegetation (CEGL002288)
- Igneous - Metamorphic Northern Dry Cliff Sparse Vegetation (CEGL002300)
- Limestone - Dolostone Midwest Moist Cliff Sparse Vegetation (CEGL002292)
- Maderate Cliff Sparse Vegetation (CEGL002293)
- Sandstone Dry Cliff Sparse Vegetation (CEGL002045)

Global Related Concepts:
- Cliff Communities (Anderson 1996) >
- Moist Acid Cliff (Chapman et al. 1989) >
- Moist Cliff (Southeast Section) (MNNHP 1993) =
- Shaded Cliff Sandstone Subtype (Faber-Langendoen 2001) =
- Shaded Rock Cliffs (Curtis 1959) >

ELEMENT DISTRIBUTION

Global Range: This moist sandstone cliff community is found throughout the central and upper midwestern United States and adjacent Canada, from Ohio and Ontario west to Minnesota, south to Kansas and east to Indiana.
Nations: CA, US
States/Provinces: AR?, IA:S3?, IL:S5, KS:SU, MI, MN:S3, MO:S3, OH, ON, WI:S4
TNC Ecoregions: 36:C, 37:C, 38:C, 44:C, 45:C, 46:C, 47:C, 48:C, 49:C
USFS Ecoregions (1994/95): 212Hi:CCC, 212Ja:CPP, 212Jn:CPP, 212Kb:CCC, 221Ea:CCC, 221Ec:CCP, 221Ed:CCP, 221Ee:CCC, 221Ef:CCC, 221Fa:CCC, 222Aa:CCC, 222Ag:CCC, 222Ak:CCC, 222Ap:CCC, 222Aq:CCC, 222Dc:CCP, 222De:CCC, 222Dh:CCC,

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222Di:CCP, 222Hf:CCC, 222Jc:CCC, 222Ka:CCC, 222Lc:CCC, 222Ld:CCC, 222Lf:CCC, 222Md:CCC, 222Me:CCC, 251Cc:CCC, 251Ce:CCC, M221:?

Federal Lands: NPS (Pictured Rocks, Saint Croix); USFS (Chequamegon-Nicolet?, Chequamegon?, Mark Twain, Nicolet?, Ottawa?, Ozark, Shawnee, Wayne)

ELEMENT SOURCES

Saint Croix National Scenic Riverway Map Code: Not mapped separately.

Saint Croix National Scenic Riverway Plots: SACN.25.

Local Description Authors: M.J. Russo

Global Description Authors: D. Faber-Langendoen

References: Anderson 1996, Chapman et al. 1989, Curtis 1959, Faber-Langendoen 2001, Homoya et al. 1985, Hop et al. 2010c, INAI unpubl. data, Lauver et al. 1999, MNNHP 1993, Midwestern Ecology Working Group n.d., Nelson 1985, WNHIP unpubl. data, White and Madany 1978

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Appendix C: Field Key to Vegetation Types

Explanation and Use of the Key

This is a field key to natural vegetation types of the Saint Croix National Scenic Riverway (SACN). The vegetation types are based on the National Vegetation Classification Standard (NVCS), Version 2 (FGDC 2008) and were derived from field data collected during the SACN vegetation mapping project. This key depicts vegetation types at the association (plant community) level, the lowest level of the NVCS, unless otherwise specified. For association types, the association name is given, followed by the Community Global Element (CEGL) code. For alliance types, the alliance name is given, followed by the Alliance Key (A.) code.

For best results, all assessments of vegetation types in the field should be done on an area of 5,000 m^2 (i.e., a 40-m radius around a point or a rectangle of 50 by 100 m) and within a single vegetation type. Appendix B: Descriptions of Vegetation Types is recommended to complement this key to ascertain correct assessment of types.

The term "dominance" means greater than 50% relative cover within a given stratum unless otherwise noted. When the term "total canopy cover" is used, it is in reference to the absolute canopy cover. All other cover values refer to relative canopy cover; e.g., if total cover of the tree canopy is 40%, then a notation of >25% cover of jack pine (*Pinus banksiana*) refers to 25% of the 40% total cover. When using this key, if quaking aspen (*Populus tremuloides*) or tamarack (*Larix laricina*) is in the tallest stratum and taller than 2 m, they are to be treated as "tree canopy."

GENERAL KEY

1A. Absence of standing water and/or peat soil. Mineral soil not saturated throughout the growing season. Upland soils and vegetation prevalent. Wetlands absent or limited to occasional vernal pools. 2

1B. Wetland soils and vegetation prevalent. Presence of standing water or saturated mineral or organic soils. 40

UPLANDS

2A. Total tree canopy >25%. Forest or woodland. 3
2B. Total tree canopy <25%. Dominated by shrubs/herbaceous vegetation or sparsely vegetated..... 34

3A. Total tree canopy cover <60%. 4
3B. Total tree canopy cover >60%. 7

4A. Sites south of Saint Croix Falls; on thin soils with bedrock visible in spots. Tree canopy dominated by eastern red-cedar (*Juniperus virginiana*), sometimes in combination with other trees such as paper birch (*Betula papyrifera*), aspen (*Populus* spp.), or white pine (*Pinus strobus*). ***Quercus muehlenbergii - Quercus* (*alba*, *velutina*) - *Juniperus virginiana* Bluff Woodland [CEGL002144]**
4B. Not as above..... 5

5A. Tree canopy >25% coniferous species..... 6
5B. Tree canopy <25% coniferous species and >50% bur oak (*Quercus macrocarpa*)..... ***Quercus alba - Quercus macrocarpa - Quercus rubra* / *Corylus americana* Woodland [CEGL002142]**

6A. Sites upstream of Riverside Landing. Tree canopy >25% of both evergreen AND deciduous trees. Tree canopy dominated by a mix of jack pine (*Pinus banksiana*) and/or red pine (*P. resinosa*) AND northern pin oak (*Quercus ellipsoidalis*) and/or bur oak (*Q. macrocarpa*)..... ***Pinus banksiana* - (*Pinus resinosa*) - *Quercus ellipsoidalis* / *Carex pensylvanica* Forest [CEGL002478]**
6B. Sites downstream of Riverside Landing; on sandy soils. Tree canopy dominated by jack pine (*Pinus banksiana*) and/or red pine (*P. resinosa*) AND red pine <80% cover relative to all evergreen trees. Northern pin oak (*Quercus ellipsoidalis*) and sometimes bur oak (*Q. macrocarpa*) can be common in canopy or as small trees (subcanopy). ..... ***Pinus banksiana - Pinus resinosa* / *Quercus ellipsoidalis* Woodland [CEGL002484]**

7A. Tree canopy >75% evergreen species. 8
7B. Tree canopy <75% evergreen species. 13

8A. Sites south of Saint Croix Falls; on thin soils with bedrock visible in spots. Tree canopy dominated by eastern red-cedar (*Juniperus virginiana*), sometimes in combination with other trees such as paper birch (*Betula papyrifera*), aspen (*Populus* spp.), or white pine (*Pinus strobus*). ***Quercus muehlenbergii - Quercus* (*alba*, *velutina*) - *Juniperus virginiana* Bluff Woodland [CEGL002144]**
8B. Sites not as above..... 9

9A. Tree canopy >25% cover of pine (*Pinus* spp.). 10
9B. Tree canopy >75% white spruce (*Picea glauca*) and/or balsam fir (*Abies balsamea*). ..... ***Picea glauca - Abies balsamea* / *Acer spicatum* / *Rubus pubescens* Forest [CEGL002446]**

10A. Tree canopy >25% eastern white pine (*Pinus strobus*)..... 11
10B. Tree canopy <25% eastern white pine (*Pinus strobus*)..... 12

11A. Sites south of Saint Croix Falls; on shallow soil over bedrock..... ***Pinus strobus* - (*Pinus resinosa*) Driftless Bluff Forest [CEGL002378]**
11B. Sites mostly north of Saint Croix Falls, on moderate to deep soil; bedrock outcrops rare to absent. ***Pinus strobus* / *Acer spicatum* - *Corylus cornuta* Forest [CEGL002445]**

12A. Tree canopy >75% red pine (*Pinus resinosa*)..... .
***Pinus resinosa* / *Vaccinium* spp. Forest [CEGL002443]**
12B. Tree canopy <75% red pine (*Pinus resinosa*); jack pine (*P. banksiana*) typically dominant; total tree canopy cover sometimes <60%. [Found upstream of Riverside Landing] .....
***Pinus banksiana* Forest Alliance [A.116]**

13A. Tree canopy >75% deciduous species. 14
13B. Tree canopy <75% deciduous species. 28

14A. Tree canopy >50% aspen (*Populus* spp.), paper birch (*Betula papyrifera*), and/or red maple (*Acer rubrum*) AND <25% cover of a combination of sugar maple (*Acer saccharum*), oaks (*Quercus* spp.), and conifers. 15
14B. Tree canopy <50% aspen (*Populus* spp.), paper birch (*Betula papyrifera*), and/or red maple (*Acer rubrum*) OR >25% cover of a combination of sugar maple (*Acer saccharum*), oaks (*Quercus* spp.), and conifers. 20

15A. Tree canopy >50% paper birch (*Betula papyrifera*); <10% cover of aspen (*Populus* spp.). .....
***Betula papyrifera* / *Acer saccharum* - Mixed Hardwoods Forest [CEGL002464]**
15B. Tree canopy <50% paper birch (*Betula papyrifera*). 16

16A. Sites found in ravines, on upper terraces of floodplains, or other wet-mesic habitats; tree canopy >75% quaking aspen (*Populus tremuloides*); other common tree species include green ash (*Fraxinus pennsylvanica*), elm (*Ulmus* spp.), hackberry (*Celtis occidentalis*), and box-elder (*Acer negundo*). .....
***Fraxinus pennsylvanica - Celtis occidentalis - Tilia americana* - (*Quercus macrocarpa*) Forest [CEGL002081] (aspen phase)**
16B. Sites not as above. 17

17A. Sites south of Franconia, MN (on either side of the river)..... .
***Populus tremuloides* / *Corylus americana* Forest [CEGL002063]**
17B. Sites north of Franconia, MN (on either side of the river). 18

18A. Understory (T3 and shorter) >25% cover by conifers; only north of Grantsburg/Hwy 70. .....
***Populus tremuloides - Betula papyrifera* / (*Abies balsamea*, *Picea glauca*) Forest [CEGL002466]**
18B. Understory (T3 and shorter) <25% cover by conifers. 19

19A. Understory (T3 and shorter) >50% cover of sugar maple (*Acer saccharum*), oaks (*Quercus* spp.), green ash (*Fraxinus pennsylvanica*), and yellow birch (*Betula alleghaniensis*)..... .
***Populus tremuloides - Betula papyrifera* / *Acer saccharum* - Mixed Hardwoods Forest [CEGL002468]**
19B. Understory (T3 and shorter) <50% cover of sugar maple (*Acer saccharum*), oaks (*Quercus* spp.), green ash (*Fraxinus pennsylvanica*), and yellow birch (*Betula alleghaniensis*)..... .
***Populus tremuloides - Betula papyrifera* - (*Acer rubrum*, *Populus grandidentata*) Forest [CEGL002467]**
20A. Tree canopy >50% maple (*Acer saccharum*, *A. rubrum*), yellow birch (*Betula alleghaniensis*), paper birch (*B. papyrifera*), and/or basswood (*Tilia americana*) AND red oak (*Quercus rubra*) <20% cover. 21
20B. Tree canopy <50% maple (*Acer saccharum*, *A. rubrum*), yellow birch (*Betula alleghaniensis*), paper birch (*B. papyrifera*), and/or basswood (*Tilia americana*) OR red oak (*Quercus rubra*) >20% cover. 23

21A. Tree canopy >20% of yellow birch (*Betula alleghaniensis*) AND cover by yellow birch greater than cover by basswood (*Tilia americana*). Sites nearly always small and associated with seeps or groundwater emergence. .....
***Acer saccharum* - *Betula alleghaniensis* - (*Tilia americana*) Forest [CEGL002457]**

21B. Tree canopy cover <20% of yellow birch (*Betula alleghaniensis*) OR cover of yellow birch less than cover of basswood (*Tilia americana*). 22

22A. Sites south of Saint Croix Falls, WI. Tree layers (T2 and T3) contains >15% southern species such as hickories (*Carya* spp.), musclewood (*Carpinus caroliniana*), and/or butternut (*Juglans cinerea*). .....
***Acer saccharum* - *Tilia americana* / *Ostrya virginiana* - *Carpinus caroliniana* Forest [CEGL002062]**

22B. Sites anywhere. Tree layers not as above. .....
***Acer saccharum* - *Tilia americana* / *Ostrya virginiana* / *Lonicera canadensis* Forest [CEGL002458]**

23A. Dominant trees variable but include green ash (*Fraxinus pennsylvanica*), bur oak (*Quercus macrocarpa*), basswood (*Tilia americana*), aspen (*Populus* spp.), box-elder (*Acer negundo*). Sites in depressions, river or stream terraces or floodplains. .....
***Fraxinus pennsylvanica* - *Celtis occidentalis* - *Tilia americana* - (*Quercus macrocarpa*) Forest [CEGL002081]**

23B. Not as above. 24

24A. Tree canopy >50% oaks (*Quercus* spp.). 25

24B. Tree canopy >20% red oak *(Quercus rubra*) and >20% sugar maple (*Acer saccharum*) AND combination of red oak and sugar maple >50% cover. .....
***Quercus rubra* - *Acer saccharum* Forest [CEGL002461]**

25A. Oak (*Quercus* spp.) forests and woodlands over thin soil, bedrock outcrops common; total tree canopy sometimes with a woodland character (50-75%). .....
***Quercus macrocarpa* – (*Quercus alba*, *Quercus ellipsoidalis*, *Quercus velutina*) Woodland [CEGL005560]**

25B. Oak (*Quercus* spp.) forests over medium to deep soil, bedrock outcrops rare to absent. 26

26A. Tree canopy >50% red oak (*Quercus rubra*) and/or white oak (*Q. alba*) AND maples (*Acer rubrum*, *A. saccharum*) <20% cover. .....
***Quercus alba* - *Quercus rubra* - *Carya ovata* Glaciated Forest [CEGL002068]**

26B. Tree canopy >50% northern pin oak (*Quercus ellipsoidalis*) and/or bur oak (*Q. macrocarpa*). 27

27A. Tree canopy >50% northern pin oak (*Quercus ellipsoidalis*). .....
***Quercus ellipsoidalis* - (*Quercus macrocarpa*) Forest [CEGL002077]**

27B. Tree canopy >50% bur oak (*Quercus macrocarpa*). .....
***Quercus alba* - *Quercus macrocarpa* - *Quercus rubra* / *Corylus americana* Woodland [CEGL002142]**

28A. Conifer component of tree canopy >50% pines (*Pinus* spp.). 29

28B. Conifer component of tree canopy <50% pines (*Pinus* spp.); tree canopy dominated by a mix of balsam fir (*Abies balsamea*), white spruce (*Picea glauca*), aspen (*Populus* spp.), and/or paper birch (*Betula papyrifera*). .....
***Picea glauca* - *Abies balsamea* - *Populus tremuloides* / Mixed Herbs Forest [CEGL002475]**

29A. Conifer component of tree canopy >75% red pine (*Pinus resinosa*); deciduous trees typically aspen (*Populus* spp.), paper birch (*Betula papyrifera*), red maple (*Acer rubrum*), oaks (*Quercus* spp.), and/or green ash (*Fraxinus pennsylvanica*). .....
***Pinus resinosa* - *Populus tremuloides* / *Diervilla lonicera* / *Vaccinium* spp. Forest [CEGL002520]**

29B. Conifer component of tree canopy <75% red pine (*Pinus resinosa*). 30

30A. Conifer component of tree canopy >25% white pine (*Pinus strobus*). 31

30B. Conifer component of tree canopy <25% white pine (*Pinus strobus*). 33

31A. Sites on thin soil with bedrock outcrops common; tree canopy a mix of white pine (*Pinus strobus*), red pine (*P. resinosa*), red oak (*Quercus rubra*), and/or sugar maple (*Acer saccharum*)...
***Pinus strobus* - *Quercus* (*alba*, *rubra*, *velutina*) Driftless Bluff Forest [CEGL005561]**

31B. Sites not on thin soil with bedrock outcrops common. 32

32A. Deciduous component of tree canopy >75% aspen (*Populus* spp.), paper birch (*Betula papyrifera*), and/or red maple (*Acer rubrum*). .....
***Pinus strobus* - *Populus tremuloides* / *Corylus cornuta* Forest [CEGL002479]**

32B. Deciduous component of tree canopy <75% aspen (*Populus* spp.), paper birch (*Betula papyrifera*), and/or red maple (*Acer rubrum*). .....
***Pinus strobus* - (*Pinus resinosa*) - *Quercus rubra* Forest [CEGL002480]**

33A. Conifer component of tree canopy >25% jack pine (*Pinus banksiana*) AND deciduous component of tree canopy >75% aspen (*Populus* spp.) and/or paper birch (*Betula papyrifera*). [Found only upstream of Riverside Landing].....
***Pinus banksiana* - *Populus tremuloides* Forest Alliance [A.390]**

33B. Conifer component of tree canopy >25% jack pine (*Pinus banksiana*) AND deciduous component of tree canopy <75% aspen (*Populus* spp.) and/or paper birch (*Betula papyrifera*).....
***Pinus banksiana* - (*Pinus resinosa*) - *Quercus ellipsoidalis* / *Carex pensylvanica* Forest [CEGL002478]**

UPLAND SHRUBLANDS

34A. >25% total canopy cover by shrubs; shrub stratum >50% cover by hazelnut (*Corylus* spp.). .....
***Corylus cornuta* - *Amelanchier* spp. Ruderal Shrubland [CEGL005562]**

34B. <25% total canopy cover by tall, short, or dwarf-shrubs. 35

UPLAND HERBACEOUS AND SPARSE VEGETATION

35A. Total vegetation cover >10%. 36
35B. Total vegetation cover <10%. 73

36A. Total tree canopy 10-25%; tree canopy dominated by jack pine (*Pinus banksiana*) and/or red pine (*P. resinosa*). .....
***Pinus banksiana - Pinus resinosa* - (*Quercus ellipsoidalis*) / *Carex pensylvanica* Wooded Herbaceous Vegetation [CEGL005124]**
36B. Total tree canopy <10% OR tree canopy not dominated by jack pine (*Pinus banksiana*) and/or red pine (*P. resinosa*). 37

37A. Thin soils with bedrock outcrops common. .....
***Schizachyrium scoparium - Bouteloua curtipendula* Bedrock Bluff Herbaceous Vegetation [CEGL002245]**
37B. Medium to deep soils, bedrock outcrops rare to absent. 38

38A. Prairies on sands 39
38B. Prairies not on sands (though may be on sandy loams); big bluestem (*Andropogon gerardii*), little bluestem (*Schizachyrium scoparium*), and Indiangrass (*Sorghastrum nutans*). .....
***Schizachyrium scoparium - Sorghastrum nutans - Bouteloua curtipendula* Herbaceous Vegetation [CEGL002214]**

39A. Dry-mesic sites; dominated by mid and tall grasses including big bluestem (*Andropogon gerardii*), little bluestem (*Schizachyrium scoparium*), Indiangrass (*Sorghastrum nutans*), and prairie dropseed (*Sporobolus heterolepis*). .....
***Schizachyrium scoparium - Sorghastrum nutans - Andropogon gerardii - Lespedeza capitata* Sand Herbaceous Vegetation [CEGL002210]**
39B. Dry sites; dominated by mid- and short-grasses including little bluestem (*Schizachyrium scoparium*), hairy grama (*Bouteloua hirsuta*), Pennsylvania sedge (*Carex pensylvanica*), Junegrass (*Koeleria macrantha*), and porcupine grass (*Hesperostipa spartea*). .....
***Schizachyrium scoparium - Danthonia spicata - Carex pensylvanica* - (*Viola pedata*) Herbaceous Vegetation [CEGL0023218]**

WETLANDS

40A. Total tree canopy >25%. Forest or woodland. 41
40B. Total tree canopy <25%. Dominated by shrubs or herbaceous vegetation or sparsely vegetated. 50

41A. Tree canopy >75% conifers (including *Larix laricina*). 42
41B. Tree canopy <75% conifers (including *Larix laricina*). 44

42A. Tree canopy dominated by black spruce (*Picea mariana*) and/or tamarack (*Larix laricina*). 43
42B. Tree canopy dominated by white cedar (*Thuja occidentalis*) and/or balsam fir (*Abies balsamea*). ..
***Thuja occidentalis* - (*Picea mariana*, *Abies balsamea*) / *Alnus incana* Forest [CEGL002456]**

43A. Black spruce (*Picea mariana*) and/or tamarack (*Larix laricina*) growing on peat over dwarf-shrubs. Short and tall shrubs usually <25% total canopy cover. .....
***Picea mariana* – (*Larix laricina*) / *Ledum groenlandicum* / *Sphagnum* spp. Forest [CEGL005271]**
43B. Tamarack (*Larix laricina*) growing over tall and short shrubs. Short and tall shrubs usually >25% total canopy cover. Peat may or may not be present. Gray alder (*Alnus incana*) and sometimes red maple (*Acer rubrum*) and bog birch (*Betula nana*) are dominant shrubs. .....
***Larix laricina* / *Alnus incana* Forest [CEGL002471]**

44A. Tree canopy >75% deciduous trees with understory conifers possible. 45
44B. Tree canopy <75% deciduous trees. Tree canopy dominated by northern white cedar (*Thuja occidentalis*) and/or balsam fir (*Abies balsamea*), and black ash (*Fraxinus nigra*). Saturated soils are mineral or well-decomposed peat. .....
***Thuja occidentalis* - *Fraxinus nigra* Forest [CEGL005165]**

45A. Swamp setting; muck soils; standing water or saturated soils present most or all of the growing season; marsh marigold (*Caltha palustris*), skunk-cabbage (*Symplocarpus foetidus*), and brome-like sedge (*Carex bromoides*) are good indicators..... 46
45B. Floodplain or temporarily flooded/saturated setting. 47

46A. Tree canopy >50% black ash (*Fraxinus nigra*) AND <20% bur oak (*Quercus macrocarpa*).....
***Fraxinus nigra* - Mixed Hardwoods - Conifers / *Cornus sericea* / *Carex* spp. Forest [CEGL002105]**
46B. Tree canopy <50% black ash (*Fraxinus nigra*); dominated by a combination of black ash (*F. nigra*), red maple (*Acer rubrum*), yellow birch (*Betula alleghaniensis*), paper birch (*B. papyrifera*), and tamarack (*Larix laricina*); swamp setting typically with muck soils. If in a floodplain setting, consider Couplet 46. .....
***Acer rubrum* - *Fraxinus* spp. - *Betula papyrifera* / *Cornus canadensis* Forest [CEGL002071]**

47A. Tree canopy >50% silver maple (*Acer saccharinum*). .....
***Acer saccharinum* - *Ulmus americana* Forest [CEGL002586]**
47B. Tree canopy <50% silver maple (*Acer saccharinum*). 48

48A. Tree canopy >50% cottonwood (*Populus deltoides*) and/or black willow (*Salix nigra*). .....
***Populus deltoides* - *Salix nigra* Forest [CEGL002018]**
48B. Tree canopy <50% cottonwood (*Populus deltoides*) and/or black willow (*Salix nigra*). 49

49A. Floodplain setting; tree canopy dominated by a mix of trees including green ash (*Fraxinus pennsylvanica*), elm (*Ulmus* spp.), box-elder (*Acer negundo*), basswood (*Tilia americana*). >5% silver maple (*Acer saccharinum*) AND <5% bur oak (*Quercus macrocarpa*). ..... ***Fraxinus pennsylvanica* - *Ulmus americana* - (*Acer negundo*, *Tilia americana*) Northern Forest [CEGL002089]**

49B. Tree canopy <5% silver maple (*Acer saccharinum*) OR >5% silver maple (*Acer saccharinum*) AND >5% bur oak (*Quercus macrocarpa*). Dominant trees variable but include green ash (*Fraxinus pennsylvanica*), bur oak (*Q. macrocarpa*), basswood (*Tilia americana*), aspen (*Populus* spp.), box-elder (*Acer negundo*). ..... ***Fraxinus pennsylvanica* - *Celtis occidentalis* - *Tilia americana* - (*Quercus macrocarpa*) Forest [CEGL002081]**

WETLAND SHRUBLANDS

Tamarack (*Larix laricina*) >2 m tall should be considered trees for the purposes of using this key.

50A. >25% total canopy cover by tall, short, or dwarf-shrubs. 51
50B. <25% total canopy cover by tall, short, or dwarf-shrubs. 57

51A. >25% total canopy cover by tall and/or short shrubs (Shrublands). 52
51B. <25% total canopy cover by tall and/or short shrubs (Dwarf-shrublands). 56

52A. Shrub canopy >50% gray alder (*Alnus incana*), dogwood (*Cornus* spp.), willows (*Salix* spp. not including *Salix interior*), and/or spiraea (*Spiraea* spp.). 53
52B. Shrub canopy <50% gray alder (*Alnus incana*), dogwood (*Cornus* spp.), willows (*Salix* spp. not including *Salix interior*), and/or spiraea (*Spiraea* spp.). 54

53A. Shrub canopy >40% gray alder (*Alnus incana*). .....
***Alnus incana* Swamp Shrubland [CEGL002381]**
53B. Shrub canopy >50% dogwood (*Cornus* spp.), willows (*Salix* spp.), and/or spiraea (*Spiraea* spp.). .
***Cornus sericea* - *Salix* (*bebbiana*, *discolor*, *petiolaris*) / *Calamagrostis stricta* Shrubland [CEGL002187]**

54A. Shrub canopy >50% sandbar willow (*Salix interior*).....
***Salix interior* Temporarily Flooded Shrubland [CEGL008562]**
54B. Shrub canopy <50% sandbar willow (*Salix interior*)..... 55

55A. Shrub canopy >50% bog birch (*Betula pumila*).....
***Betula pumila* / *Chamaedaphne calyculata* / *Carex lasiocarpa* Shrubland [CEGL002494]**
55B. Shrub canopy >50% scrubby tamarack (*Larix laricina*); uncommon association expected only in northern portion of Namekagon River and upper Saint Croix River. .....
***Larix laricina* / *Chamaedaphne calyculata* / *Carex lasiocarpa* Shrubland [CEGL005226]**

56A. Sites on shorelines (shorefens), dense leatherleaf (*Chamaedaphne calyculata*) and/or sweetgale (*Myrica gale*) often with woollyfruit sedge (*Carex lasiocarpa*).....
***Chamaedaphne calyculata* - *Myrica gale* / *Carex lasiocarpa* Dwarf-shrubland [CEGL005228]**
56B. Sites not on shorelines. High cover of leatherleaf (*Chamaedaphne calyculata*) sometimes with sweetgale (*Myrica gale*) growing with sphagnum (*Sphagnum* spp.) mosses. .....
***Chamaedaphne calyculata* / *Carex oligosperma* / *Sphagnum* spp. Poor Fen Dwarf-shrubland [CEGL005277]**

WETLAND HERBACEOUS VEGETATION

57A. Total vegetation cover >10%. 58
57B. Total vegetation cover <10%. 73

58A. Seasonally flooded, semipermanently flooded, or saturated herbaceous wetland. 59
58B. Permanently or semipermanently flooded wetland with standing water generally >1 m deep..... 72

59A. Wetlands >50% by skunk-cabbage (*Symplocarpus foetidus*) muck soils, typically under a forest canopy. .....
***Symplocarpus foetidus* Herbaceous Vegetation [CEGL002385]**
59B. Wetlands <50% by skunk-cabbage (*Symplocarpus foetidus*), muck soils, typically under a forest canopy. 60

60A. Wetland >50% cover of cattails (*Typha* spp.), bulrushes (*Schoenoplectus* spp.), bur-reed (*Sparganium* spp.), sweetflag (*Acorus americana*), and/or rushes (*Juncus* spp.). 62
60B. Wetland <50% cover of cattails (*Typha* spp.), bulrushes (*Schoenoplectus* spp.), bur-reed (*Sparganium* spp.), and/or rushes (*Juncus* spp.). 61
60C. No strong dominants; sites on edges of wetland and show signs of disturbance (beavers, human-caused); sedges (*Carex* spp.), grasses, ferns, shrubs and small trees may all be present. .....
Wet Meadow Mixed Herbaceous Map Class [HWM]

61A. Herbaceous canopy >25% cattails (*Typha* spp.), bulrushes (*Schoenoplectus* spp.), bur-reed (*Sparganium* spp.), sweetflag (*Acorus americana*), and/or rushes (*Juncus* spp.) AND <25% sedges (*Carex* spp.). 62
61B. Herbaceous canopy <25% cattails (*Typha* spp.), bulrushes (*Schoenoplectus* spp.), bur-reed (*Sparganium* spp.), and/or rushes (*Juncus* spp.) OR >25% sedges (*Carex* spp.). 63

62A. Herbaceous canopy >80% cattails (*Typha* spp.); typically deep marshes with standing water through the growing season. .....
***Typha* spp. Midwest Herbaceous Vegetation [CEGL002233]**
62B. Herbaceous canopy <80% cattails (*Typha* spp.); typically shallow marshes which may dry up at times. .....
***Schoenoplectus tabernaemontani* - *Typha* spp. - (*Sparganium* spp., *Juncus* spp.) Herbaceous Vegetation [CEGL002026]**

63A. Herbaceous canopy >25% sedges (*Carex* spp.). 64
63B. Herbaceous canopy <25% sedges (*Carex* spp.). 67

64A. Fens on peat substrate; sphagnum (*Sphagnum* spp.) very abundant as groundcover. 65
64B. Not on peat substrate; sphagnum (*Sphagnum* spp.) may be common but not dominating the groundcover. 66

65A. Sites on shorelines of ponds, lakes, or streams; common sedges include wiregrass (*Carex lasiocarpa*), beaked sedge (*C. rostrata*), and shoreline sedge (*C. lacustris*). .....
***Carex lasiocarpa* - (*Carex rostrata*) - *Equisetum fluviatile* Herbaceous Vegetation [CEGL005229]**
65B. Sites not on shorelines; common sedges include wiregrass (*Carex lasiocarpa*), Northwest Territory sedge (*C. utriculata*), hairy sedge (*C. lacustris*), and fewseed sedge (*C. oligosperma*).....
***Carex lasiocarpa* - *Carex oligosperma* / *Sphagnum* spp. Herbaceous Vegetation [CEGL002265]**

66A. Wetland dominated by tussock sedge (*Carex stricta*). .....
***Carex stricta* - *Carex* ssp. Herbaceous Vegetation [CEGL002258]**

66B. Wetland primarily dominated by tall, wide-leaved sedges such as Tuckerman's sedge (*Carex tuckermanii*), beaked sedge (*C. rostrata*), Northwest Territory sedge (*C. utriculata*), and/or wool-grass (*Scirpus cyperinus*), and bulrush (*S. atrovirens*). .....
***Carex* (*rostrata*, *utriculata*) - *Carex lacustris* - (*Carex vesicaria*) Herbaceous Vegetation [CEGL002257]**

67A. Herbaceous canopy >80% common reed (*Phragmites australis*).....
***Phragmites australis* Eastern North America Temperate Semi-natural Herbaceous Vegetation [CEGL004141]**

67B. Herbaceous canopy <80% common reed (*Phragmites australis*)..... 68

68A. Herbaceous canopy >80% reed canary grass (*Phalaris arundinacea*). .....
***Phalaris arundinacea* Eastern Herbaceous Vegetation [CEGL006044]**

68B. Herbaceous canopy <80% reed canary grass (*Phalaris arundinacea*). 69

69A. Herbaceous canopy >50% wild rice (*Zizania aquatica*, *Z. palustris*).....
***Zizania* (*aquatica*, *palustris*) Herbaceous Vegetation [CEGL002382]**

69B. Herbaceous canopy <50% wild rice (*Zizania aquatica*, *Z. palustris*)..... 70

70A. Herbaceous canopy >50% bluejoint grass (*Calamagrostis canadensis*) and reed canary grass (*Phalaris arundinacea*).....
***Calamagrostis canadensis* - *Phalaris arundinacea* Herbaceous Vegetation [CEGL005174]**

70B. Herbaceous canopy <50% bluejoint grass (*Calamagrostis canadensis*) and reed canary grass (*Phalaris arundinacea*)..... 71

71A. Herbaceous canopy >50% prairie cordgrass (*Spartina pectinata*).....
***Spartina pectinata* - *Carex* spp. - *Calamagrostis canadensis* - *Lythrum alatum* - (*Oxypolis rigidior*) Herbaceous Vegetation Association [CEGL002224]**

71B. Herbaceous canopy >50% arrowhead (*Sagittaria latifolia*) and/or rice cutgrass (*Leersia oryzoides*).....
***Sagittaria latifolia* - *Leersia oryzoides* Herbaceous Vegetation [CEGL005240]**

72A. Pond or open water community dominated by floating aquatic macrophytes. .....
***Nuphar lutea* ssp. *advena* - *Nymphaea odorata* Herbaceous Vegetation [CEGL002386]**

72B. Pond or open water community dominated by submergent aquatic macrophytes. .....
***Potamogeton* spp. - *Ceratophyllum* spp. Midwest Herbaceous Vegetation [CEGL002282]**

SPARSE VEGETATION

73A. Site on unconsolidated substrates; sand or gravel. 74
73B. Sites on consolidated substrates. 75

74A. Cobble and gravel bars in and along river/streams. .....
Igneous - Metamorphic Cobble - Gravel River Shore Sparse Vegetation [CEGL002304]
74B. Sand bars in and along river/streams. .....
Riverine Sand Flats - Bars Sparse Vegetation [CEGL002049]

75A. Sites on igneous or metamorphic substrates, dry. .....
Igneous - Metamorphic Northern Dry Cliff Sparse Vegetation Association [CEGL002300]
75B. Sites on igneous or metamorphic substrates, dry. 76

76A. Sites on limestone, moist. .....
Limestone - Dolostone Midwest Moist Cliff Sparse Vegetation Association [CEGL002292]
76B. Sites on sandstone. 77

77A. Sites on dry sandstone substrate. .....
Sandstone Dry Cliff Sparse Vegetation Association [CEGL002045]
77B. Sites on moist sandstone substrates. .....
Sandstone Midwest Moist Cliff Sparse Vegetation Association [CEGL002287]

Appendix D: List of Plant Species

Explanation of the Species List

Plant taxa were identified and documented from vegetation sample plots and accuracy assessment sites collected for the Saint Croix National Scenic Riverway (SACN) vegetation mapping project. Plant taxa, along with other sample data, were entered into the National Park Service PLOTS Database Version 2 (NatureServe 2005) for subsequent analyses (plant community descriptions and map assessment). Table D-1 is an export of all plant taxa generated from the PLOTS Database for this project. Note that this list includes taxa identified to the genus, species, and sub-species level. This list is not intended to be comprehensive of every taxon at the SACN. The plant taxa list is organized alphabetically by scientific name. Nomenclature follows the PLANTS database (U.S. Department of Agriculture 2004).

Table D-1. Plant species list of Saint Croix National Scenic Riverway (Wisconsin/Minnesota).

Scientific Name	Common Name	Family
Abies	fir	Pinaceae
Abies balsamea	balsam fir	Pinaceae
Acalypha rhomboidea	Virginia threeseed mercury	Euphorbiaceae
Acer negundo	boxelder	Aceraceae
Acer rubrum	red maple	Aceraceae
Acer saccharinum	silver maple	Aceraceae
Acer saccharum	sugar maple	Aceraceae
Acer spicatum	mountain maple	Aceraceae
Achillea millefolium	common yarrow	Asteraceae
Acorus	sweetflag	Acoraceae
Acorus americanus	sweetflag	Acoraceae
Actaea	baneberry	Ranunculaceae
Actaea pachypoda	white baneberry	Ranunculaceae
Actaea rubra	red baneberry	Ranunculaceae
Adiantum	maidenhair fern	Pteridaceae
Adiantum pedatum	northern maidenhair	Pteridaceae
Aesculus	buckeye	Hippocastanaceae
Agastache foeniculum	blue giant hyssop	Lamiaceae
Agastache scrophulariifolia	purple giant hyssop	Lamiaceae
Ageratina altissima	white snakeroot	Asteraceae
Ageratina altissima var. *altissima*	white snakeroot	Asteraceae
Agrimonia gryposepala	tall hairy agrimony	Rosaceae
Agrostis gigantea	redtop	Poaceae
Agrostis hyemalis	winter bentgrass	Poaceae
Agrostis scabra	rough bentgrass	Poaceae
Alisma	water plantain	Alismataceae
Alisma plantago-aquatica	American waterplantain	Alismataceae
Alisma triviale	northern water plantain	Alismataceae
Alliaria petiolata	garlic mustard	Brassicaceae
Allium canadense	meadow garlic	Liliaceae
Allium tricoccum	wild leek	Liliaceae
Alnus	alder	Betulaceae
Alnus incana	speckled alder	Betulaceae
Alnus incana ssp. *rugosa*	speckled alder	Betulaceae
Alnus viridis	green alder	Betulaceae
Amaranthus	pigweed	Amaranthaceae
Amaranthus rudis	tall amaranth	Amaranthaceae

Scientific Name	Common Name	Family
Amaranthus tuberculatus	roughfruit amaranth	Amaranthaceae
Ambrosia artemisiifolia	annual ragweed	Asteraceae
Ambrosia psilostachya	Cuman ragweed	Asteraceae
Ambrosia trifida	great ragweed	Asteraceae
Amelanchier	serviceberry	Rosaceae
Amelanchier laevis	Allegheny serviceberry	Rosaceae
Amelanchier sanguinea	roundleaf serviceberry	Rosaceae
Amorpha canescens	leadplant	Fabaceae
Amorpha nana	dwarf false indigo	Fabaceae
Amphicarpaea bracteata	American hogpeanut	Fabaceae
Andromeda polifolia	bog rosemary	Ericaceae
Andromeda polifolia var. *glaucophylla*	bog rosemary	Ericaceae
Andropogon gerardii	big bluestem	Poaceae
Anemone	anemone	Ranunculaceae
Anemone canadensis	Canadian anemone	Ranunculaceae
Anemone cylindrica	candle anemone	Ranunculaceae
Anemone quinquefolia	nightcaps	Ranunculaceae
Anemone virginiana	tall thimbleweed	Ranunculaceae
Anemone virginiana var. *alba*	tall thimbleweed	Ranunculaceae
Angelica atropurpurea	purplestem angelica	Apiaceae
Antennaria	pussytoes	Asteraceae
Antennaria neglecta	field pussytoes	Asteraceae
Antennaria parlinii	Parlin's pussytoes	Asteraceae
Antennaria plantaginifolia	woman's tobacco	Asteraceae
Apios americana	groundnut	Fabaceae
Apocynum	dogbane	Apocynaceae
Apocynum androsaemifolium	spreading dogbane	Apocynaceae
Apocynum cannabinum	Indianhemp	Apocynaceae
Aquilegia	columbine	Ranunculaceae
Aquilegia canadensis	red columbine	Ranunculaceae
Arabis	rockcress	Brassicaceae
Arabis canadensis	sicklepod	Brassicaceae
Arabis lyrata	lyrate rockcress	Brassicaceae
Arabis nuttallii	Nuttall's rockcress	Brassicaceae
Aralia hispida	bristly sarsaparilla	Araliaceae
Aralia nudicaulis	wild sarsaparilla	Araliaceae
Aralia racemosa	American spikenard	Araliaceae
Archidium minus	small archidium moss	Archidiaceae
Arctium minus	lesser burrdock	Asteraceae
Arctostaphylos uva-ursi	kinnikinnick	Ericaceae
Arisaema	Jack in the pulpit	Araceae
Arisaema dracontium	green dragon	Araceae
Arisaema triphyllum	Jack in the pulpit	Araceae
Arisaema triphyllum ssp. *triphyllum*	Jack in the pulpit	Araceae
Aristida basiramea	forked threeawn	Poaceae
Aristida tuberculosa	seaside threeawn	Poaceae
Artemisia	sagebrush	Asteraceae
Artemisia campestris	field sagewort	Asteraceae
Artemisia ludoviciana	white sagebrush	Asteraceae
Artemisia serrata	sawtooth wormwood	Asteraceae

Scientific Name	Common Name	Family
Asarum canadense	Canadian wildginger	Aristolochiaceae
Asclepias	milkweed	Asclepiadaceae
Asclepias exaltata	poke milkweed	Asclepiadaceae
Asclepias incarnata	swamp milkweed	Asclepiadaceae
Asclepias speciosa	showy milkweed	Asclepiadaceae
Asclepias syriaca	common milkweed	Asclepiadaceae
Asclepias tuberosa	butterfly milkweed	Asclepiadaceae
Asclepias viridiflora	green comet milkweed	Asclepiadaceae
Asplenium rhizophyllum	walking fern	Aspleniaceae
Aster	aster	Asteraceae
Athyrium filix-femina	common ladyfern	Dryopteridaceae
Athyrium filix-femina ssp. *angustum*	subarctic ladyfern	Dryopteridaceae
Atrichum	atrichum moss	Polytrichaceae
Avena fatua	wild oat	Poaceae
Barbarea vulgaris	garden yellowrocket	Brassicaceae
Berteroa incana	hoary false madwort	Brassicaceae
Berula erecta	cutleaf waterparsnip	Apiaceae
Betula	birch	Betulaceae
Betula alleghaniensis	yellow birch	Betulaceae
Betula nana	dwarf birch	Betulaceae
Betula papyrifera	paper birch	Betulaceae
Betula pumila	bog birch	Betulaceae
Betula pumila var. *glandulifera*	bog birch	Betulaceae
Bidens	beggarticks	Asteraceae
Bidens cernua	nodding beggartick	Asteraceae
Bidens connata	purplestem beggarticks	Asteraceae
Bidens coronata	crowned beggarticks	Asteraceae
Bidens frondosa	devil's beggartick	Asteraceae
Bidens tripartita	threelobe beggarticks	Asteraceae
Blephilia ciliata	downy pagoda-plant	Lamiaceae
Blephilia hirsuta	hairy pagoda-plant	Lamiaceae
Boehmeria cylindrica	smallspike false nettle	Urticaceae
Botrychium dissectum	cutleaf grapefern	Ophioglossaceae
Botrychium multifidum	leathery grapefern	Ophioglossaceae
Botrychium virginianum	rattlesnake fern	Ophioglossaceae
Bouteloua	grama	Poaceae
Bouteloua curtipendula	sideoats grama	Poaceae
Brachyelytrum erectum	bearded shorthusk	Poaceae
Brasenia schreberi	watershield	Cabombaceae
Brassica	mustard	Brassicaceae
Bromus	brome	Poaceae
Bromus ciliatus	fringed brome	Poaceae
Bromus inermis	smooth brome	Poaceae
Bromus kalmii	arctic brome	Poaceae
Bromus latiglumis	earlyleaf brome	Poaceae
Bromus pubescens	hairy woodland brome	Poaceae
Bromus secalinus	rye brome	Poaceae
Bryum	bryum moss	Bryaceae
Calamagrostis canadensis	bluejoint	Poaceae
Calamovilfa longifolia	prairie sandreed	Poaceae

Scientific Name	Common Name	Family
Calla palustris	water arum	Araceae
Calophyllum	calophyllum	Clusiaceae
Caltha	marsh marigold	Ranunculaceae
Caltha palustris	yellow marsh marigold	Ranunculaceae
Calystegia sepium	hedge false bindweed	Convolvulaceae
Calystegia sepium ssp. *sepium*	hedge false bindweed	Convolvulaceae
Calystegia spithamaea	low false bindweed	Convolvulaceae
Calystegia spithamaea ssp. *spithamaea*	low false bindweed	Convolvulaceae
Campanula	bellflower	Campanulaceae
Campanula aparinoides	marsh bellflower	Campanulaceae
Campanula rotundifolia	bluebell bellflower	Campanulaceae
Cardamine	bittercress	Brassicaceae
Cardamine oligosperma	little western bittercress	Brassicaceae
Cardamine pensylvanica	Pennsylvania bittercress	Brassicaceae
Carex	sedge	Cyperaceae
Carex amphibola	eastern narrowleaf sedge	Cyperaceae
Carex aquatilis	water sedge	Cyperaceae
Carex arctata	drooping woodland sedge	Cyperaceae
Carex backii	Back's sedge	Cyperaceae
Carex bebbii	Bebb's sedge	Cyperaceae
Carex bicknellii	Bicknell's sedge	Cyperaceae
Carex blanda	eastern woodland sedge	Cyperaceae
Carex bromoides	bromelike sedge	Cyperaceae
Carex brunnescens	brownish sedge	Cyperaceae
Carex buxbaumii	Buxbaum's sedge	Cyperaceae
Carex canescens	silvery sedge	Cyperaceae
Carex cephaloidea	thinleaf sedge	Cyperaceae
Carex chordorrhiza	creeping sedge	Cyperaceae
Carex communis	fibrousroot sedge	Cyperaceae
Carex comosa	longhair sedge	Cyperaceae
Carex crinita	fringed sedge	Cyperaceae
Carex cristatella	crested sedge	Cyperaceae
Carex deweyana	Dewey sedge	Cyperaceae
Carex disperma	softleaf sedge	Cyperaceae
Carex ebenea	ebony sedge	Cyperaceae
Carex eburnea	bristleleaf sedge	Cyperaceae
Carex echinata	star sedge	Cyperaceae
Carex emoryi	Emory's sedge	Cyperaceae
Carex foenea	dryspike sedge	Cyperaceae
Carex foenea var. *foenea*	dryspike sedge	Cyperaceae
Carex gracilescens	slender looseflower sedge	Cyperaceae
Carex gracillima	graceful sedge	Cyperaceae
Carex gynandra	nodding sedge	Cyperaceae
Carex haydenii	Hayden's sedge	Cyperaceae
Carex hirtifolia	pubescent sedge	Cyperaceae
Carex hystericina	bottlebrush sedge	Cyperaceae
Carex inops ssp. *heliophila*	sun sedge	Cyperaceae
Carex interior	inland sedge	Cyperaceae
Carex intumescens	greater bladder sedge	Cyperaceae
Carex lacustris	hairy sedge	Cyperaceae

Scientific Name	Common Name	Family
Carex lasiocarpa	woollyfruit sedge	Cyperaceae
Carex leptalea	bristlystalked sedge	Cyperaceae
Carex lupuliformis	false hop sedge	Cyperaceae
Carex lupulina	hop sedge	Cyperaceae
Carex magellanica	boreal bog sedge	Cyperaceae
Carex magellanica ssp. *irrigua*	boreal bog sedge	Cyperaceae
Carex normalis	greater straw sedge	Cyperaceae
Carex oligocarpa	richwoods sedge	Cyperaceae
Carex oligosperma	fewseed sedge	Cyperaceae
Carex ovalis	eggbract sedge	Cyperaceae
Carex pauciflora	fewflower sedge	Cyperaceae
Carex peckii	Peck's sedge	Cyperaceae
Carex pedunculata	longstalk sedge	Cyperaceae
Carex pensylvanica	Pennsylvania sedge	Cyperaceae
Carex pseudocyperus	cypresslike sedge	Cyperaceae
Carex radiata	eastern star sedge	Cyperaceae
Carex retrorsa	knotsheath sedge	Cyperaceae
Carex rosea	rosy sedge	Cyperaceae
Carex rostrata	beaked sedge	Cyperaceae
Carex scoparia	broom sedge	Cyperaceae
Carex sparganioides	burr reed sedge	Cyperaceae
Carex sprengelii	Sprengel's sedge	Cyperaceae
Carex stipata	owlfruit sedge	Cyperaceae
Carex striata	Walter's sedge	Cyperaceae
Carex stricta	upright sedge	Cyperaceae
Carex tenera	quill sedge	Cyperaceae
Carex tribuloides	blunt broom sedge	Cyperaceae
Carex trisperma	threeseeded sedge	Cyperaceae
Carex tuckermanii	Tuckerman's sedge	Cyperaceae
Carex typhina	cattail sedge	Cyperaceae
Carex umbellata	parasol sedge	Cyperaceae
Carex utriculata	Northwest Territory sedge	Cyperaceae
Carex vesicaria	blister sedge	Cyperaceae
Carpinus caroliniana	American hornbeam	Betulaceae
Carya	hickory	Juglandaceae
Carya cordiformis	bitternut hickory	Juglandaceae
Carya glabra	pignut hickory	Juglandaceae
Carya ovata	shagbark hickory	Juglandaceae
Caulophyllum thalictroides	blue cohosh	Berberidaceae
Ceanothus	ceanothus	Rhamnaceae
Ceanothus americanus	New Jersey tea	Rhamnaceae
Celastrus scandens	American bittersweet	Celastraceae
Celtis occidentalis	common hackberry	Ulmaceae
Centaurea biebersteinii	spotted knapweed	Asteraceae
Cerastium fontanum ssp. *vulgare*	big chickweed	Caryophyllaceae
Ceratodon	ceratodon moss	Ditrichaceae
Ceratophyllum	hornwort	Ceratophyllaceae
Ceratophyllum demersum	coon's tail	Ceratophyllaceae
Chamaedaphne calyculata	leatherleaf	Ericaceae
Chamaesyce glyptosperma	ribseed sandmat	Euphorbiaceae

Scientific Name	Common Name	Family
Chamaesyce maculata	spotted sandmat	Euphorbiaceae
Check data sheet	lamiastrum	Lamiaceae
Chelone glabra	white turtlehead	Scrophulariaceae
Chenopodium album	lambsquarters	Chenopodiaceae
Chenopodium leptophyllum	narrowleaf goosefoot	Chenopodiaceae
Chimaphila umbellata	pipsissewa	Pyrolaceae
Chrysosplenium americanum	American golden saxifrage	Saxifragaceae
Cicuta bulbifera	bulblet-bearing water hemlock	Apiaceae
Cicuta maculata	spotted water hemlock	Apiaceae
Cinna	woodreed	Poaceae
Cinna arundinacea	sweet woodreed	Poaceae
Cinna latifolia	drooping woodreed	Poaceae
Circaea alpina	small enchanter's nightshade	Onagraceae
Circaea lutetiana	broadleaf enchanter's nightshade	Onagraceae
Circaea lutetiana ssp. *canadensis*	broadleaf enchanter's nightshade	Onagraceae
Cirsium	thistle	Asteraceae
Cirsium arvense	Canada thistle	Asteraceae
Cirsium discolor	field thistle	Asteraceae
Cirsium muticum	swamp thistle	Asteraceae
Cladonia	cup lichen	Cladoniaceae
Claytonia virginica	Hammond's claytonia	Portulacaceae
Clematis	leather flower	Ranunculaceae
Clematis virginiana	devil's darning needles	Ranunculaceae
Climacium	climacium moss	Climaciaceae
Clintonia	bluebead	Liliaceae
Clintonia borealis	bluebead	Liliaceae
Comandra umbellata	bastard toadflax	Santalaceae
Comarum palustre	purple marshlocks	Rosaceae
Comptonia peregrina	sweet fern	Myricaceae
Convolvulus arvensis	field bindweed	Convolvulaceae
Conyza canadensis	Canadian horseweed	Asteraceae
Conyza canadensis var. *pusilla*	Canadian horseweed	Asteraceae
Coptis trifolia	threeleaf goldthread	Ranunculaceae
Coreopsis	tickseed	Asteraceae
Coreopsis palmata	stiff tickseed	Asteraceae
Cornus	dogwood	Cornaceae
Cornus alternifolia	alternateleaf dogwood	Cornaceae
Cornus amomum	silky dogwood	Cornaceae
Cornus canadensis	bunchberry dogwood	Cornaceae
Cornus florida	flowering dogwood	Cornaceae
Cornus foemina	stiff dogwood	Cornaceae
Cornus racemosa	gray dogwood	Cornaceae
Cornus rugosa	roundleaf dogwood	Cornaceae
Cornus sericea	redosier dogwood	Cornaceae
Cornus sericea ssp. *sericea*	redosier dogwood	Cornaceae
Corydalis sempervirens	rock harlequin	Fumariaceae
Corylus	hazelnut	Betulaceae
Corylus americana	American hazelnut	Betulaceae
Corylus cornuta	beaked hazelnut	Betulaceae
Crataegus	hawthorn	Rosaceae

Scientific Name	Common Name	Family
Crataegus calpodendron	pear hawthorn	Rosaceae
Crataegus chrysocarpa	fireberry hawthorn	Rosaceae
Crataegus crus-galli	cockspur hawthorn	Rosaceae
Crataegus macrosperma	bigfruit hawthorn	Rosaceae
Crataegus monogyna	oneseed hawthorn	Rosaceae
Crataegus punctata	dotted hawthorn	Rosaceae
Crataegus succulenta	fleshy hawthorn	Rosaceae
Crepis tectorum	narrowleaf hawksbeard	Asteraceae
Cryptotaenia canadensis	Canadian honewort	Apiaceae
Cuscuta	dodder	Cuscutaceae
Cuscuta gronovii	scaldweed	Cuscutaceae
Cyperus	flatsedge	Cyperaceae
Cyperus bipartitus	slender flatsedge	Cyperaceae
Cyperus diandrus	umbrella flatsedge	Cyperaceae
Cyperus erythrorhizos	redroot flatsedge	Cyperaceae
Cyperus lupulinus	Great Plains flatsedge	Cyperaceae
Cyperus lupulinus ssp. *lupulinus*	Great Plains flatsedge	Cyperaceae
Cyperus odoratus	fragrant flatsedge	Cyperaceae
Cyperus schweinitzii	Schweinitz's flatsedge	Cyperaceae
Cyperus squarrosus	bearded flatsedge	Cyperaceae
Cyperus strigosus	strawcolored flatsedge	Cyperaceae
Cypripedium acaule	moccasin flower	Orchidaceae
Cypripedium parviflorum	lesser yellow lady's slipper	Orchidaceae
Cypripedium pubescens var. *pubescens*	greater yellow lady's slipper	Orchidaceae
Cypripedium reginae	showy lady's slipper	Orchidaceae
Cystopteris bulbifera	bulblet bladderfern	Dryopteridaceae
Cystopteris fragilis	brittle bladderfern	Dryopteridaceae
Dactylis glomerata	orchardgrass	Poaceae
Dalea purpurea	violet prairie clover	Fabaceae
Dalea purpurea var. *purpurea*	violet prairie clover	Fabaceae
Danthonia spicata	poverty oatgrass	Poaceae
Daucus carota	Queen Anne's lace	Apiaceae
Delphinium carolinianum ssp. *virescens*	Carolina larkspur	Ranunculaceae
Dennstaedtia punctilobula	eastern hayscented fern	Dennstaedtiaceae
Desmodium	ticktrefoil	Fabaceae
Desmodium canadense	showy ticktrefoil	Fabaceae
Desmodium glutinosum	pointedleaf ticktrefoil	Fabaceae
Desmodium nudiflorum	nakedflower ticktrefoil	Fabaceae
Dichanthelium acuminatum	tapered rosette grass	Poaceae
Dichanthelium acuminatum var. *fasciculatum*	western panicgrass	Poaceae
Dichanthelium leibergii	Leiberg's panicum	Poaceae
Dichanthelium linearifolium	slimleaf panicgrass	Poaceae
Dichanthelium oligosanthes var. *oligosanthes*	Heller's rosette grass	Poaceae
Dichanthelium ovale var. *addisonii*	Addison's rosette grass	Poaceae
Dichanthelium xanthophysum	slender rosette grass	Poaceae
Dicranum	dicranum moss	Dicranaceae
Diervilla	bush honeysuckle	Caprifoliaceae
Diervilla lonicera	northern bush honeysuckle	Caprifoliaceae
Dioscorea villosa	wild yam	Dioscoreaceae
Dirca palustris	eastern leatherwood	Thymelaeaceae

Scientific Name	Common Name	Family
Doellingeria umbellata	parasol whitetop	Asteraceae
Doellingeria umbellata var. *umbellata*	parasol whitetop	Asteraceae
Draba reptans	Carolina draba	Brassicaceae
Drosera	sundew	Droseraceae
Drosera rotundifolia	roundleaf sundew	Droseraceae
Dryopteris	woodfern	Dryopteridaceae
Dryopteris carthusiana	spinulose woodfern	Dryopteridaceae
Dryopteris clintoniana	Clinton's woodfern	Dryopteridaceae
Dryopteris crinalis	serpent woodfern	Dryopteridaceae
Dryopteris cristata	crested woodfern	Dryopteridaceae
Dryopteris expansa	spreading woodfern	Dryopteridaceae
Dryopteris filix-mas	male fern	Dryopteridaceae
Dryopteris intermedia	intermediate woodfern	Dryopteridaceae
Dryopteris marginalis	marginal woodfern	Dryopteridaceae
Duchesnea indica	Indian strawberry	Rosaceae
Dulichium arundinaceum	threeway sedge	Cyperaceae
Echinochloa muricata	rough barnyardgrass	Poaceae
Echinochloa muricata var. *muricata*	rough barnyardgrass	Poaceae
Echinochloa walteri	coast cockspur grass	Poaceae
Eleocharis	spikerush	Cyperaceae
Eleocharis acicularis	needle spikerush	Cyperaceae
Eleocharis olivacea var. *olivacea*	bright green spikerush	Cyperaceae
Eleocharis ovata	ovate spikerush	Cyperaceae
Eleocharis palustris	common spikerush	Cyperaceae
Elodea	waterweed	Hydrocharitaceae
Elodea canadensis	Canadian waterweed	Hydrocharitaceae
Elymus	wildrye	Poaceae
Elymus canadensis	Canada wildrye	Poaceae
Elymus hystrix	eastern bottlebrush grass	Poaceae
Elymus hystrix var. *hystrix*	eastern bottlebrush grass	Poaceae
Elymus repens	quackgrass	Poaceae
Elymus trachycaulus	slender wheatgrass	Poaceae
Elymus trachycaulus ssp. *trachycaulus*	slender wheatgrass	Poaceae
Elymus villosus	hairy wildrye	Poaceae
Elymus virginicus	Virginia wildrye	Poaceae
Enemion biternatum	eastern false rue anemone	Ranunculaceae
Epilobium	willowherb	Onagraceae
Epilobium ciliatum	fringed willowherb	Onagraceae
Epilobium coloratum	purpleleaf willowherb	Onagraceae
Epilobium leptophyllum	bog willowherb	Onagraceae
Equisetum	horsetail	Equisetaceae
Equisetum arvense	field horsetail	Equisetaceae
Equisetum fluviatile	water horsetail	Equisetaceae
Equisetum hyemale	scouringrush horsetail	Equisetaceae
Equisetum laevigatum	smooth horsetail	Equisetaceae
Equisetum palustre	marsh horsetail	Equisetaceae
Equisetum pratense	meadow horsetail	Equisetaceae
Equisetum scirpoides	dwarf scouringrush	Equisetaceae
Equisetum sylvaticum	woodland horsetail	Equisetaceae
Eragrostis cilianensis	stinkgrass	Poaceae

Scientific Name	Common Name	Family
Eragrostis hypnoides	teal lovegrass	Poaceae
Eragrostis spectabilis	purple lovegrass	Poaceae
Erechtites hieraciifolia	American burnweed	Asteraceae
Erigeron	fleabane	Asteraceae
Erigeron annuus	eastern daisy fleabane	Asteraceae
Erigeron philadelphicus	Philadelphia fleabane	Asteraceae
Erigeron strigosus	prairie fleabane	Asteraceae
Eriophorum	cottongrass	Cyperaceae
Eriophorum vaginatum	tussock cottongrass	Cyperaceae
Eriophorum vaginatum var. *spissum*	tussock cottongrass	Cyperaceae
Eriophorum virginicum	tawny cottongrass	Cyperaceae
Erythronium albidum	white fawnlily	Liliaceae
Euonymus atropurpurea	eastern wahoo	Celastraceae
Eupatorium	thoroughwort	Asteraceae
Eupatorium album	white thoroughwort	Asteraceae
Eupatorium maculatum	spotted joepyeweed	Asteraceae
Eupatorium perfoliatum	common boneset	Asteraceae
Eupatorium purpureum	sweetscented joepyeweed	Asteraceae
Eupatorium serotinum	lateflowering thoroughwort	Asteraceae
Euphorbia	spurge	Euphorbiaceae
Euphorbia corollata	flowering spurge	Euphorbiaceae
Euphorbia cyparissias	cypress spurge	Euphorbiaceae
Eurybia macrophylla	bigleaf aster	Asteraceae
Eurybia radula	low rough aster	Asteraceae
Euthamia graminifolia	flat-top goldentop	Asteraceae
Euthamia graminifolia var. *graminifolia*	flat-top goldentop	Asteraceae
Festuca	fescue	Poaceae
Festuca occidentalis	western fescue	Poaceae
Festuca subverticillata	nodding fescue	Poaceae
Festuca trachyphylla	hard fescue	Poaceae
Fragaria	strawberry	Rosaceae
Fragaria vesca	woodland strawberry	Rosaceae
Fragaria virginiana	Virginia strawberry	Rosaceae
Frangula alnus	glossy buckthorn	Rhamnaceae
Fraxinus	ash	Oleaceae
Fraxinus americana	white ash	Oleaceae
Fraxinus nigra	black ash	Oleaceae
Fraxinus pennsylvanica	green ash	Oleaceae
Fraxinus quadrangulata	blue ash	Oleaceae
Galearis spectabilis	showy orchid	Orchidaceae
Galeopsis tetrahit	brittlestem hempnettle	Lamiaceae
Galium	bedstraw	Rubiaceae
Galium aparine	stickywilly	Rubiaceae
Galium asprellum	rough bedstraw	Rubiaceae
Galium boreale	licorice bedstraw	Rubiaceae
Galium boreale	northern bedstraw	Rubiaceae
Galium circaezans var. *circaezans*	licorice bedstraw	Rubiaceae
Galium concinnum	shining bedstraw	Rubiaceae
Galium labradoricum	northern bog bedstraw	Rubiaceae
Galium mexicanum ssp. *asperrimum*	Mexican bedstraw	Rubiaceae

Scientific Name	Common Name	Family
Galium obtusum	bluntleaf bedstraw	Rubiaceae
Galium palustre	common marsh bedstraw	Rubiaceae
Galium tinctorium	stiff marsh bedstraw	Rubiaceae
Galium trifidum	threepetal bedstraw	Rubiaceae
Galium triflorum	fragrant bedstraw	Rubiaceae
Gaultheria hispidula	creeping snowberry	Ericaceae
Gaultheria procumbens	eastern teaberry	Ericaceae
Gaylussacia baccata	black huckleberry	Ericaceae
Gentiana	gentian	Gentianaceae
Gentiana andrewsii	closed bottle gentian	Gentianaceae
Geranium	geranium	Geraniaceae
Geranium maculatum	spotted geranium	Geraniaceae
Geum	avens	Rosaceae
Geum aleppicum	yellow avens	Rosaceae
Geum canadense	white avens	Rosaceae
Geum macrophyllum	largeleaf avens	Rosaceae
Geum rivale	purple avens	Rosaceae
Glechoma hederacea	ground ivy	Lamiaceae
Gleditsia triacanthos	honeylocust	Fabaceae
Glyceria borealis	small floating mannagrass	Poaceae
Glyceria canadensis	rattlesnake mannagrass	Poaceae
Glyceria grandis	American mannagrass	Poaceae
Glyceria striata	fowl mannagrass	Poaceae
Goodyera	rattlesnake plantain	Orchidaceae
Goodyera pubescens	downy rattlesnake plantain	Orchidaceae
Goodyera tesselata	checkered rattlesnake plantain	Orchidaceae
Gratiola neglecta	clammy hedgehyssop	Scrophulariaceae
Gymnocarpium dryopteris	western oakfern	Dryopteridaceae
Hackelia	stickseed	Boraginaceae
Hedeoma hispida	rough false pennyroyal	Lamiaceae
Helenium autumnale	common sneezeweed	Asteraceae
Helianthemum bicknellii	hoary frostweed	Cistaceae
Helianthemum canadense	longbranch frostweed	Cistaceae
Helianthus	sunflower	Asteraceae
Helianthus divaricatus	woodland sunflower	Asteraceae
Helianthus giganteus	giant sunflower	Asteraceae
Helianthus hirsutus	hairy sunflower	Asteraceae
Helianthus pauciflorus ssp. *pauciflorus*	stiff sunflower	Asteraceae
Helianthus strumosus	paleleaf woodland sunflower	Asteraceae
Heliopsis helianthoides	smooth oxeye	Asteraceae
Hemerocallis fulva	orange daylily	Liliaceae
Hepatica	hepatica	Ranunculaceae
Hepatica nobilis	hepatica	Ranunculaceae
Hepatica nobilis var. *acuta*	sharplobe hepatica	Ranunculaceae
Hepatica nobilis var. *obtusa*	roundlobe hepatica	Ranunculaceae
Heracleum maximum	common cowparsnip	Apiaceae
Hesperis matronalis	dames rocket	Brassicaceae
Hesperostipa spartea	porcupinegrass	Poaceae
Heteranthera dubia	grassleaf mudplantain	Pontederiaceae
Heuchera richardsonii	Richardson's alumroot	Saxifragaceae

Scientific Name	Common Name	Family
Hieracium	hawkweed	Asteraceae
Hieracium aurantiacum	orange hawkweed	Asteraceae
Hieracium caespitosum	meadow hawkweed	Asteraceae
Hieracium kalmii	Kalm's hawkweed	Asteraceae
Hieracium longipilum	hairy hawkweed	Asteraceae
Hieracium paniculatum	Allegheny hawkweed	Asteraceae
Hieracium umbellatum	narrowleaf hawkweed	Asteraceae
Houstonia longifolia	longleaf summer bluet	Rubiaceae
Humulus lupulus	common hop	Cannabaceae
Huperzia lucidula	shining clubmoss	Lycopodiaceae
Hydrocotyle americana	American marshpennywort	Apiaceae
Hydrophyllum	waterleaf	Hydrophyllaceae
Hydrophyllum virginianum	Shawnee salad	Hydrophyllaceae
Hylocomium	hylocomium feather moss	Hylocomiaceae
Hypericum	St. Johnswort	Clusiaceae
Hypericum ascyron	great St. Johnswort	Clusiaceae
Hypericum majus	large St. Johnswort	Clusiaceae
Hypericum mutilum	dwarf St. Johnswort	Clusiaceae
Hypericum perforatum	common St. Johnswort	Clusiaceae
Ilex	holly	Aquifoliaceae
Ilex verticillata	common winterberry	Aquifoliaceae
Impatiens	touch-me-not	Balsaminaceae
Impatiens capensis	jewelweed	Balsaminaceae
Impatiens pallida	pale touch-me-not	Balsaminaceae
Iris	iris	Iridaceae
Iris pseudacorus	paleyellow iris	Iridaceae
Iris versicolor	harlequin blueflag	Iridaceae
Iva xanthifolia	giant sumpweed	Asteraceae
Juglans cinerea	butternut	Juglandaceae
Juglans nigra	black walnut	Juglandaceae
Juncus	rush	Juncaceae
Juncus balticus	Baltic rush	Juncaceae
Juncus effusus	common rush	Juncaceae
Juncus nodosus	knotted rush	Juncaceae
Juncus tenuis	poverty rush	Juncaceae
Juniperus communis	common juniper	Cupressaceae
Juniperus virginiana	eastern redcedar	Cupressaceae
Kalmia polifolia	bog laurel	Ericaceae
Koeleria macrantha	prairie Junegrass	Poaceae
Lactuca	lettuce	Asteraceae
Lactuca biennis	tall blue lettuce	Asteraceae
Lactuca canadensis	Canada lettuce	Asteraceae
Lactuca serriola	prickly lettuce	Asteraceae
Laportea	laportea	Urticaceae
Laportea canadensis	Canadian woodnettle	Urticaceae
Larix laricina	tamarack	Pinaceae
Lathyrus	pea	Fabaceae
Lathyrus ochroleucus	cream pea	Fabaceae
Lathyrus palustris	marsh pea	Fabaceae
Lathyrus venosus	veiny pea	Fabaceae

Scientific Name	Common Name	Family
Lechea	pinweed	Cistaceae
Lechea minor	thymeleaf pinweed	Cistaceae
Lechea stricta	prairie pinweed	Cistaceae
Ledum groenlandicum	bog Labrador tea	Ericaceae
Leersia	cutgrass	Poaceae
Leersia oryzoides	rice cutgrass	Poaceae
Leersia virginica	whitegrass	Poaceae
Lemna	duckweed	Lemnaceae
Lemna minor	common duckweed	Lemnaceae
Lemna minuta	least duckweed	Lemnaceae
Leonurus	motherwort	Lamiaceae
Leonurus cardiaca	common motherwort	Lamiaceae
Lespedeza capitata	roundhead lespedeza	Fabaceae
Leucanthemum vulgare	oxeye daisy	Asteraceae
Leucobryum glaucum	leucobryum moss	Leucobryaceae
Liatris	blazing star	Asteraceae
Liatris aspera	tall blazing star	Asteraceae
Lichenochora	lichenochora	Phyllachoraceae
Lilium	lily	Liliaceae
Lilium lancifolium	tiger lily	Liliaceae
Lilium michiganense	Michigan lily	Liliaceae
Linaria vulgaris	butter and eggs	Scrophulariaceae
Lindernia dubia	yellowseed false pimpernel	Scrophulariaceae
Linnaea borealis	twinflower	Caprifoliaceae
Lipocarpha micrantha	smallflower halfchaff sedge	Cyperaceae
Lithospermum	stoneseed	Boraginaceae
Lithospermum canescens	hoary puccoon	Boraginaceae
Lithospermum caroliniense	Carolina puccoon	Boraginaceae
Lithospermum caroliniense var. *caroliniense*	Carolina puccoon	Boraginaceae
Lobelia	lobelia	Campanulaceae
Lobelia cardinalis	cardinalflower	Campanulaceae
Lobelia siphilitica	great blue lobelia	Campanulaceae
Lonicera	honeysuckle	Caprifoliaceae
Lonicera canadensis	American fly honeysuckle	Caprifoliaceae
Lonicera dioica	limber honeysuckle	Caprifoliaceae
Lonicera hirsuta	hairy honeysuckle	Caprifoliaceae
Lonicera japonica	Japanese honeysuckle	Caprifoliaceae
Lonicera morrowii	Morrow's honeysuckle	Caprifoliaceae
Lonicera tatarica	Tatarian honeysuckle	Caprifoliaceae
Lonicera villosa	mountain fly honeysuckle	Caprifoliaceae
Lonicera xylosteum	dwarf honeysuckle	Caprifoliaceae
Lotus corniculatus	birdfoot deervetch	Fabaceae
Ludwigia	primrose-willow	Onagraceae
Ludwigia palustris	marsh seedbox	Onagraceae
Lupinus perennis	sundial lupine	Fabaceae
Luzula acuminata	hairy woodrush	Juncaceae
Luzula acuminata var. *acuminata*	hairy woodrush	Juncaceae
Luzula campestris	field woodrush	Juncaceae
Luzula multiflora	common woodrush	Juncaceae
Lycopodium	clubmoss	Lycopodiaceae

Scientific Name	Common Name	Family
Lycopodium annotinum	stiff clubmoss	Lycopodiaceae
Lycopodium clavatum	running clubmoss	Lycopodiaceae
Lycopodium complanatum	groundcedar	Lycopodiaceae
Lycopodium dendroideum	tree groundpine	Lycopodiaceae
Lycopodium digitatum	fan clubmoss	Lycopodiaceae
Lycopodium obscurum	rare clubmoss	Lycopodiaceae
Lycopodium sabinifolium	savinleaf groundpine	Lycopodiaceae
Lycopus	waterhorehound	Lamiaceae
Lycopus americanus	American water horehound	Lamiaceae
Lycopus uniflorus	northern bugleweed	Lamiaceae
Lycopus virginicus	Virginia water horehound	Lamiaceae
Lysimachia	yellow loosestrife	Primulaceae
Lysimachia ciliata	fringed loosestrife	Primulaceae
Lysimachia nummularia	creeping jenny	Primulaceae
Lysimachia quadriflora	fourflower yellow loosestrife	Primulaceae
Lysimachia quadrifolia	whorled yellow loosestrife	Primulaceae
Lysimachia terrestris	earth loosestrife	Primulaceae
Lysimachia thyrsiflora	tufted loosestrife	Primulaceae
Lythrum salicaria	purple loosestrife	Lythraceae
Mahonia repens	creeping barberry	Berberidaceae
Maianthemum	mayflower	Liliaceae
Maianthemum canadense	Canada mayflower	Liliaceae
Maianthemum racemosum	feathery false lily of the vally	Liliaceae
Maianthemum racemosum ssp. *racemosum*	feathery false lily of the vally	Liliaceae
Maianthemum stellatum	starry false lily of the vally	Liliaceae
Maianthemum trifolium	threeleaf false lily of the vally	Liliaceae
Malus pumila	paradise apple	Rosaceae
Matteuccia struthiopteris	ostrich fern	Dryopteridaceae
Medicago lupulina	black medick	Fabaceae
Medicago sativa	alfalfa	Fabaceae
Melampyrum lineare	narrowleaf cowwheat	Scrophulariaceae
Menispermum canadense	common moonseed	Menispermaceae
Mentha aquatica	water mint	Lamiaceae
Mentha arvensis	wild mint	Lamiaceae
Menyanthes trifoliata	buckbean	Menyanthaceae
Milium effusum	American milletgrass	Poaceae
Mimulus ringens	Allegheny monkeyflower	Scrophulariaceae
Mitchella repens	partridgeberry	Rubiaceae
Mitella diphylla	twoleaf miterwort	Saxifragaceae
Mitella nuda	naked miterwort	Saxifragaceae
Mnium	mnium calcareous moss	Mniaceae
Moehringia lateriflora	bluntleaf sandwort	Caryophyllaceae
Mollugo verticillata	green carpetweed	Molluginaceae
Monarda didyma	scarlet beebalm	Lamiaceae
Monarda fistulosa	wild bergamot	Lamiaceae
Moneses uniflora	single delight	Pyrolaceae
Morus alba	white mulberry	Moraceae
Muhlenbergia	muhly	Poaceae
Muhlenbergia frondosa	wirestem muhly	Poaceae
Muhlenbergia glomerata	spiked muhly	Poaceae

Scientific Name	Common Name	Family
Myosotis scorpioides	true forget-me-not	Boraginaceae
Myosoton aquaticum	giantchickweed	Caryophyllaceae
Myrica gale	sweetgale	Myricaceae
Myriophyllum	watermilfoil	Haloragaceae
Myriophyllum sibiricum	shortspike watermilfoil	Haloragaceae
Myriophyllum spicatum	spike watermilfoil	Haloragaceae
Najas	waternymph	Najadaceae
Nemopanthus mucronatus	catberry	Aquifoliaceae
Nuphar	pond-lily	Nymphaeaceae
Nuphar lutea	yellow pond-lily	Nymphaeaceae
Nuphar lutea ssp. *variegata*	varigated yellow pond-lily	Nymphaeaceae
Nymphaea	waterlily	Nymphaeaceae
Nymphaea odorata	American white waterlily	Nymphaeaceae
Nymphaea odorata ssp. *tuberosa*	American white waterlily	Nymphaeaceae
Oenothera biennis	common evening-primrose	Onagraceae
Oligoneuron rigidum	stiff goldenrod	Asteraceae
Oligoneuron rigidum var. *humile*	stiff goldenrod	Asteraceae
Onoclea sensibilis	sensitive fern	Dryopteridaceae
Opuntia fragilis	brittle pricklypear	Cactaceae
Orthilia secunda	sidebells wintergreen	Pyrolaceae
Oryzopsis	ricegrass	Poaceae
Oryzopsis asperifolia	roughleaf ricegrass	Poaceae
Osmorhiza	sweetroot	Apiaceae
Osmorhiza claytonii	Clayton's sweetroot	Apiaceae
Osmorhiza longistylis	longstyle sweetroot	Apiaceae
Osmunda	osmunda	Osmundaceae
Osmunda cinnamomea	cinnamon fern	Osmundaceae
Osmunda claytoniana	interrupted fern	Osmundaceae
Osmunda regalis	royal fern	Osmundaceae
Ostrya virginiana	hophornbeam	Betulaceae
Oxalis	woodsorrel	Oxalidaceae
Oxalis montana	mountain woodsorrel	Oxalidaceae
Oxalis stricta	common yellow oxalis	Oxalidaceae
Oxalis violacea	violet woodsorrel	Oxalidaceae
Packera aurea	golden ragwort	Asteraceae
Panax quinquefolius	American ginseng	Araliaceae
Panicum	panicgrass	Poaceae
Panicum capillare	witchgrass	Poaceae
Panicum phildelphicum	witchgrass	Poaceae
Panicum virgatum	switchgrass	Poaceae
Parietaria pensylvanica	Pennsylvania pellitory	Urticaceae
Parthenocissus	creeper	Vitaceae
Parthenocissus quinquefolia	Virginia creeper	Vitaceae
Parthenocissus vitacea	woodbine	Vitaceae
Pedicularis canadensis	Canadian lousewort	Scrophulariaceae
Pedicularis lanceolata	swamp lousewort	Scrophulariaceae
Pellaea glabella	smooth cliffbrake	Pteridaceae
Penstemon grandiflorus	large beardtongue	Scrophulariaceae
Penthorum sedoides	ditch stonecrop	Crassulaceae
Petasites frigidus	arctic sweet coltsfoot	Asteraceae

Scientific Name	Common Name	Family
Petasites sagittatus	arrowleaf sweet coltsfoot	Asteraceae
Phalaris arundinacea	reed canarygrass	Poaceae
Phegopteris connectilis	long beechfern	Thelypteridaceae
Phleum pratense	timothy	Poaceae
Phlox divaricata	wild blue phlox	Polemoniaceae
Phlox pilosa	downy phlox	Polemoniaceae
Photinia floribunda	purple chokeberry	Rosaceae
Photinia melanocarpa	black chokeberry	Rosaceae
Phragmites australis	common reed	Poaceae
Phryma	phryma	Verbenaceae
Phryma leptostachya	American lopseed	Verbenaceae
Physalis heterophylla	clammy groundcherry	Solanaceae
Physalis virginiana	Virginia groundcherry	Solanaceae
Physocarpus opulifolius	common ninebark	Rosaceae
Physostegia virginiana	obedient plant	Lamiaceae
Picea	spruce	Pinaceae
Picea glauca	white spruce	Pinaceae
Picea mariana	black spruce	Pinaceae
Pilea	clearweed	Urticaceae
Pilea pumila	Canadian clearweed	Urticaceae
Pinus banksiana	jack pine	Pinaceae
Pinus resinosa	red pine	Pinaceae
Pinus strobus	eastern white pine	Pinaceae
Pinus sylvestris	Scotch pine	Pinaceae
Piptatherum pungens	mountain ricegrass	Poaceae
Piptatherum racemosum	blackseed ricegrass	Poaceae
Plagiomnium	plagiomnium moss	Mniaceae
Plantago	plantain	Plantaginaceae
Plantago major	common plantain	Plantaginaceae
Platanthera	fringed orchid	Orchidaceae
Platanthera psycodes	lesser purple fringed orchid	Orchidaceae
Pleurozium schreberi	Schreber's big red stem moss	Hylocomiaceae
Poa	bluegrass	Poaceae
Poa alsodes	grove bluegrass	Poaceae
Poa compressa	Canada bluegrass	Poaceae
Poa palustris	fowl bluegrass	Poaceae
Poa pratensis	Kentucky bluegrass	Poaceae
Polygala paucifolia	gaywings	Polygalaceae
Polygala polygama	racemed milkwort	Polygalaceae
Polygonatum	Solomon's seal	Liliaceae
Polygonatum biflorum	smooth Solomon's seal	Liliaceae
Polygonatum hirsutum	broadleaf Solomon's seal	Liliaceae
Polygonatum pubescens	hairy Solomon's seal	Liliaceae
Polygonella articulata	coastal jointweed	Polygonaceae
Polygonum	knotweed	Polygonaceae
Polygonum amphibium	water knotweed	Polygonaceae
Polygonum arifolium	halberdleaf tearthumb	Polygonaceae
Polygonum cilinode	fringed black bindweed	Polygonaceae
Polygonum convolvulus	black bindweed	Polygonaceae
Polygonum hydropiper	marshpepper knotweed	Polygonaceae

Scientific Name	Common Name	Family
Polygonum hydropiperoides	swamp smartweed	Polygonaceae
Polygonum lapathifolium	curlytop knotweed	Polygonaceae
Polygonum pensylvanicum	Pennsylvania smartweed	Polygonaceae
Polygonum punctatum	dotted smartweed	Polygonaceae
Polygonum sagittatum	arrowleaf tearthumb	Polygonaceae
Polygonum tenue	pleatleaf knotweed	Polygonaceae
Polygonum virginianum	jumpseed	Polygonaceae
Polymnia canadensis	whiteflower leafcup	Asteraceae
Polypodium	polypody	Polypodiaceae
Polypodium virginianum	rock polypody	Polypodiaceae
Polytrichum	polytrichum moss	Polytrichaceae
Pontederia cordata	pickerelweed	Pontederiaceae
Populus	cottonwood	Salicaceae
Populus ×jackii	balm-of-Gilead	Salicaceae
Populus balsamifera	balsam poplar	Salicaceae
Populus deltoides	eastern cottonwood	Salicaceae
Populus grandidentata	bigtooth aspen	Salicaceae
Populus tremuloides	quaking aspen	Salicaceae
Potamogeton	pondweed	Potamogetonaceae
Potamogeton amplifolius	largeleaf pondweed	Potamogetonaceae
Potamogeton epihydrus	ribbonleaf pondweed	Potamogetonaceae
Potamogeton natans	floating pondweed	Potamogetonaceae
Potamogeton nodosus	longleaf pondweed	Potamogetonaceae
Potamogeton praelongus	whitestem pondweed	Potamogetonaceae
Potamogeton robbinsii	Robbins' pondweed	Potamogetonaceae
Potamogeton zosteriformis	flatstem pondweed	Potamogetonaceae
Potentilla	cinquefoil	Rosaceae
Potentilla arguta	tall cinquefoil	Rosaceae
Potentilla norvegica	Norwegian cinquefoil	Rosaceae
Potentilla simplex	common cinquefoil	Rosaceae
Prenanthes alba	white rattlesnakeroot	Asteraceae
Prenanthes serpentaria	cankerweed	Asteraceae
Prunella	selfheal	Lamiaceae
Prunella vulgaris	common selfheal	Lamiaceae
Prunus	plum	Rosaceae
Prunus americana	American plum	Rosaceae
Prunus nigra	Canadian plum	Rosaceae
Prunus pensylvanica	pin cherry	Rosaceae
Prunus pumila	sandcherry	Rosaceae
Prunus serotina	black cherry	Rosaceae
Prunus virginiana	chokecherry	Rosaceae
Pteridium aquilinum	western brackenfern	Dennstaedtiaceae
Ptilium crista-castrensis	knights plume moss	Hypnaceae
Pycnanthemum tenuifolium	narrowleaf mountainmint	Lamiaceae
Pyrola	wintergreen	Pyrolaceae
Pyrola americana	American wintergreen	Pyrolaceae
Pyrola asarifolia	liverleaf wintergreen	Pyrolaceae
Pyrola elliptica	waxflower shinleaf	Pyrolaceae
Pyrola minor	snowline wintergreen	Pyrolaceae
Quercus	oak	Fagaceae

Scientific Name	Common Name	Family
Quercus alba	white oak	Fagaceae
Quercus bicolor	swamp white oak	Fagaceae
Quercus ellipsoidalis	northern pin oak	Fagaceae
Quercus ellipsoidalis x rubra		Fagaceae
Quercus macrocarpa	bur oak	Fagaceae
Quercus muehlenbergii	chinkapin oak	Fagaceae
Quercus rubra	northern red oak	Fagaceae
Quercus velutina	black oak	Fagaceae
Ranunculus	buttercup	Ranunculaceae
Ranunculus abortivus	littleleaf buttercup	Ranunculaceae
Ranunculus acris	tall buttercup	Ranunculaceae
Ranunculus hispidus	bristly buttercup	Ranunculaceae
Ranunculus longirostris	longbeak buttercup	Ranunculaceae
Ranunculus pensylvanicus	Pennsylvania buttercup	Ranunculaceae
Ranunculus recurvatus	blisterwort	Ranunculaceae
Ranunculus rhomboideus	Labrador buttercup	Ranunculaceae
Rhamnus	buckthorn	Rhamnaceae
Rhamnus alnifolia	alderleaf buckthorn	Rhamnaceae
Rhamnus cathartica	common buckthorn	Rhamnaceae
Rhus glabra	smooth sumac	Anacardiaceae
Rhus hirta	staghorn sumac	Anacardiaceae
Rhytidiadelphus	goose neck moss	Hylocomiaceae
Ribes	currant	Grossulariaceae
Ribes americanum	American black currant	Grossulariaceae
Ribes cynosbati	eastern prickly gooseberry	Grossulariaceae
Ribes glandulosum	skunk currant	Grossulariaceae
Ribes hirtellum	hairystem gooseberry	Grossulariaceae
Ribes lacustre	prickly currant	Grossulariaceae
Ribes missouriense	Missouri gooseberry	Grossulariaceae
Ribes oxyacanthoides	Canadian gooseberry	Grossulariaceae
Ribes triste	red currant	Grossulariaceae
Riccia fluitans		Ricciaceae
Robinia pseudoacacia	black locust	Fabaceae
Rorippa nasturtium-aquaticum	watercress	Brassicaceae
Rosa	rose	Rosaceae
Rosa arkansana	prairie rose	Rosaceae
Rosa blanda	smooth rose	Rosaceae
Rosa carolina	Carolina rose	Rosaceae
Rosa multiflora	multiflora rose	Rosaceae
Rosa palustris	swamp rose	Rosaceae
Rosa rugosa	rugosa rose	Rosaceae
Rubus	blackberry	Rosaceae
Rubus allegheniensis	Allegheny blackberry	Rosaceae
Rubus flagellaris	northern dewberry	Rosaceae
Rubus hispidoides	bog dewberry	Rosaceae
Rubus hispidus	bristly dewberry	Rosaceae
Rubus idaeus	American red raspberry	Rosaceae
Rubus idaeus ssp. *strigosus*	grayleaf red raspberry	Rosaceae
Rubus occidentalis	black raspberry	Rosaceae
Rubus parviflorus	thimbleberry	Rosaceae

Scientific Name	Common Name	Family
Rubus pensilvanicus	Pennsylvania blackberry	Rosaceae
Rubus pubescens	dwarf red blackberry	Rosaceae
Rubus recurvans	recurved blackberry	Rosaceae
Rudbeckia	coneflower	Asteraceae
Rudbeckia hirta	blackeyed Susan	Asteraceae
Rudbeckia hirta var. *pulcherrima*	blackeyed Susan	Asteraceae
Rudbeckia laciniata	cutleaf coneflower	Asteraceae
Rudbeckia subtomentosa	sweet coneflower	Asteraceae
Rumex	dock	Polygonaceae
Rumex acetosa	garden sorrel	Polygonaceae
Rumex acetosella	common sheep sorrel	Polygonaceae
Rumex altissimus	pale dock	Polygonaceae
Rumex crispus	curly dock	Polygonaceae
Rumex orbiculatus	greater water dock	Polygonaceae
Rumex orbiculatus var. *borealis*	greater water dock	Polygonaceae
Sagittaria	arrowhead	Alismataceae
Sagittaria latifolia	broadleaf arrowhead	Alismataceae
Sagittaria rigida	sessilefruit arrowhead	Alismataceae
Salix	willow	Salicaceae
Salix alba	white willow	Salicaceae
Salix bebbiana	Bebb willow	Salicaceae
Salix discolor	pussy willow	Salicaceae
Salix exigua	narrowleaf willow	Salicaceae
Salix fragilis	crack willow	Salicaceae
Salix humilis	prairie willow	Salicaceae
Salix interior	sandbar willow	Salicaceae
Salix lucida	shining willow	Salicaceae
Salix nigra	black willow	Salicaceae
Salix pedicellaris	bog willow	Salicaceae
Salix petiolaris	meadow willow	Salicaceae
Salix planifolia	diamondleaf willow	Salicaceae
Salix pyrifolia	balsam willow	Salicaceae
Sambucus	elderberry	Caprifoliaceae
Sambucus nigra ssp. *canadensis*	common elderberry	Caprifoliaceae
Sambucus racemosa	red elderberry	Caprifoliaceae
Sambucus racemosa var. *racemosa*	red elderberry	Caprifoliaceae
Sanguinaria canadensis	bloodroot	Papaveraceae
Sanicula canadensis	Canadian blacksnakeroot	Apiaceae
Sanicula marilandica	Maryland sanicle	Apiaceae
Sanicula odorata	clustered blacksnakeroot	Apiaceae
Sanicula trifoliata	largefruit blacksnakeroot	Apiaceae
Sarracenia purpurea	purple pitcherplant	Sarraceniaceae
Saxifraga pensylvanica	eastern swamp saxifrage	Saxifragaceae
Scheuchzeria palustris	rannoch-rush	Scheuchzeriaceae
Schizachne purpurascens	false melic	Poaceae
Schizachyrium scoparium	little bluestem	Poaceae
Schoenoplectus acutus	hardstem bulrush	Cyperaceae
Schoenoplectus acutus var. *acutus*	hardstem bulrush	Cyperaceae
Schoenoplectus fluviatilis	river bulrush	Cyperaceae
Schoenoplectus tabernaemontani	softstem bulrush	Cyperaceae

Scientific Name	Common Name	Family
Scirpus	bulrush	Cyperaceae
Scirpus atrocinctus	blackgirdle bulrush	Cyperaceae
Scirpus atrovirens	green bulrush	Cyperaceae
Scirpus cyperinus	woolgrass	Cyperaceae
Scrophularia lanceolata	lanceleaf figwort	Scrophulariaceae
Scutellaria	skullcap	Lamiaceae
Scutellaria galericulata	marsh skullcap	Lamiaceae
Scutellaria lateriflora	blue skullcap	Lamiaceae
Scutellaria parvula	small skullcap	Lamiaceae
Selaginella	spikemoss	Selaginellaceae
Selaginella rupestris	northern selaginella	Selaginellaceae
Selaginella selaginoides	club spikemoss	Selaginellaceae
Setaria viridis	green bristlegrass	Poaceae
Sibbaldiopsis tridentata	shrubby fivefingers	Rosaceae
Silene	catchfly	Caryophyllaceae
Silene antirrhina	sleepy silene	Caryophyllaceae
Silene vulgaris	maidenstears	Caryophyllaceae
Sisyrinchium	blue-eyed grass	Iridaceae
Sium suave	hemlock waterparsnip	Apiaceae
Smilax	greenbrier	Smilacaceae
Smilax herbacea	smooth carrionflower	Smilacaceae
Smilax pseudochina	bamboo vine	Smilacaceae
Smilax tamnoides	bristly greenbrier	Smilacaceae
Solanum dulcamara	climbing nightshade	Solanaceae
Solidago	goldenrod	Asteraceae
Solidago bicolor	white goldenrod	Asteraceae
Solidago canadensis	Canada goldenrod	Asteraceae
Solidago canadensis var. *scabra*	Canada goldenrod	Asteraceae
Solidago flexicaulis	zigzag goldenrod	Asteraceae
Solidago gigantea	giant goldenrod	Asteraceae
Solidago hispida	hairy goldenrod	Asteraceae
Solidago juncea	early goldenrod	Asteraceae
Solidago nemoralis	gray goldenrod	Asteraceae
Solidago rugosa	wrinkleleaf goldenrod	Asteraceae
Solidago speciosa	showy goldenrod	Asteraceae
Solidago uliginosa	bog goldenrod	Asteraceae
Sonchus	sowthistle	Asteraceae
Sorghastrum nutans	Indiangrass	Poaceae
Sparganium	bur-reed	Sparganiaceae
Sparganium americanum	American bur-reed	Sparganiaceae
Sparganium angustifolium	narrowleaf bur-reed	Sparganiaceae
Sparganium erectum	simplestem bur-reed	Sparganiaceae
Sparganium erectum ssp. *stoloniferum*	simplestem bur-reed	Sparganiaceae
Sparganium eurycarpum	broadfruit bur-reed	Sparganiaceae
Spartina pectinata	prairie cordgrass	Poaceae
Sphagnum	sphagnum	Sphagnaceae
Sphenopholis obtusata	prairie wedgescale	Poaceae
Spiraea	spirea	Rosaceae
Spiraea alba	white meadowsweet	Rosaceae
Spiraea alba var. *latifolia*	white meadowsweet	Rosaceae

Scientific Name	Common Name	Family
Spiraea tomentosa	steeplebush	Rosaceae
Spirodela polyrrhiza	common duckmeat	Lemnaceae
Sporobolus	dropseed	Poaceae
Sporobolus cryptandrus	sand dropseed	Poaceae
Sporobolus heterolepis	prairie dropseed	Poaceae
Stachys	hedgenettle	Lamiaceae
Stachys palustris	marsh hedgenettle	Lamiaceae
Stachys tenuifolia	smooth hedgenettle	Lamiaceae
Staphylea trifolia	American bladdernut	Staphyleaceae
Stellaria	starwort	Caryophyllaceae
Stellaria longifolia	longleaf starwort	Caryophyllaceae
Stellaria media	common chickweed	Caryophyllaceae
Streptopus amplexifolius	claspleaf twistedstalk	Liliaceae
Streptopus lanceolatus var. *roseus*	twistedstalk	Liliaceae
Stuckenia pectinatus	sago pondweed	Potamogetonaceae
Symphoricarpos	snowberry	Caprifoliaceae
Symphoricarpos albus	common snowberry	Caprifoliaceae
Symphoricarpos occidentalis	western snowberry	Caprifoliaceae
Symphyotrichum	aster	Asteraceae
Symphyotrichum boreale	northern bog aster	Asteraceae
Symphyotrichum ciliolatum	Lindley's aster	Asteraceae
Symphyotrichum cordifolium	common blue wood aster	Asteraceae
Symphyotrichum laeve var. *laeve*	smooth blue aster	Asteraceae
Symphyotrichum lanceolatum ssp. *lanceolatum* var. *lanceolatum*	white panicle aster	Asteraceae
Symphyotrichum lateriflorum	calico aster	Asteraceae
Symphyotrichum lateriflorum var. *lateriflorum*	calico aster	Asteraceae
Symphyotrichum ontarione	bottomland aster	Asteraceae
Symphyotrichum oolentangiense var. *oolentangiense*	skyblue aster	Asteraceae
Symphyotrichum puniceum	purplestem aster	Asteraceae
Symphyotrichum puniceum var. *puniceum*	purplestem aster	Asteraceae
Symphyotrichum sericeum	western silver aster	Asteraceae
Symphyotrichum undulatum	waxyleaf aster	Asteraceae
Symphyotrichum urophyllum	white arrowleaf aster	Asteraceae
Symplocarpus foetidus	skunk cabbage	Araceae
Syringa vulgaris	common lilac	Oleaceae
Talinum rugospermum	prairie fameflower	Portulacaceae
Taraxacum officinale	common dandelion	Asteraceae
Taxus canadensis	Canada yew	Taxaceae
Tephrosia	hoarypea	Fabaceae
Tephrosia virginiana	Virginia tephrosia	Fabaceae
Teucrium canadense	Canada germander	Lamiaceae
Thalictrum	meadow-rue	Ranunculaceae
Thalictrum dasycarpum	purple meadow-rue	Ranunculaceae
Thalictrum dioicum	early meadow-rue	Ranunculaceae
Thalictrum pubescens	king of the meadow	Ranunculaceae
Thalictrum thalictroides	rue anemone	Ranunculaceae
Thelypteris	maiden fern	Thelypteridaceae
Thelypteris noveboracensis	New York fern	Thelypteridaceae
Thelypteris palustris	eastern marsh fern	Thelypteridaceae

Scientific Name	Common Name	Family
Thelypteris simulata	bog fern	Thelypteridaceae
Thuidium	thuidium moss	Thuidiaceae
Thuja occidentalis	northern white-cedar	Cupressaceae
Tilia americana	American basswood	Tiliaceae
Torreyochloa pallida var. *pallida*	pale false mannagrass	Poaceae
Toxicodendron pubescens	Atlantic poison oak	Anacardiaceae
Toxicodendron radicans	eastern poison ivy	Anacardiaceae
Toxicodendron rydbergii	western poison ivy	Anacardiaceae
Tradescantia occidentalis	prairie spiderwort	Commelinaceae
Tragopogon dubius	yellow salsify	Asteraceae
Triadenum	marsh St. Johnswort	Clusiaceae
Triadenum fraseri	Fraser's marsh St. Johnswort	Clusiaceae
Trientalis	starflower	Primulaceae
Trientalis borealis	starflower	Primulaceae
Trifolium arvense	rabbitfoot clover	Fabaceae
Trifolium aureum	golden clover	Fabaceae
Trifolium hybridum	alsike clover	Fabaceae
Trifolium pratense	red clover	Fabaceae
Trillium	trillium	Liliaceae
Trillium cernuum	whip-poor-will flower	Liliaceae
Trillium chloropetalum var. *giganteum*	giant wakerobin	Liliaceae
Trillium grandiflorum	snow trillium	Liliaceae
Trillium maculatum	spotted wakerobin	Liliaceae
Triosteum	horse-gentian	Caprifoliaceae
Triosteum aurantiacum	orangefruit horse-gentian	Caprifoliaceae
Typha	cattail	Typhaceae
Typha angustifolia	narrowleaf cattail	Typhaceae
Typha latifolia	broadleaf cattail	Typhaceae
Ulmus	elm	Ulmaceae
Ulmus americana	American elm	Ulmaceae
Ulmus pumila	Siberian elm	Ulmaceae
Ulmus rubra	slippery elm	Ulmaceae
Ulmus serotina	September elm	Ulmaceae
Urtica	nettle	Urticaceae
Urtica dioica	stinging nettle	Urticaceae
Urtica dioica ssp. *gracilis*	stinging nettle	Urticaceae
Utricularia	bladderwort	Lentibulariaceae
Utricularia macrorhiza	common bladderwort	Lentibulariaceae
Uvularia grandiflora	largeflower bellwort	Liliaceae
Uvularia perfoliata	perfoliate bellwort	Liliaceae
Uvularia sessilifolia	sessileleaf bellwort	Liliaceae
Vaccinium angustifolium	lowbush blueberry	Ericaceae
Vaccinium fuscatum	black highbush blueberry	Ericaceae
Vaccinium macrocarpon	cranberry	Ericaceae
Vaccinium myrtilloides	velvetleaf huckleberry	Ericaceae
Vaccinium oxycoccos	small cranberry	Ericaceae
Vallisneria	eelgrass	Hydrocharitaceae
Vallisneria americana	American eelgrass	Hydrocharitaceae
Verbascum thapsus	common mullein	Scrophulariaceae
Verbascum virgatum	wand mullein	Scrophulariaceae

Scientific Name	Common Name	Family
Verbena hastata	swamp verbena	Verbenaceae
Verbena stricta	hoary verbena	Verbenaceae
Vernonia fasciculata	prairie ironweed	Asteraceae
Veronica	speedwell	Scrophulariaceae
Veronica officinalis	common gypsyweed	Scrophulariaceae
Veronicastrum virginicum	Culver's root	Scrophulariaceae
Viburnum	viburnum	Caprifoliaceae
Viburnum acerifolium	mapleleaf viburnum	Caprifoliaceae
Viburnum dentatum	southern arrowwood	Caprifoliaceae
Viburnum lentago	nannyberry	Caprifoliaceae
Viburnum opulus	European cranberrybush	Caprifoliaceae
Viburnum opulus var. *americanum*	American cranberrybush	Caprifoliaceae
Viburnum rafinesquianum	downy arrowwood	Caprifoliaceae
Vicia americana	American vetch	Fabaceae
Vicia caroliniana	Carolina vetch	Fabaceae
Vicia sativa	garden vetch	Fabaceae
Viola	violet	Violaceae
Viola adunca	hookedspur violet	Violaceae
Viola canadensis	Canadian white violet	Violaceae
Viola conspersa	American dog violet	Violaceae
Viola macloskeyi	small white violet	Violaceae
Viola pedatifida	prairie violet	Violaceae
Viola pubescens	downy yellow violet	Violaceae
Viola pubescens var. *pubescens*	downy yellow violet	Violaceae
Viola sagittata	arrowleaf violet	Violaceae
Viola selkirkii	Selkirk's violet	Violaceae
Vitis	grape	Vitaceae
Vitis riparia	riverbank grape	Vitaceae
Waldsteinia fragarioides	Appalachian barren strawberry	Rosaceae
Woodsia ilvensis	rusty woodsia	Dryopteridaceae
Woodsia obtusa	bluntlobe cliff fern	Dryopteridaceae
Xanthium strumarium var. *glabratum*	rough cockleburr	Asteraceae
Zanthoxylum	pricklyash	Rutaceae
Zanthoxylum americanum	common pricklyash	Rutaceae
Zizania	wildrice	Poaceae
Zizania aquatica	annual wildrice	Poaceae
Zizia aurea	golden zizia	Apiaceae

Appendix E: Descriptions of Map Classes

Explanation of Map-class Descriptions

This appendix to the Main Report of the Saint Croix National Scenic Riverway (SACN) vegetation mapping project provides descriptions of the 68 map classes we used to map the SACN and environs for the National Park Service (NPS) Vegetation Inventory Program (VIP). Of these 68 map classes, 65 represent vegetation types listed within the National Vegetation Classification Standard (NVCS), Version 2 (FGDC 2008), whereas another three represent non-vegetation units (open water). For those map classes representing floristic types (alliance and association) in the NVCS, we recommend using Appendix B: Descriptions of Vegetation Types and Appendix C: Field Key to Vegetation Types to complement the map-class descriptions in this appendix.

Each map-class description provides the formal map-class name and code we used for mapping. Names for map classes representing floristic types (alliance and association) in the NVCS are the synonym names provided by NatureServe. (For map-class phases, the phase section of the name is not part of the synonym name.) For map classes representing vegetation types above the floristic level in the NVCS and for non-vegetation features, we devised succinct names to describe the feature.

At the commencement of each map-class description, we provide the official classification name and code that the map class represents in the NVCS; however, for non-vegetation map classes, we provide the classification given in the 2001 version of the National Land Cover Database (NLCD) (Homer et al. 2004). Each map class is described with a focus on the SACN and its immediate environs and not necessarily on the region beyond. Also, descriptions are from a mapping, rather than an ecologic, perspective. But some ecologic concepts are inherent to the descriptions, as one would expect when describing the mapping of types in the NVCS. We also occasionally discuss how map classes relate to other map classes, because many vegetation types transition into each other.

Throughout the map-class descriptions, “RD” refers to relative density, and “AA” refers to accuracy assessment. Hardwood trees refer to all deciduous tree species. Also, all tree species (e.g., sugar maple, northern white-cedar) are to be assumed to be of heights >5 m, unless otherwise specified (e.g., shrub-height trees) in the description. The term “tree species” in this assumption includes general references to trees as conifers and hardwoods. Also, unless otherwise noted, the herbaceous types have <25% total tree and shrub canopy closure. Shrubland types have >25% shrub canopy closure, and <25% tree canopy closure. Forests and woodlands have >25% tree canopy closure.

Furthermore, much reference is made to the various “sections” of the SACN to help describe general locations of where map classes were applied. These sections refer to three general segments of the SACN (Figure E-1). The “upper section” of the SACN refers to the lands within the SACN project boundary that are upstream from Riverside Landing, which is just south a few kilometers from the confluence of the Saint Croix River and Namekagon River. The upper section includes the upper reach of the Saint Croix River and the Namekagon River, both to the northern extents of the SACN project boundary. The “middle section” of the SACN refers to the lands that are downstream from Riverside Landing to Nevers Dam Landing just a few kilometers north of St. Croix Falls. The “lower section” of the SACN refers to the lands that are

downstream from Nevers Dam Landing and continue to the southern extent of the SACN project boundary, which is at the confluence of the Saint Croix River and the Mississippi River.

Along with describing the map classes via text, ground pictures are provided to give visual depictions of the vegetation types and non-vegetation features that the map classes represent. It is worth noting that the pictures are a partial representation; to capture all variations within a map class would be daunting.

We organized map classes representing vegetation types by the hierarchy in the NVCS. We organized map classes representing non-vegetation features (e.g., open water) by using the classification in the NLCD. Map-classification codes, names, and their crosswalk to the NVCS and the NLCD are listed in Table E-1. The map classification is listed alphabetically by map-class code in Table E-2 at the end of this appendix.

Minimum Mapping Units

Map classes are generally mapped to the NPS VIP minimum mapping unit (MMU) standard of 0.5 ha. For vegetation types unique to the immediate surroundings (e.g., herbaceous wetland within an upland forest setting), we allowed for mapping below the MMU, down to 0.25 ha. In addition, we applied a secondary MMU of 2.0 ha for physiognomic feature changes within a particular map class (e.g., open versus closed forest).

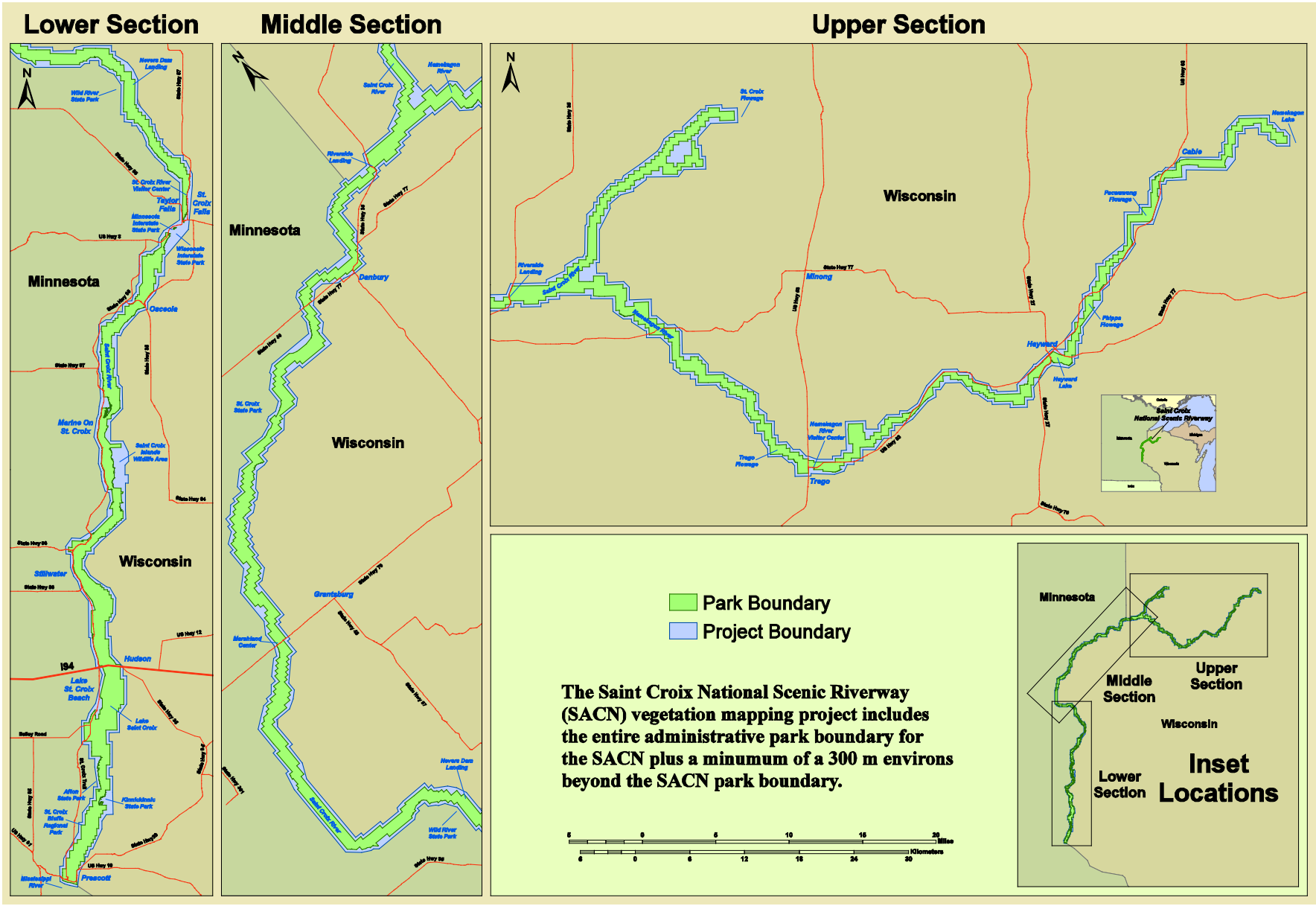


Figure E-1. The three sections of the Saint Croix National Scenic Riverway (Wisconsin/Minnesota), which are frequently referred to in the map-class descriptions.

Page Reference to Map-classification Descriptions

Eastern Red-cedar - (Hardwood) Bluff Woodland (WRC) 18
Midwestern White Oak - Red Oak Forest (FWR) 19
Oak Driftless Bluff Woodland (WOR) 21
Conifer Plantation (FPE) 23
Conifer Ruderal Forest (FCX) 24
Hardwood Ruderal Forest (FDX) 25
Conifer - Hardwood Ruderal Forest (FMX) 27
Jack Pine - Northern Pin Oak Forest (FJO) 28
Red Pine - Aspen - Birch Forest (FRA) 30
Red Pine / Blueberry Dry Forest (FRP) 31
White Pine - (Red Pine) - Oak Forest (FPO) 32
White Pine - Aspen - Birch Forest (FWA) 34
White Pine / Mountain Maple Mesic Forest (FWM) 35
Northern Pin Oak - (Bur Oak) Forest (FPB) 36
Jack Pine - Red Pine Barrens (N/A) 37
Jack Pine - Red Pine / Scrub Oak Woodland (WJO) 38
Aspen / American Hazel Forest (FQA) 39
North-Central Dry-Mesic Oak Woodland (WBO) 40
Maple - Yellow Birch Northern Hardwoods Forest (N/A) 42
Sugar Maple - American Basswood Forest (FMT) 43
Paper Birch / Sugar Maple - Mixed Hardwoods Forest (FPH) 45
White Pine - (Red Pine) Driftless Bluff Forest (FPR) 46
Aspen - Birch / Hardwood Forest (FAM) 47
Northern Red Oak - Sugar Maple Forest (FOM) 49
Floodplain Hardwood Forest (FHF) 50
Ash - Elm - Mixed Lowland Hardwood Forest (FAL, FBL, and FQL) 52
    Ash - Elm - Mixed Lowland Hardwood Forest (ash - elm phase)–FAL 53
    Ash - Elm - Mixed Lowland Hardwood Forest (bur oak phase)–FBL 54
    Ash - Elm - Mixed Lowland Hardwood Forest (aspen phase)–FQL 55
Red Maple - Ash - Birch Swamp Forest (FRM) 56
Black Ash - Mixed Hardwood Swamp (FBA) 57
White-cedar - Black Ash Swamp (FCA) 58
Gray Alder Swamp (SAS) 59
Jack Pine Forest (FJP) 60
Jack Pine - Quaking Aspen Forest (FJA) 61
Spruce - Fir - Aspen Forest (FCP) 62
Spruce - Fir / Mountain Maple Forest (FSF) 63

Aspen - Birch / Boreal Conifer Forest (FAC) 64
Black Spruce and/or Tamarack Swamp (FST) 65
White-cedar - (Mixed Conifer) / Alder Swamp (FCS) 67
Midwest Dry-Mesic Grassland Prairie (HMP) 68
Little Bluestem Bedrock Bluff Prairie (N/A) 69
Midwest Dry Sand Prairie (HDP) 70
Deciduous Ruderal Shrubland (SDX) 71
Conifer - Deciduous Ruderal Shrubland (SMX) 72
Ruderal Grassland (HMX) 73
Hazelnut - Serviceberry Ruderal Shrubland (SHZ) 74
Riverine Cobble - Gravel - Sand Shore (VSB) 75
Skunk-cabbage Seepage Meadow (N/A) 76
Northern Sedge Poor Fen (HSP) 77
Leatherleaf Poor Fen (DLF) 78
Tamarack Scrub Poor Fen (STS) 79
Woolly-fruit Sedge Shore Fen (HSS) 80
Leatherleaf - Sweetgale Shore Fen (DLS) 81
Sandbar Willow Shrubland (SWL) 82
Reed Canarygrass Eastern Marsh (HPH) 83
Eastern Reed Marsh (HPG) 85
Sedge Meadow and/or Emergent Herbaceous Marsh (HMM) 86
Wild Rice Marsh (HWR) 88
Wet Meadow Mixed Herbaceous (HWM) 89
Bluejoint Wet Meadow (HCC) 90
Upright Sedge Wet Meadow (HUS) 91
Mixed Shrub Swamp and/or Fen (SMW) 92
Central Cordgrass Wet Prairie (N/A) 94
Arrowhead - Rice Cutgrass Marsh (N/A) 95
Water-lily Aquatic Wetland (HFA) 96
Midwest Pondweed Submerged Aquatic Wetland (HSV) 97
Flooded Meadow, Marsh, and Aquatic Herbaceous Vegetation Complex (HME) 98
Northern (Laurentian) Igneous - Metamorphic Dry Cliff (N/A) 99
Midwest Moist Limestone - Dolostone Cliff (N/A) 100
Midwest Dry Sandstone Cliff (N/A) 101
Midwest Moist Sandstone Cliff (N/A) 102
Cranberry Crop Field (DCF) 103
Herbaceous Crop Field (HCF) 104
Pasture and Hay Field (HPF) 105

Developed Area (CDV) 106
Open Space – 21 (O) 106
Low Intensity – 22 (L) 106
Medium Intensity – 23 (M) 106
High Intensity – 24 (H) 106
Stream and River (NSR) 108
Open Water Pond (NWP) 109
Open Water Lake (NWL) 110

Table E-1. Map classification with crosswalk to the National Vegetation Classification Standard, Version 2 (FGDC 2008), for the Saint Croix National Scenic Riverway (Minnesota/Wisconsin) vegetation mapping project.

[NVCS, National Vegetation Classification Standard; NLCD, National Land Cover Database]

Map-class Code	Map-class Name
1. FOREST & WOODLAND CLASS	
1.C.2.Na. (D008.) Eastern North American Cool Temperate Forest Division	
M153. Central Mesophytic Hardwood Forest Macrogroup	
G021. North-Central Beech - Maple - Basswood Forest Group	
Acer saccharum - *Tilia americana* / *Ostrya virginiana* - *Carpinus caroliniana* Forest Association (CEGL002062)	
FMT*	Sugar Maple - American Basswood Forest*
M012. Central Oak-Hardwood & Pine Forest Macrogroup	
G016. Chinkapin Oak - Ash - Red-cedar Alkaline Forest Group	
Quercus muehlenbergii - *Quercus* (*alba*, *velutina*) - (*Juniperus virginiana* var. *virginiana*) Bluff Woodland Association (CEGL002144)	
WRC	Eastern Red-cedar - (Hardwood) Bluff Woodland
G158. Northeastern & North-Central Oak - Hickory Forest Group	
Quercus alba - *Quercus rubra* - *Carya ovata* Glaciated Forest Association (CEGL002068)	
FWR	Midwestern White Oak - Red Oak Forest
Pinus strobus - *Quercus* (*alba*, *rubra*, *velutina*) Driftless Bluff Forest Association (CEGL005561)	
FPO*	White Pine - (Red Pine) - Oak Forest*
Quercus macrocarpa - *Quercus* (*alba*, *ellipsoidalis*, *velutina*) Woodland Association (CEGL005560)	
WOR	Oak Driftless Bluff Woodland
M013. Eastern North American Ruderal Forest & Plantation Macrogroup	
G032. Northern & Central Conifer & Hardwood Plantation Group	
FPE	Conifer Plantation
G030. Northern & Central Hardwood & Conifer Ruderal Forest Group	
FCX	Conifer Ruderal Forest
FDX	Hardwood Ruderal Forest
FMX	Conifer - Hardwood Ruderal Forest
M159. Northern & Eastern Pine - Oak Forest, Woodland & Barrens Macrogroup	
G025. White Pine - Red Pine - Jack Pine - Oak Forest & Woodland Group	
Pinus banksiana - (*Pinus resinosa*) - *Quercus ellipsoidalis* / *Carex pensylvanica* Forest Association (CEGL002478)	
FJO	Jack Pine - Northern Pin Oak Forest

Map-class Code	Map-class Name
Pinus resinosa - *Populus tremuloides* / *Diervilla lonicera* - *Vaccinium* spp. Forest Association (CEGL002520)	
FRA	Red Pine - Aspen - Birch Forest
Pinus resinosa / *Vaccinium* spp. Forest Association (CEGL002443)	
FRP	Red Pine / Blueberry Dry Forest
Pinus strobus - (*Pinus resinosa*) - *Quercus rubra* Forest Association (CEGL002480)	
FPO*	White Pine - (Red Pine) - Oak Forest*
Pinus strobus - *Populus tremuloides* / *Corylus cornuta* Forest Association (CEGL002479)	
FWA	White Pine - Aspen - Birch Forest
Pinus strobus / *Acer spicatum* - *Corylus cornuta* Forest Association (CEGL002445)	
FWM	White Pine / Mountain Maple Mesic Forest
Quercus ellipsoidalis - (*Quercus macrocarpa*) Forest Association (CEGL002077)	
FPB	Northern Pin Oak - (Bur Oak) Forest
G160. Great Lakes Pine Barrens Group	
Pinus banksiana - *Pinus resinosa* - (*Quercus ellipsoidalis*) / *Carex pensylvanica* Wooded Herbaceous Vegetation Association (CEGL005124)	
N/A	Jack Pine - Red Pine Barrens
Pinus banksiana - *Pinus resinosa* / *Quercus ellipsoidalis* Woodland Association (CEGL002484)	
WJO	Jack Pine - Red Pine / Scrub Oak Woodland
M151. Northern Great Plains Woodland Macrogroup	
G146. Eastern Great Plains Tallgrass Aspen Parkland Group	
Populus tremuloides / *Corylus americana* Forest Association (CEGL002063)	
FQA	Aspen / American Hazel Forest
G329. Great Plains Oak Woodland Group	
Quercus alba - *Quercus macrocarpa* - *Quercus rubra* / *Corylus americana* Woodland Association (CEGL002142)	
WBO	North-Central Dry-Mesic Oak Woodland
M014. Northern Mesic Hardwood & Conifer Forest Macrogroup	
G163. Northern Hardwood - Hemlock - White Pine Forest Group	
Acer saccharum - *Betula alleghaniensis* - (*Tilia americana*) Forest Association (CEGL002457)	
N/A	Maple - Yellow Birch Northern Hardwoods Forest
Acer saccharum - *Tilia americana* / *Ostrya virginiana* / *Lonicera canadensis* Forest Association (CEGL002458)	
FMT*	Sugar Maple - American Basswood Forest*
Betula papyrifera / *Acer saccharum* - Mixed Hardwoods Forest Association (CEGL002464)	
FPH	Paper Birch / Sugar Maple - Mixed Hardwoods Forest

Map-class Code	Map-class Name
Pinus strobus - (*Pinus resinosa*) Driftless Bluff Forest Association (CEGL002378)	
FPR	White Pine - (Red Pine) Driftless Bluff Forest
Populus tremuloides - *Betula papyrifera* - (*Acer rubrum*, *Populus grandidentata*) Forest Association (CEGL002467)	
FAM*	Aspen - Birch / Hardwood Forest*
Populus tremuloides - *Betula papyrifera* / *Acer saccharum* - Mixed Hardwoods Forest Association (CEGL002468)	
FAM*	Aspen - Birch / Hardwood Forest*
Quercus rubra - *Acer saccharum* - (*Betula alleghaniensis*) Forest Association (CEGL002461)	
FOM	Northern Red Oak - Sugar Maple Forest
1.C.3.Na. (D011.) Eastern North American Flooded & Swamp Forest Division	
M029. Northern & Central Floodplain Forest & Scrub Macrogroup	
G041. Eastern Cottonwood - Black Willow Flooded & Swamp Group	
Populus deltoides - *Salix nigra* Forest Association (CEGL002018)	
FHF*	Floodplain Hardwood Forest*
G040. Silver Maple - Green Ash - Sycamore Floodplain Group	
Acer saccharinum - *Ulmus americana* Forest Association (CEGL002586)	
FHF*	Floodplain Hardwood Forest*
Fraxinus pennsylvanica - *Celtis occidentalis* - *Tilia americana* - (*Quercus macrocarpa*) Forest Association (CEGL002081)	
FAL	Ash - Elm - Mixed Lowland Hardwood Forest (ash - elm phase)
FBL	Ash - Elm - Mixed Lowland Hardwood Forest (bur oak phase)
FQL	Ash - Elm - Mixed Lowland Hardwood Forest (aspen phase)
Fraxinus pennsylvanica - *Ulmus americana* - (*Acer negundo*, *Tilia americana*) Northern Forest Association (CEGL002089)	
FHF*	Floodplain Hardwood Forest*
M030. Northern & Central Swamp Forest Macrogroup	
G046. Northern & Central Conifer & Hardwood Alkaline Swamp Group	
Acer rubrum - *Fraxinus* spp. - *Betula papyrifera* / *Cornus canadensis* Forest Association (CEGL002071)	
FRM	Red Maple - Ash - Birch Swamp Forest
Fraxinus nigra - Mixed Hardwoods - Conifers / *Cornus sericea* / *Carex* spp. Forest Association (CEGL002105)	
FBA	Black Ash - Mixed Hardwood Swamp
Thuja occidentalis - *Fraxinus nigra* Forest Association (CEGL005165)	
FCA	White-cedar - Black Ash Swamp

Map-class Code	Map-class Name
M160. Northern & Central Tall Shrub Wetland Macrogroup	
G167. Northern & Central Shrub Swamp Group	
Alnus incana Swamp Shrubland Association (CEGL002381)	
SAS	Gray Alder Swamp
1.D.1.Na. (D014.) North American Boreal Forest Division	
M037. Eastern & Central North American Boreal Conifer & Hardwood Forest Macrogroup	
G047. Jack Pine - Black Spruce Forest Group	
Pinus banksiana Forest Alliance (A.116)	
FJP	Jack Pine Forest
Pinus banksiana - *Populus tremuloides* Forest Alliance (A.390)	
FJA	Jack Pine - Quaking Aspen Forest
G048. White Spruce - Balsam Fir Forest Group	
Picea glauca - *Abies balsamea* - *Populus tremuloides* / Mixed Herbs Forest Association (CEGL002475)	
FCP	Spruce - Fir - Aspen Forest
Picea glauca - *Abies balsamea* / *Acer spicatum* / *Rubus pubescens* Forest Association (CEGL002446)	
FSF	Spruce - Fir / Mountain Maple Forest
Populus tremuloides - *Betula papyrifera* / (*Abies balsamea*, *Picea glauca*) Forest Association (CEGL002466)	
FAC	Aspen - Birch / Boreal Conifer Forest
1.D.2.Na. (D016.) North American Boreal Flooded & Swamp Forest Division	
M299. North American Boreal Swamp Forest Macrogroup	
G050. Eastern Black Spruce - Tamarack Acidic Swamp Group	
Picea mariana - (*Larix laricina*) / *Ledum groenlandicum* / *Sphagnum* spp. Forest Association (CEGL005271)	
FST*	Black Spruce and/or Tamarack Swamp*
G051. Eastern Tamarack - Conifer Alkaline Swamp Group	
Larix laricina / *Alnus incana* Forest Association (CEGL002471)	
FST*	Black Spruce and/or Tamarack Swamp*
Thuja occidentalis - (*Picea mariana*, *Abies balsamea*) / *Alnus incana* Forest Association (CEGL002456)	
FCS	White-cedar - (Mixed Conifer) / Alder Swamp

Map-class Code	Map-class Name
2. SHRUBLAND & GRASSLAND CLASS	
2.C.1.Nb. (D023.) Great Plains Grassland & Shrubland Division	
M054. Great Plains Tallgrass Prairie & Shrubland Macrogroup	
G333. Central Great Plains Tallgrass Prairie Group	
Schizachyrium scoparium - *Sorghastrum nutans* - *Bouteloua curtipendula* Herbaceous Vegetation Association (CEGL002214)	
HMP*	Midwest Dry-Mesic Grassland Prairie*
G151. Sand & Gravel Tallgrass Prairie Group	
Schizachyrium scoparium - *Bouteloua curtipendula* Bedrock Bluff Herbaceous Vegetation Association (CEGL002245)	
N/A	Little Bluestem Bedrock Bluff Prairie
Schizachyrium scoparium - *Danthonia spicata* - *Carex pensylvanica* - (*Viola pedata*) Herbaceous Vegetation Association (CEGL002318)	
HDP	Midwest Dry Sand Prairie
Schizachyrium scoparium - *Sorghastrum nutans* - *Andropogon gerardii* - *Lespedeza capitata* Sand Herbaceous Vegetation Association (CEGL002210)	
HMP*	Midwest Dry-Mesic Grassland Prairie*
2.C.1.Nc. (D024.) Eastern North American Grassland, Meadow & Shrubland Division	
M123. Eastern North American Ruderal Shrubland & Grassland Macrogroup	
G059. Northern & Central Ruderal Meadow & Shrubland Group	
SDX	Deciduous Ruderal Shrubland
SMX	Conifer - Deciduous Ruderal Shrubland
HMX	Ruderal Grassland
Corylus cornuta - *Amelanchier* spp. Ruderal Shrubland Association (CEGL005562)	
SHZ	Hazelnut - Serviceberry Ruderal Shrubland
2.C.3.Na. (D026.) Eastern North American Dune & Coastal Grassland & Shrubland Division	
M176. Eastern North American Beach, Shoreline & Flat Macrogroup	
G343. Eastern North American River Shoreline Group [Placeholder]	
Igneous - Metamorphic Cobble - Gravel River Shore Sparse Vegetation Association (CEGL002304)	
VSB*	Riverine Cobble - Gravel - Sand Shore*
Riverine Sand Flats - Bars Sparse Vegetation Association (CEGL002049)	
VSB*	Riverine Cobble - Gravel - Sand Shore*

Map-class Code	Map-class Name
2.C.4.Na. (D029.) North American Bog & Fen Division	
M061. Appalachian, Interior Plateau & Prairie Fen Macrogroup	
G183. North-Central Appalachian, Interior & Prairie Fen Group	
Symplocarpus foetidus Herbaceous Vegetation Association (CEGL002385)	
N/A	Skunk-cabbage Seepage Meadow
M062. North American Boreal Bog & Fen Macrogroup	
G386. Eastern North American Boreal Acidic Bog & Poor Fen Group	
Betula pumila / *Chamaedaphne calyculata* / *Carex lasiocarpa* Shrubland Association (CEGL002494)	
SMW*	Mixed Shrub Swamp and/or Fen*
Carex lasiocarpa - *Carex oligosperma* / *Sphagnum* spp. Herbaceous Vegetation Association (CEGL002265)	
HSP	Northern Sedge Poor Fen
Chamaedaphne calyculata / *Carex oligosperma* / *Sphagnum* spp. Poor Fen Dwarf-shrubland Association (CEGL005277)	
DLF	Leatherleaf Poor Fen
Larix laricina / *Chamaedaphne calyculata* / *Carex lasiocarpa* Shrubland Association (CEGL005226)	
STS	Tamarack Scrub Poor Fen
G185. Eastern North American Boreal Alkaline Fen Group	
Carex lasiocarpa - (*Carex rostrata*) - *Equisetum fluviatile* Herbaceous Vegetation Association (CEGL005229)	
HSS	Woolly-fruit Sedge Shore Fen
Chamaedaphne calyculata - *Myrica gale* / *Carex lasiocarpa* Dwarf-shrubland Association (CEGL005228)	
DLS	Leatherleaf - Sweetgale Shore Fen
2.C.5.Na. (D030.) Eastern North American Freshwater Wet Meadow, Riparian & Marsh Division	
M165. Eastern North American Riverscour Wetland Macrogroup	
G194. Northern & Central Riverscour Wetland Group	
Salix interior Temporarily Flooded Shrubland Association (CEGL008562)	
SWL	Sandbar Willow Shrubland
M303. Eastern North American Ruderal Wet Meadow & Marsh Macrogroup	
G556. Northern & Central Ruderal Wet Meadow & Marsh Group	
Phalaris arundinacea Eastern Herbaceous Vegetation Association (CEGL006044)	
HPH / HME*	Reed Canarygrass Eastern Marsh / Flooded Meadow, Marsh, and Aquatic Herbaceous Vegetation Complex*
Phragmites australis Eastern North America Temperate Semi-natural Herbaceous Vegetation Association (CEGL004141)	
HPG / HME*	Eastern Reed Marsh / Flooded Meadow, Marsh, and Aquatic Herbaceous Vegetation Complex*

Map-class Code	Map-class Name
M069. Eastern North American Wet Meadow & Marsh Macrogroup	
G125. Eastern North American Freshwater Marsh Group	
Schoenoplectus tabernaemontani - *Typha* spp. - (*Sparganium* spp., *Juncus* spp.) Herbaceous Vegetation Association (CEGL002026)	
HMM* / HME*	Sedge Meadow and/or Emergent Herbaceous Marsh* / Flooded Meadow, Marsh, and Aquatic Herbaceous Vegetation Complex*
Typha spp. Midwest Herbaceous Vegetation Association (CEGL002233)	
HMM* / HME*	Sedge Meadow and/or Emergent Herbaceous Marsh* / Flooded Meadow, Marsh, and Aquatic Herbaceous Vegetation Complex*
Zizania (*aquatica*, *palustris*) Herbaceous Vegetation Association (CEGL002382)	
HWR / HME*	Wild Rice Marsh / Flooded Meadow, Marsh, and Aquatic Herbaceous Vegetation Complex*
G112. Eastern North American Wet Meadow Group	
HWM	Wet Meadow Mixed Herbaceous
Calamagrostis canadensis - *Eupatorium maculatum* Herbaceous Vegetation Association (CEGL005174)	
HCC	Bluejoint Wet Meadow
Carex (*rostrata*, *utriculata*) - *Carex lacustris* - (*Carex vesicaria*) Herbaceous Vegetation Association (CEGL002257)	
HMM* / HME*	Sedge Meadow and/or Emergent Herbaceous Marsh* / Flooded Meadow, Marsh, and Aquatic Herbaceous Vegetation Complex*
Carex stricta - *Carex* spp. Herbaceous Vegetation Association (CEGL002258)	
HUS	Upright Sedge Wet Meadow
Cornus sericea - *Salix* (*bebbiana*, *discolor*, *petiolaris*) / *Calamagrostis stricta* Shrubland Association (CEGL002187)	
SMW*	Mixed Shrub Swamp and/or Fen*
Spartina pectinata - *Carex* spp. - *Calamagrostis canadensis* - *Lythrum alatum* - (*Oxypolis rigidior*) Herbaceous Vegetation Association (CEGL002224)	
N/A	Central Cordgrass Wet Prairie
G325. Great Plains Freshwater Marsh Group	
Sagittaria latifolia - *Leersia oryzoides* Herbaceous Vegetation Association (CEGL005240)	
HME*	Flooded Meadow, Marsh, and Aquatic Herbaceous Vegetation Complex*

Map-class Code	Map-class Name
5. AQUATIC VEGETATION CLASS	
5.B.1.Na. (D049.) North American Freshwater Aquatic Vegetation Division	
M108. Eastern North American Freshwater Aquatic Vegetation Macrogroup	
G114. Eastern North American Freshwater Aquatic Vegetation Group	
Nuphar advena - *Nymphaea odorata* Herbaceous Vegetation Association (CEGL002386)	
HFA / HME*	Water-lily Aquatic Wetland / Flooded Meadow, Marsh, and Aquatic Herbaceous Vegetation Complex*
Potamogeton spp. - *Ceratophyllum* spp. Midwest Herbaceous Vegetation Association (CEGL002282)	
HSV / HME*	Midwest Pondweed Submerged Aquatic Wetland / Flooded Meadow, Marsh, and Aquatic Herbaceous Vegetation Complex*
6. NONVASCULAR & SPARSE VASCULAR ROCK VEGETATION CLASS	
6.B.2.Na. (D051.) Eastern North American Temperate Cliff, Scree & Rock Vegetation Division	
M111. Eastern North American Cliff & Rock Vegetation Macrogroup	
G106. Eastern North American Temperate Cliff Group	
Igneous - Metamorphic Northern Dry Cliff Sparse Vegetation Association (CEGL002300)	
N/A	Northern (Laurentian) Igneous - Metamorphic Dry Cliff
Limestone - Dolostone Midwest Moist Cliff Sparse Vegetation Association (CEGL002292)	
N/A	Midwest Moist Limestone - Dolostone Cliff
Sandstone Dry Cliff Sparse Vegetation Association (CEGL002045)	
N/A	Midwest Dry Sandstone Cliff
Sandstone Midwest Moist Cliff Sparse Vegetation Association (CEGL002287)	
N/A	Midwest Moist Sandstone Cliff
7. AGRICULTURAL VEGETATION CULTURAL CLASS	
Woody Agricultural Vegetation Subclass (L2)	
Woody Horticultural Crop Formation (L3)	
Bush fruit and berries (shrub) Subformation (L4)	
Berries Subgroup (L6)	
DCF	Cranberry Crop Field
Herbaceous Agricultural Vegetation Subclass (L2)	
Cultivated Crop Formation (L3)	
HCF	Herbaceous Crop Field
Pasture / Hay Formation (L3)	
Permanent Pasture & Hayland Subformation (L4)	
HPF	Pasture and Hay Field

Map-class Code	Map-class Name
8. DEVELOPED VEGETATION CULTURAL CLASS	
Herbaceous & Woody Developed Vegetation Cultural Subclass (L2)	
Other Developed Urban / Built Up Vegetation Formation (L3)	
Developed Area (NLCD 2001; 21-24)	
CDV	Developed Area
NON-NVCS UNITS	
Non-Vegetated Water & Land (<1% vegetated)	
Non-Vegetated Water	
Open Water (NLCD 2001; 11)	
NSR	Stream and River
NWP	Open Water Pond
NWL	Open Water Lake

*Map class also represents other vegetation types.

Eastern Red-cedar - (Hardwood) Bluff Woodland (WRC)

The Eastern Red-cedar - (Hardwood) Bluff Woodland (WRC) map class represents the *Quercus muehlenbergii* - *Quercus* (*alba*, *velutina*) - (*Juniperus virginiana* var. *virginiana*) Bluff Woodland Association (CEGL002144) in the NVCS. The common name for the CEGL002144 type is Chinquapin Oak Bluff Woodland. Normally, when a map class represents one association, the map-class name is the same as the common name for the association. In this particular case, however, chinquapin oak is not a significant component of WRC sites within the SACN lands, but eastern red-cedar is. Although assigning a common name to an association may not always reflect local scenarios, in this case it seems that were the map class named merely "chinquapin oak," it would be somewhat misguiding. The WRC map class was used only in the lower section of the SACN, from the Interstate State Parks area near St. Croix Falls, Wisconsin southward to the confluence of the Saint Croix and Mississippi Rivers.

The WRC map class captures short-statured stands (usually 5–10 m tall) that are characterized by eastern red-cedar being the dominant or co-dominant tree. These red-cedar stands are on thin soils over basalt bedrock or limestone sedimentary rock but not in old-field settings that are above the bluffs. The typical topographic site is on steep bluff slopes along the lower section of the Saint Croix River and Lake Saint Croix.

Of the tree-canopy layer, the RD of conifers to hardwoods is >25%, with the RD of red-cedar to conifers, including eastern white pine, being >50%. Other associated trees commonly include white pine, paper birch, and aspens. American basswood, white oak, red oak, and bur oak can be present in low densities. Although the tree canopy is characteristically open, the suppression of fire has allowed for closed canopies to form; in some cases, a dense and monotypic-doghair stand of red-cedar has formed. Physiognomic modifiers were applied to all WRC map classes and can be used to help gage the physiognomic structure of these red-cedar stands.

For AA, the WRC map class was assessed independently of all other map classes.





Midwestern White Oak - Red Oak Forest (FWR)

The Midwestern White Oak - Red Oak Forest (FWR) map class represents the *Quercus alba* - *Quercus rubra* - *Carya ovata* Glaciated Forest Association (CEGL002068) in the NVCS. The FWR map class was used commonly in the lower section of the SACN and infrequently in the middle section. The majority of FWR that was mapped occurs from Nevers Dam Landing southward to the confluence of the Saint Croix and Mississippi Rivers.

The FWR map class captures oak-dominant forests over medium to deep soils of dry to dry-mesic sites on various aspects and gradients. These oak forests are common to the upland flats, crests, interfluves on bluffs, steep-ridge slopes, and eroded ravines with colluvial gravity flow; however, these oak forests are not common on sand.

Of the tree-canopy layer, the RD of hardwoods to conifers is >75%, and the RD of oaks to other hardwoods is >50% (often >75%). Furthermore, the RD of northern red oak and white oak to all hardwoods is >50%, while the RD of sugar maple and red maple to all hardwoods is <20%. Occasionally sites can be dominant with bur oak; however, these bur-oak dominant sites are classified as FWR only when in the proper environmental setting. Other hardwood associates to FWR are American basswood, green ash, American elm, northern pin oak, and aspens. The tree canopy is usually closed with mature oak trees, yet the canopy can also be open and of a clumped pattern, particularly in areas receiving disturbance. Physiognomic modifiers were applied to all FWR map classes and can be used to help gage the physiognomic structure of these oak-dominant forests.

The FWR map class was used to map only tree-height (>5 m) stands, not those at shrub height (<5 m). The understory floristics of early-successional stands (likely regeneration from recent clear-cutting events) are usually not developed enough to be a viable association type. Although using tree height as a conventional gage to determine ecological transitions can be somewhat arbitrary, it was used to promote consistency in mapping.

Viewing distinctions on the aerial photographs between the FWR class and the Northern Pin Oak - (Bur Oak) Forest (FPB) map class was problematic, particularly when the vegetation was on steep south-facing bluff slopes in the lower section of the SACN.

For AA, the FWR map class was assessed independently of all other map classes.







Oak Driftless Bluff Woodland (WOR)

The Oak Driftless Bluff Woodland (WOR) map class represents the *Quercus macrocarpa* - *Quercus* (*alba*, *ellipsoidalis*, *velutina*) Woodland Association (CEGL005560) in the NVCS. The WOR map class was used only in the lower section of the SACN, with most occurrences located in the area between St. Croix Falls, Wisconsin and Osceola, Wisconsin; the only other occurrences are few in the area between Osceola, Wisconsin and Marine on St. Croix, Minnesota.

The WOR map class captures oak-dominant woodlands on shallow soils over the basalt bedrock region located south of St. Croix Falls, Wisconsin. They are most common to the Interstate State Parks area. Sites of WOR are dry to dry-mesic. Exposed bedrock and boulders are common and can be seen on the aerial photographs through the open canopy of oak trees.

Of the tree-canopy layer, the RD of hardwoods to conifers is >75%, and the RD of oaks to other hardwoods is usually >50%; if not, then rock elm is typically the primary tree. Oak species consist of any mixture of bur, northern pin, white, and red; however, the RD of each oak specie to all other oak species is usually <50%. A commonly associated tree is rock elm, which can even be dominant over the oaks. Rock-elm trees were leaf-off at the time of aerial photography, thus providing greater visibility to the woodland characteristics in the understory, namely boulders and exposed bedrock. The tree canopy can be moderately closed (40–70%) or very open (10–25%), resembling a wooded prairie. Eastern red-cedar and eastern white pine can be present but in low density; the RD of conifer trees to hardwood trees is <25%. Shrubs in the understory are of low density; the understory vegetation is more representative with woodland-herbaceous species.

Soils and geology layers were employed to help identify the basalt bedrock extents for mapping not just the WOR map class but also the *Pinus strobus* - *Quercus* (*alba*, *rubra*, *velutina*) Driftless Bluff Forest Association (CEGL005561). However, CEGL005561 needed to be merged with the *Pinus strobus* - (*Pinus resinosa*) - *Quercus rubra* Forest Association (CEGL002480) because results from the AA analysis indicated confusion in the mapping of these vegetation types. This merge produced the White Pine - (Red Pine) - Oak Forest (FPO) map class. Given the resolution used for mapping in this project, it might be that the soils and geology layers are too broad to distinguish the CEGL005561 and CEGL002480 types. However, the AA analysis shows the mapping of the WOR map class to be successful in distinguishing it from other map classes of non-driftless bluff forests and woodlands. Perhaps woodlands, generally featuring open-tree canopies, allow for the sufficient inspection of the understory, whereas forests, generally featuring closed canopies, do not allow for such inspection. This observation would be a logical explanation for our results given that the understory woodland characteristics (boulders and bedrock outcrops) of WOR could be seen on the aerial photographs, whereas the more closed forests would obscure the viewing of the understory. In addition, the rock elm that is common to WOR exhibited leaf-off conditions on the aerial photographs and this allowed for even more viewing of the woodland characteristics in the understory.

For AA, the WOR map class was assessed independently of all other map classes.







Conifer Plantation (FPE)

The Conifer Plantation (FPE) map class represents the Northern & Central Conifer & Hardwood Plantation Group (G032) in the NVCS. The FPE map class was used commonly throughout the entire SACN, most frequently along the Namekagon River in the upper section of the SACN and least commonly along the middle section of the SACN.

The FPE map class captures conifers that have been planted, consisting of any conifer species—most commonly red pine and occasionally eastern white pine, jack pine, and spruce.

Because of the cultivated disposition of being a plantation, the FPE map class was not assessed for accuracy.



Conifer Ruderal Forest (FCX)

The Conifer Ruderal Forest (FCX) map class represents, in part, the Northern & Central Hardwood & Conifer Ruderal Forest Group (G030) in the NVCS. Because of disturbance from human activity and the inherent variability of floristic vegetation in these early successional forests, a floristic type was not determined. The FCX map class was used commonly throughout the entire SACN, most frequently along the Namekagon River in the upper section of the SACN and least commonly along the middle section of the SACN.

The FCX map class captures ruderal forests that are often resultant from past human disturbance (e.g., old field, harvested conifer plantation) and wherein, of the tree-canopy layer, the RD of conifers to hardwoods is >75%. Conifers consist of tree species both common and unique to the SACN area. These ruderal forests can feature an open or closed tree canopy and can consist of tall- or short-statured (including shrub-height) trees (<5 m). (A distinction is made between shrub species and tree species that are "shrub" height.) An example of an open-canopy, tall-statured stand of FCX is an old herbaceous field with mature conifer trees scattered throughout, in which trees might include, but would not be limited to, spruces, pines, and eastern red-cedar. An example of a closed-canopy, short-statured stand of FCX is a field of young, even-aged jack pine growing up in response to a recent clear cut of a forest or plantation. Although these examples may include trees that are common to other valid association types at the SACN, they lack the ecological integrity necessary in the understory vegetation, both in the shrub and herbaceous layers.

When stands of conifers became established with understory vegetation representative of viable forest association types, then map classes representing those association types were considered. From an aerial photograph, it can be a challenge to determine the status of understory vegetation when the transition is far enough along. So, general rules were put in place to promote consistency in the approach. For example, in the upper section of the SACN upstream from Riverside Landing, when closed-canopy stands of jack pine transitioned from shrub-height stature (<5 m) to tree-height stature (>5 m), the Jack Pine Forest (FJP) map class was considered.

Because of the disturbance regime inherent to ruderal forests, the FCX map class was not assessed for accuracy.





Hardwood Ruderal Forest (FDX)

The Hardwood Ruderal Forest (FDX) map class represents, in part, the Northern & Central Hardwood & Conifer Ruderal Forest Group (G030) in the NVCS. Because of disturbance from human activity and the inherent variability of floristic vegetation in these early successional forests, a floristic type was not determined. The FDX map class was used commonly throughout the entire SACN.

The FDX map class captures ruderal forests that are often resultant from past human disturbance (e.g., old field) and wherein, of the tree-canopy layer, the RD of hardwoods to conifers is >75%. Also, the combined RD of aspen, paper birch, and red maple to all other hardwoods is <50%. Hardwoods consist of deciduous tree species both common and unique to the SACN area. These ruderal forests can feature an open or closed tree canopy and can consist of tall- or short-statured (including shrub-height) trees (<5 m). (A distinction is made between shrub species and tree species that are "shrub" height.) An example of an open-canopy, tall-statured stand of FDX is an old herbaceous field with a mix of tall hardwood trees scattered throughout, of which trees might include, but would not be limited to, black locust, American walnut, American basswood, ashes, aspens, and even some oaks. An example of a short-statured stand of FDX is an open field of shrub-height northern pin oak regenerating from stumps left from a recent clear cut. Although these examples may include trees that are common to other valid association types at the SACN, they lack the ecological integrity necessary in the understory vegetation, both in the shrub and herbaceous layers.

When stands of hardwoods became established with understory vegetation representative of viable forest association types, then map classes representing those association types were considered. From an aerial photograph, it can be a challenge to determine the status of understory vegetation when the transition is far enough along. So, general rules were put in place to promote consistency in the approach. For example, in the middle and upper sections of the SACN, when young stands of northern pin oak transitioned from shrub-height stature (<5 m) to tree-height stature (>5 m), the Northern Pin Oak - (Bur Oak) Forest (FPB) map class was considered.

Because of the disturbance regime inherent to ruderal forests, the FDX map class was not assessed for accuracy.







Conifer - Hardwood Ruderal Forest (FMX)

The Conifer - Hardwood Ruderal Forest (FMX) map class represents, in part, the Northern & Central Hardwood & Conifer Ruderal Forest Group (G030) in the NVCS. Because of disturbance from human activity and the inherent variability of floristic vegetation in these early successional forests, a floristic type was not determined. The FMX map class was used commonly throughout the entire SACN.

The FMX map class captures ruderal forests that are often resultant from past human disturbance (e.g., old field) and wherein, of the tree-canopy layer, the mutual RD of conifers and hardwoods is >25%. Also, the combined RD of aspen, paper birch, and red maple to all other hardwoods is <50%. Conifers and hardwoods consist of tree species both common and unique to the SACN area. These ruderal forests can feature an open or closed tree canopy and can consist of tall- or short-statured (including shrub-height) trees (<5 m). (A distinction is made between shrub species and tree species that are "shrub" height.) An example of a stand of FMX is an old herbaceous field with a mix of conifer and hardwood trees scattered throughout, in which trees might include, but would not be limited to, black locust, American walnut, American basswood, ashes, aspens, some oaks, pines, spruces, and eastern red-cedar. Although this example may include trees that are common to other valid association types at the SACN, they lack the ecological integrity necessary in the understory vegetation, both in the shrub and herbaceous layers.

When stands of mixed conifers and hardwoods became established with understory vegetation representative of viable forest association types, then map classes representing those association types were considered. From an aerial photograph, it can be a challenge to determine that status of understory vegetation when the transition is far enough along. So, general rules were put in place to promote consistency in the approach. For example, when the combined RD of aspens, paper birch, and red maple to all other hardwoods was >50% (with oaks being less than co-dominant), then one of several aspen-conifer map classes were considered, depending on location and RD of conifer trees to each other.

Because of the disturbance regime inherent to ruderal forests, the FMX map class was not assessed for accuracy.





Jack Pine - Northern Pin Oak Forest (FJO)

The Jack Pine - Northern Pin Oak Forest (FJO) map class represents the *Pinus banksiana* - (*Pinus resinosa*) - *Quercus ellipsoidalis* / *Carex pensylvanica* Forest Association (CEGL002478) in the NVCS. The FJO map class was used only in the middle and upper sections of the SACN, with map occurrences following the sandy outwash plains beginning just north of Nevers Dam Landing and onward north to the upper reach of the Saint Croix River and lower reach of the Namekagon River (ending just southwest of Hayward, Wisconsin). The most common mapping occurrences of FJO are along the Namekagon River between Trego, Wisconsin and the confluence of the Namekagon and Saint Croix Rivers.

The FJO map class captures dry pine-oak forests on well-drained, sandy, infertile soils. Of the tree-canopy layer, the RD of conifers to hardwoods is >25%, and the RD of pines to other conifers is >50%. The pine component is usually dominated by jack pine and can be mixed with or even dominated by red pine; however, the RD of eastern white pine to all other pines is <25%. When on the sandy outwash plains, the jack pine component can be completely replaced by red pine and still be considered the FJO type, as long as the hardwood component is present and meeting the above criteria. The hardwood component has a RD of oaks to hardwoods of >25%, in which northern pin oak is the dominant oak; a significant component of bur oak is common. The FJO map class can feature a closed or open tree canopy and consists of trees that are moderately tall but rarely taller than 5–15 m.

The FJO map class was used to map only tree-height (>5 m) stands, not those of shrub height (<5 m). The understory floristics of early-successional stands (likely regeneration from recent clear-cutting events) are usually not developed enough to be a viable association type. Although using tree height as a conventional gage can be somewhat arbitrary to determine the ecological transition, it was used to promote consistency in mapping.

The vegetation concepts associated with the FJO map class change somewhat from southern to northern latitudes. To map the FJO map class more in concert with these conceptual changes, some intricate mapping conventions were put in place, including an arbitrary line placed at Riverside Landing to separate these conventions. They are described in the following paragraphs, building upon the conventions already discussed above.

Upstream from Riverside Landing

The mapping conventions for those lands upstream from Riverside Landing allow that tree canopy closure can be open or closed. The RD of oak (northern pin oak is dominant, with some bur oak) to pines (dominant jack pine and/or, when on sandy outwash plains, dominant red pine) is 15%.

When the tree canopy closure is <60%, the Jack Pine - Red Pine / Scrub Oak Woodland (WJO) map class would normally be used. However, the vegetation type that the WJO map class represents is a southern type, and the upper section of the SACN is too far north of the geographic parameters for that vegetation type. Thus, an exception was allowed to continue mapping the FJO map class in the upper section of the SACN, even when tree canopy closure was <60%.

Downstream from Riverside Landing

The mapping conventions for those lands downstream from Riverside Landing allow that tree canopy closure must be >60%. The RD of oak (dominant northern pin oak with bur oak) to pine (dominant jack pine or dominant red pine when on sandy outwash plains) can be lacking when jack pine is present; however, when jack pine is replaced with red pine in outwash sand plains, then a RD of oak-hardwoods to pine needs to be >15%.

When the RD of oak to pine is <15%, the Jack Pine Forest (FJP) map class would normally be used. However, the vegetation type that the FJP map class represents is a northern type, and the middle section of the SACN is too far south of the geographic parameters for that vegetation type. Thus, an exception was allowed to continue mapping the FJO map class throughout the middle section of the SACN, even when the RD of oaks to pines was <15%.

For AA, the FJO map class was assessed independently of all other map classes.









Red Pine - Aspen - Birch Forest (FRA)

The Red Pine - Aspen - Birch Forest (FRA) map class represents the *Pinus resinosa* - *Populus tremuloides* / *Diervilla lonicera* - *Vaccinium* spp. Forest Association (CEGL002520) in the NVCS. The FRA map class was used throughout the entire SACN; however, it was used rarely in the lower section of SACN, infrequently in the middle section, and frequently in the upper section.

The FRA map class captures dry to dry-mesic forests, usually on well-drained sands, of mixed conifers and hardwoods wherein, of the tree-canopy layer, the RD of red pine to other conifers is >75%. The RD of hardwood trees to conifer trees is >25%. Hardwoods consist mostly of aspens, paper birch, and/or red maple; however, hardwoods can occur with varying amounts of other hardwood trees, yet with oaks and sugar maple being less than co-dominant.

The FRA map class was used to map forest stands of red pine-aspen/hardwoods that were tall and mature, as well as those that were at shrub height (<5 m) and early successional because of recent clear-cutting events. When the forest was of shrub-height stature, the combined RD of aspens, paper birch, and/or red maple to other hardwoods was required to be >50%, with oaks, sugar maple, and other hardwoods being less than co-dominant. Also, the FRA map class can have a closed-to-open tree canopy. In some cases, partial harvesting of pine and aspen has opened up the forest canopy significantly. Physiognomic modifiers were applied to all FRA map classes and can be used to help gage the physiognomic structure of these red pine-aspen/hardwood forests.

The FRA map class was also used to map older red pine plantations wherein the ecological understory vegetation had become characteristic of the CEGL002520 type and the aspen/hardwood component met the criteria for a mixed conifer-hardwood forest.

For AA, the FRA map class was assessed independently of all other map classes.





Red Pine / Blueberry Dry Forest (FRP)

The Red Pine / Blueberry Dry Forest (FRP) map class represents the *Pinus resinosa* / *Vaccinium* spp. Forest Association (CEGL002443) of the NVCS. The FRP map class was used commonly in the upper section of the SACN and infrequently in the middle section, just dipping into the northern tip of the lower section.

The FRP map class captures dry to dry-mesic pine-conifer forests wherein red pine is strongly dominant. Of the tree-canopy layer, the RD of red pine to all other conifers is >75%, and the RD of conifers to hardwoods is >75%; however, when on the sandy outwash plains, the RD of oak-dominant hardwoods to pines is required to be <15%. The tree canopy can be open or closed, and in some cases, partial harvesting of red pine has significantly opened up the forest canopy. Physiognomic modifiers were applied to all FRP map classes and can be used to help gage the physiognomic structure of these red pine forests.

The FRP map class was used to map only tree-height (>5 m) stands, not those of shrub height (<5 m). The understory floristics of early-successional stands (likely regeneration from recent clear-cutting events) are usually not developed enough to be a viable association type. Although using tree height as a conventional gage to determine ecological transitions can be somewhat arbitrary, it was used to promote consistency in mapping.

Planted red pine stands were captured with the Conifer Plantation (FPE) map class.

For AA, the FRP map class was assessed independently of all other map classes.





White Pine - (Red Pine) - Oak Forest (FPO)

The White Pine - (Red Pine) - Oak Forest (FPO) map class represents both the *Pinus strobus* - (*Pinus resinosa*) - *Quercus rubra* Forest Association (CEGL002480) and the *Pinus strobus* - *Quercus* (*alba*, *rubra*, *velutina*) Driftless Bluff Forest Association (CEGL005561) of the NVCS. Of these two associations, the CEGL002480 type is more common throughout the entire SACN; most occurrences of CEGL005561 are thought to be restricted to the basalt bedrock extents of the Interstate State Parks area between Osceola, Wisconsin and St. Croix Falls, Wisconsin (lower section of the SACN). These two pine-oak forest types were originally mapped distinctly; however, results from the AA analysis indicated confusion in the mapping of these vegetation types. Information on soil and geology layers was used to help identify the extents of basalt bedrock for distinctive mapping of CEGL002480 and CEGL005561. It might be, however, that at the resolution used for mapping in this project the soils and geology layers are too broad; therefore, after discussion with NPS staff, these two associations were merged into one map class.

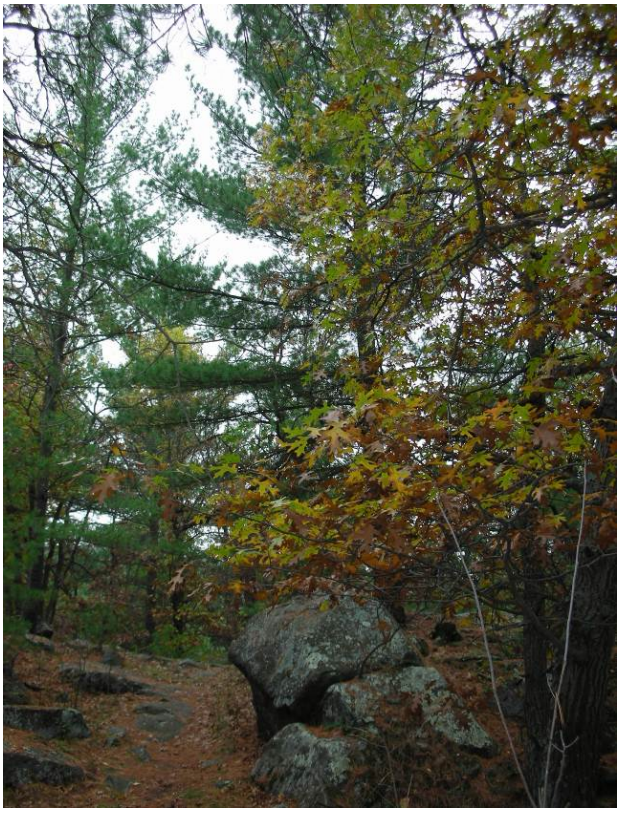
The FPO map class was used throughout the SACN, commonly in the southern and middle sections and infrequently in the upper section. With the merging of the two forest associations, the environmental gradient was broad for the FPO map class, ranging from thin soils with bedrock outcrops on the dry, bluff slopes to the deep, loamy soils in mesic, sheltered ravines.

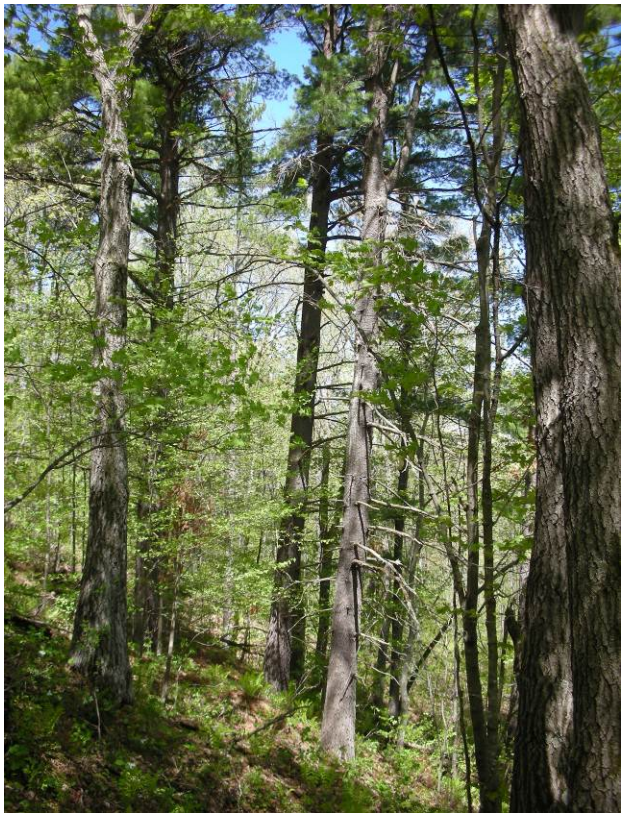
The FPO map class captures mesic to dry-mesic forests of eastern white pine-hardwoods wherein a mix of white oak, northern red oak, and bur oak are the dominant or co-dominant hardwood trees; however, when co-dominant, the combined RD of aspens, paper birch, and/or red maple to all hardwoods is required to be <50%. Other hardwood trees might consist of aspen, paper birch, red maple, sugar maple, American basswood, and white ash. Of the tree-canopy layer, the mutual RD of conifers and hardwoods is >25%, with a RD of white pine to conifers of >25%. The more representative mix of pine and oak trees for FPO is of white pine and red oak. However, other mixes are common, including white pine and bur oak, red pine and red oak, and red pine and bur oak. Red pine often complements white pine, more often in dry-mesic settings. Even when the RD of white pine to other pines (namely red pine) was <25%, the FPO map class was considered as long as the oak-hardwood dominance did not consist of northern pin oak.

The FPO map class was used to map only tree-height (>5 m) stands, not those of shrub height (<5 m). The understory floristics of early-successional stands (likely regeneration from recent clear-cutting events) are usually not developed enough to be a viable association type. Although using tree height as a conventional gage to determine ecological transitions can be somewhat arbitrary, it was used to promote consistency in mapping.

For AA, the FPO map class was assessed independently of all other map classes.







White Pine - Aspen - Birch Forest (FWA)

The White Pine - Aspen - Birch Forest (FWA) map class represents the *Pinus strobus* - *Populus tremuloides* / *Corylus cornuta* Forest Association (CEGL002479) in the NVCS. The FWA map class was used throughout the entire SACN; rarely in the lower section, progressively more commonly from south to north in the middle section, and progressively more frequently from south to north in the upper section. The most frequent use of FWA is along the upper half of the Namekagon River (increased use starting near Hayward, Wisconsin).

The FWA map class captures mesic to dry-mesic forests of mixed conifers and hardwoods wherein, of the tree-canopy layer, the RD of eastern white pine to other conifers is >25%; however, the RD of eastern red-cedar to pines is required to be <50%. The RD of hardwood trees to conifer trees is required to be >25%. Hardwoods consist mostly of aspens, paper birch, and/or red maple; however, hardwoods can occur with varying amounts of other hardwood trees (but with oaks and sugar maple being less than co-dominant). White pine often forms a supracanopy above the hardwood-forest canopy. A significant amount of red pine is likely present in the more dry-mesic sites. These mixed white pine-aspen/hardwood forests can include an element of balsam fir, white spruce, and northern white-cedar.

The FWA map class was used to map forest stands of white pine-aspen/hardwoods that were tall and mature as well as those at shrub height (<5 m) and that were early successional due to recent clear-cutting events. When the forest was of shrub-height stature, the combined RD of aspens, paper birch, and red maple to other hardwoods was required to be >50%, with oaks, sugar maple, and other hardwoods being less than co-dominant. Also, the FWA map class can have a closed-to-open tree canopy. In some cases, partial harvesting of pine and aspen has opened up the forest canopy significantly. Physiognomic modifiers were applied to all FWA map classes and can be used to help gage the physiognomic structure of these white pine-aspen/hardwood forests.

For AA, the FWA map class was assessed independently of all other map classes.





White Pine / Mountain Maple Mesic Forest (FWM)

The White Pine / Mountain Maple Mesic Forest (FWM) map class represents the *Pinus strobus* / *Acer spicatum* - *Corylus cornuta* Forest Association (CEGL002445) in the NVCS. The FWM map class was used throughout the entire SACN, although infrequently except for the common use along the upper half of the Namekagon River (increased use starting near Hayward, Wisconsin).

The FWM map class captures mesic to dry-mesic pine-conifer forests on well-developed soils, but not those forests occurring on shallow soils over bedrock. Of the tree canopy, the RD of eastern white pine to other conifers is >25%; however, the RD of eastern red-cedar to pine to is required to be <50%. The RD of conifers to hardwoods is >75%. The tree canopy can be open or closed, and in some cases, partial harvesting of white pine has significantly opened up the forest canopy. Physiognomic modifiers were applied to all FWM map classes and can be used to help gage the physiognomic structure of these white pine forests.

The FWM map class was used to map only tree-height (>5 m) stands, not those of shrub height (<5 m). The understory floristics of early-successional stands (likely regeneration from recent clear-cutting events) are usually not developed enough to be a viable association type. Although using tree height as a conventional gage to determine ecological transitions can be somewhat arbitrary, it was used to promote consistency in mapping.

Information on soils and geology layers was used to help identify the basalt bedrock extents that exist between St. Croix Falls, Wisconsin and Osceola, Wisconsin. Although these layers might be too broad for the resolution used for mapping in this project (see discussion in the map-class description for Oak Driftless Bluff Woodland), they were used to help distinguish the FWM and the White Pine - (Red Pine) Driftless Bluff Forest (FPR) map classes.

Planted white-pine stands were captured with the Conifer Plantation (FPE) map class.

For AA, the FWM map class was assessed independently of all other map classes.





Northern Pin Oak - (Bur Oak) Forest (FPB)

The Northern Pin Oak - (Bur Oak) Forest (FPB) map class represents the *Quercus ellipsoidalis* - (*Quercus macrocarpa*) Forest Association (CEGL002077) in the NVCS. The FPB map class was used throughout the middle and upper sections of the SACN, infrequently along the upper half of the Namekagon River, and frequently in the remainder of the upper section and throughout the middle section, following along the sandy outwash plains. A few stands of FPB occur in the lower section of the SACN; however, these were not mapped because they were small stands and, because they occurred on steep mid-to-upper south-aspect slopes on the bluffs, they were difficult to discern (via the viewing of aerial photographs) from other oak forest types. Discernment between the FPB and the Midwestern White Oak - Red Oak Forest (FWR) map classes was most problematic.

The FPB map class captures oak forests dominated by northern pin oak, often with bur oak occurring as a strong associate tree. Of the tree canopy, the RD of hardwoods to conifers is >75%. The RD of pin oak to all other hardwoods is >25%; however, the RD of pin oak to all other oaks is >50%. The presence of white oak and red oak is usually scant or not at all. Bur oak might have a high presence but should not be dominant to pin oak. These pin-oak forests are typical to the sandy outwash plains in the middle and upper sections of the SACN. They are also common to built-up sandy islands and embankments of the Saint Croix and the Namekagon Rivers. They also occur occasionally on the steep south-aspect slopes of bluffs in the lower section of the SACN.

The FPB map class was used to map only tree-height (>5 m) stands, not those of shrub-height (<5 m). The understory floristics of early-successional stands (likely regeneration from recent clear-cutting events) are usually not developed enough to be a viable association type. Although using tree height as a conventional gage to determine ecological transitions can be somewhat arbitrary, it was used to promote consistency in mapping.

For AA, the FPB map class was assessed independently of all other map classes.





Jack Pine - Red Pine Barrens (N/A)

Because areas of the Jack Pine - Red Pine Barrens type were thought to be too small to map (well below the size of a MMU), no map class was derived to represent the *Pinus banksiana* - *Pinus resinosa* - (*Quercus ellipsoidalis*) / *Carex pensylvanica* Wooded Herbaceous Vegetation Association (CEGL005124) in the NVCS. Therefore, the Jack Pine - Red Pine Barrens type is captured as an inclusion by other map classes that were used to map the surroundings of these pine barrens, most likely by the Jack Pine - Red Pine / Scrub Oak Woodland (WJO) and the Jack Pine - Northern Pin Oak Forest (FJO) map classes; however, the type may be mapped as an inclusion within other forest and woodland map classes, too.

The Jack Pine - Red Pine Barrens is a dry, sandy herbaceous barren with scattered pines consisting of 10–25% canopy coverage. The herbaceous component is most similar to the vegetation type that is represented by the Midwest Dry Sand Prairie (HDP) map class, which represents the *Schizachyrium scoparium* - *Danthonia spicata* - *Carex pensylvanica* - (*Viola pedata*) Herbaceous Vegetation Association (CEGL002318) in the NVCS.

For AA, because of the lack of a map class, the Jack Pine - Red Pine Barrens type was not used to assess any map class.



Jack Pine - Red Pine / Scrub Oak Woodland (WJO)

The Jack Pine - Red Pine / Scrub Oak Woodland (WJO) map class represents the *Pinus banksiana* - *Pinus resinosa* / *Quercus ellipsoidalis* Woodland Association (CEGL002484) in the NVCS. The WJO map class was used commonly at one localized area within the very southern extent of the middle section of the SACN (in Wisconsin across from the Wild River State Park, Minnesota). The WJO map class was purposely not used upstream from Riverside Landing into the upper section of the SACN because the area was recognized as being too far north for the WJO type.

The WJO map class captures open-canopy stands of jack pine on dry, well-drained, sandy, infertile soils. Of the tree-canopy layer, the combined RD of jack pine and red pine to other conifers is >50%; however, the RD of red pine to other conifers is <75%. The tree canopy closure must be <60%. Northern pin oak and bur oak are common as a scrub-subcanopy tree, with some being in the canopy. These forests are of moderate height (5–15 m) but are rarely taller.

The WJO map class was used to map only tree-height (>5 m) stands, not those of shrub-height (<5 m). The understory floristics of early-successional stands (likely regeneration from recent clear-cutting events) are usually not developed enough to be a viable association type. Although using tree height as a conventional gage to determine ecological transitions can be somewhat arbitrary, it was used to promote consistency in mapping.

For AA, the WJO map class was assessed independently of all other map classes.



Aspen / American Hazel Forest (FQA)

The Aspen / American Hazel Forest (FQA) map class represents the *Populus tremuloides* / *Corylus americana* Forest Association (CEGL002063) in the NVCS. The FQA map class was used to map all aspen forests on lands south of the midway point between St. Croix Falls, Wisconsin and Osceola, Wisconsin, which is in the lower section of the SACN. For lands immediately north of this midway point, the Aspen - Birch / Hardwood Forest (FAM) map class was used. In the immediate areas north and south of this midway point there exists an overlap between the FQA and FAM types wherein they could not be distinguished by viewing the aerial photographs; thus, a location at which point to discriminate the FQA and FAM map classes was determined based on ecological and vegetation data. Although designating a somewhat arbitrary location for this distinction was less than desirable, but it provided a low-cost solution to the alternative course, which was to merge the two map classes.

The FQA map class captures forest stands that are primarily dominated by quaking aspen. Of the tree-canopy layer, the RD of hardwoods to conifers is >75%, and the RD of aspen to other hardwoods is >50%, with oaks, sugar maple, and other hardwoods being less than co-dominant. The understory is dominant with shrub. Sites are generally indicative of past disturbance.

For AA, the FQA map class was assessed independently of all other map classes.



North-Central Dry-Mesic Oak Woodland (WBO)

The North-Central Dry-Mesic Oak Woodland (WBO) map class represents the *Quercus alba* - *Quercus macrocarpa* - *Quercus rubra* / *Corylus americana* Woodland Association (CEGL002142) in the NVCS. The WBO map class was used throughout most of the SACN, most frequently in the middle section, somewhat rarely in the lower section, and commonly in the lower half of the upper section. No mapping of WBO occurred along the upper reach of the Namekagon River, beginning just downstream from Hayward, Wisconsin.

The WBO map class captures dry oak woodlands that are dominated by bur oak and that occur typically on built-up sandy islands and embankments; however, these bur-oak woodlands do not occur over the basalt rock-exposure lands of the Interstate State Parks area (in the lower section of the SACN). Of the tree-canopy layer, the RD of hardwoods to conifers is >75%, and the RD of bur oak to other hardwoods is >50%. Other oaks are commonly present, including northern pin oak and northern red oak. The tree canopy closure of these bur-oak woodlands tend to be more closed than are typical woodland tree canopies; often the tree canopy closure is 60–75% but is rarely more.

The WBO map class was used to map only tree-height (>5 m) stands, not those of shrub-height (<5 m). The understory floristics of early-successional stands (likely regeneration from recent clear-cutting events) are usually not developed enough to be a viable association type. Although using tree height as a conventional gage to determine ecological transitions can be somewhat arbitrary, it was used to promote consistency in mapping.

When stands of bur oak occurred in lowland settings (even when the distinction between lowland and upland was subtle), an interpretative decision had to be made between using the (upland) WBO map class or the (lowland) bur-oak phase (FBL) of the Ash - Elm - Mixed Lowland Hardwood Forest map class. This distinction was difficult to make by viewing the color-infrared aerial photographs; therefore, additional inspection of true-color aerial photographs obtained during leaf-off conditions was performed to help identify subtle changes in topography. (Even during field observations, it was difficult to distinguish the WBO map class and the FBL map-class phase.)

For AA, the WBO map class was assessed independently of all other map classes.









Maple - Yellow Birch Northern Hardwoods Forest (N/A)

Because areas of the Maple - Yellow Birch Northern Hardwoods Forest type were thought to be too small to map (well below the size of a MMU), no map class was derived to represent the *Acer saccharum* - *Betula alleghaniensis* - (*Tilia americana*) Forest Association (CEGL002457) in the NVCS. Therefore, the Maple - Yellow Birch Northern Hardwoods Forest type is captured as an inclusion by other map classes that were used to map the surroundings of these northern hardwood forests, most likely by the Sugar Maple - American Basswood Forest (FMT) and Northern Red Oak - Sugar Maple Forest (FOM) map classes; however, the type may be mapped as an inclusion within other forest map classes, too.

The Maple - Yellow Birch Northern Hardwoods Forest type is typically found around small seep locations within mesic forests having a mix of yellow birch, sugar maple, red maple, and even some American basswood. Of the tree-canopy layer, the RD of hardwoods to conifers is >75%. Of the hardwoods, the RD of yellow birch (or paper birch if the yellow birch has been removed via disturbance events) to other hardwoods is >20%. The RD of yellow birch to basswood is greater.

For AA, because of the lack of a map class, the Maple - Yellow Birch Northern Hardwoods Forest type was not used to assess any map class.



Sugar Maple - American Basswood Forest (FMT)

The Sugar Maple - American Basswood Forest (FMT) map class represents both the *Acer saccharum* - *Tilia americana* / *Ostrya virginiana* / *Lonicera canadensis* Forest Association (CEGL002458) and the Acer *saccharum* - *Tilia americana* / *Ostrya virginiana* - *Carpinus caroliniana* Forest Association (CEGL002062) in the NVCS. Of the two, the CEGL002458 association is much more common across the landscape and occurs throughout the range of CEGL002062 association at the SACN. Having said that, the CEGL002062 type is more common in southern latitudes, while the CEGL002458 type is more common in northern latitudes. The overlap between the two associations is spatially extensive; therefore, mapping them distinctly on the basis of aerial photographs was problematic. For this reason, these two hardwood forest types were merged into one map class. The FMT map class was used frequently throughout the SACN except for along the lower half of the Namekagon River where it was used rarely to infrequently.

The FMT map class captures mixed-hardwood forests that are wet-mesic to mesic and occur on well-developed loamy soils consisting primarily of sugar maple and/or American basswood wherein the RD of oaks (primarily of northern red oak) to hardwoods is <20%. Of the tree-canopy layer, the RD of hardwoods to conifers is >75%. When yellow birch is present, the RD of basswood to birch is greater. A fair amount of green ash and red maple is common. These mixed-hardwood forests occur on just about any slope and aspect as long as the site is mesic. They occur less commonly on south- and west-aspect slopes unless seeps provide for mesic conditions.

Tree canopy closure is typically >80%. A canopy closure of <80% is indicative of type of disturbance. Physiognomic modifiers were applied to all FMT map classes and can be used to help gage the physiognomic structure of these mixed-hardwood mesic forests, perhaps providing some information on the level of disturbance.

The FMT map class was used to map only tree-height (>5 m) stands, not those of shrub-height (<5 m). The understory floristics of early-successional stands (likely regeneration from recent clear-cutting events) are usually not developed enough to be a viable association type. Although using tree height as a conventional gage to determine ecological transitions can be somewhat arbitrary, it was used to promote consistency in mapping.

It is assumed that small areas (below the size of a MMU) of *Acer saccharum* - *Betula alleghaniensis* - (*Tilia americana*) Forest Association (CEGL002457) were mapped as inclusions of the FMT map class. These areas would have a greater RD of yellow birch (sometimes replaced with paper birch) to basswood and would typically be located in seep locations.

When stands dominated by basswood occurred in lowland settings (even when the distinction between lowland and upland was subtle), an interpretative decision had to be made between using the (upland) FMT map class or the (lowland) ash - elm phase (FAL) of the Ash - Elm - Mixed Lowland Hardwood Forest map class. This distinction was difficult to make by viewing the color-infrared aerial photographs; therefore, additional inspection of true-color aerial photographs obtained during leaf-off conditions was performed to help identify subtle changes in topography. (Even during field observations, it was difficult to distinguish the FMT map class and the FAL map-class phase.)

For AA, the FMT map class was assessed independently of all other map classes.







Paper Birch / Sugar Maple - Mixed Hardwoods Forest (FPH)

The Paper Birch / Sugar Maple - Mixed Hardwoods Forest (FPH) map class represents the *Betula papyrifera* / *Acer saccharum* - Mixed Hardwoods Forest Association (CEGL002464) in the NVCS. The FPH map class was used rarely, with two occurrences in the far northern extent (just north of Namekagon Lake) of the SACN.

The FPH map class captures early successional forests that are dominated by paper birch. Of the tree-canopy layer, the RD of hardwoods to conifers is >75%, and the RD of paper birch to other hardwoods (including red maple, hophornbeam, sugar maple, American basswood, and aspens) is >50%; however, these forests are more typically of monotypic paper birch. The combined RD of sugar maple, oaks, and conifers to paper birch/hardwoods is <25%. A few aspens may be present or otherwise are not present at all; the RD of aspens to other hardwoods is <10%.

For AA, the FPH map class was assessed independently of all other map classes.



White Pine - (Red Pine) Driftless Bluff Forest (FPR)

The White Pine - (Red Pine) Driftless Bluff Forest (FPR) map class represents the *Pinus strobus* - (*Pinus resinosa*) Driftless Bluff Forest Association (CEGL002378) in the NVCS. The FPR map class was used infrequently and only in the lower section of the SACN. It was most commonly mapped of the basalt bedrock lands between St. Croix Falls, Wisconsin and Osceola, Wisconsin.

The FPR map class captures mature pine forests on thin soils over basalt bedrock or limestone along the bluffs. Exposed bedrock boulders or limestone are typically present. Of the tree-canopy layer, the RD of conifers to hardwoods is >75%. The RD of pines to conifers is >25% and the RD of eastern white pine to all conifers is >25%; however, the RD of eastern red-cedar to white pine is <50%. Red pine is normally co-dominant with white pine.

Soils and geology layers were employed to help identify the basalt bedrock extents that exist between St. Croix Falls and Osceola, Wisconsin. Although these layers might be too broad for the resolution of mapping for this vegetation mapping project (see discussion in the map-class description for Oak Driftless Bluff Woodland), they were used to help distinguish the FPR and White Pine / Mountain Maple Mesic Forest (FWM) map classes.

For AA, the FPR map class was assessed independently of all other map classes.





Aspen - Birch / Hardwood Forest (FAM)

The Aspen - Birch / Hardwood Forest (FAM) map class represents both the *Populus tremuloides* - *Betula papyrifera* - (*Acer rubrum*, *Populus grandidentata*) Forest Association (CEGL002467) and the Populus tremuloides - Betula papyrifera / Acer saccharum - Mixed Hardwoods Forest Association (CEGL002468) in the NVCS. Of the two associations, the CEGL002467 type is more common to the SACN area than is the CEGL02468 type. Mapping these two forest types in distinction was not possible by viewing the aerial photographs because the understory vegetation, which distinguishes these two associations, was obscured by the tree canopy.

The FAM map class was used to map aspen/hardwood forests on lands north of the midway point between St. Croix Falls and Osceola, Wisconsin, which is in the lower section of the SACN. For lands immediately south of this midway point, the Aspen / American Hazel Forest (FQA) map class was used. In the immediate areas north and south of this midway point, there exists an overlap between the FAM and FQA types wherein they could not be discerned by viewing the aerial photographs; thus, a location at which point to discriminate the FQA and FAM map classes was determined based on ecological and vegetation data. Although designating a somewhat arbitrary location to distinguish these two map classes was a less than desirable solution, it provided a low-cost alternative to merging the two map classes. The FAM map class was used throughout the SACN, rarely in the lower section, infrequently in the lower third of the middle section, and frequently in the remaining middle section and throughout the entire upper section of the SACN.

The FAM map class captures aspen-paper birch forests that are mesic to dry-mesic and include mixed hardwoods in the canopy and subcanopy, including (but not limited to) oaks, sugar maple, American basswood, and green ash. Of both the tree-canopy layer and the tree-subcanopy (<5 m) layer, the RD of hardwoods to conifers is >75%. The combined RD of aspens, paper birch, and/or red maple to other hardwoods is >50%, and the RD of aspens to hardwoods is >10%. Furthermore, the combined RD of oaks and sugar maple to is aspens, birch, and/or red maple is <25%, and the RD of oaks to aspens, birch, and/or red maple is <20%.

These aspen/hardwood forests are successional and typically occur in response to repetitive clear-cut harvesting activities. Often times the young forests are monotypic stands of quaking aspen. In contrast, older forests are often a mix of big-tooth aspen, quaking aspen, paper birch, and red maple. These aspen/hardwood forests can be at various growth stages, from young, short shrub-height (<5 m) trees to mature, tall, pole-size (>15 m) trees. The canopy closure can be open or closed. Physiognomic modifiers were applied to all FAM map classes and can be used to help gage the growth stage. It is noteworthy that aspens, paper birch, and red maple are generally seen as “neutral” trees within other hardwood forest types; therefore, the combined RD of these aspens, paper birch, and red maple to other hardwoods being >50% provides for a less ambiguous distinction from other hardwood map classes.

When stands dominated by aspen occurred in lowland settings (even when the distinction between lowland and upland was subtle), an interpretative decision had to be made between using the (upland) FAM map class or the (lowland) aspen phase (FQL) of the Ash - Elm - Mixed Lowland Hardwood Forest map class. This distinction was difficult to make by viewing the color-infrared aerial photographs; therefore, additional inspection of true-color aerial photographs obtained during leaf-off conditions was performed to help identify subtle changes in

topography. (Even during field observations, it was difficult to distinguish the FAM map class and the FQL map-class phase.)

For AA, the FAM map class was assessed independently of all other map classes.











Northern Red Oak - Sugar Maple Forest (FOM)

The Northern Red Oak - Sugar Maple Forest (FOM) map class represents the *Quercus rubra* - *Acer saccharum* - (*Betula alleghaniensis*) Forest Association (CEGL002461) in the NVCS. The FOM map class was used throughout the entire SACN, frequently throughout the lower section and the southern half of the middle section of the SACN, commonly in the northern half of the middle section, and infrequently in the upper section.

The FOM map class captures mixed northern red oak-hardwood forests that are mesic to dry-mesic. Of the tree-canopy layer, the RD of hardwoods to conifers is >75%. The combined RD of northern red oak and sugar maple to other hardwoods is >50%, and the RD of each red oak and sugar maple to other hardwoods, including each other, is >20%. Other hardwoods common to FOM include American basswood, aspens, and red maple. Other oaks can be present but are usually low in density. These red oak-hardwood forests range across a variety of environmental sites yet tend toward mesic rather than dry locations; they do not occur on the dry, thin soils of the basalt bedrock and boulder exposures of the Interstate State Parks area.

The FOM map class was used to map only tree-height (>5 m) stands, not those of shrub-height (<5 m). The understory floristics of early-successional stands (likely regeneration from recent clear-cutting events) are usually not developed enough to be a viable association type. Although using tree height as a conventional gage to determine ecological transitions can be somewhat arbitrary, it was used to promote consistency in mapping.

It is assumed that small inclusions (below the size of a MMU) of *Acer saccharum* - *Betula alleghaniensis* - (*Tilia americana*) Forest Association (CEGL002457) were mapped with the FOM map class. These areas are typically in seep locations.

For AA, the FOM map class was assessed independently of all other map classes.





Floodplain Hardwood Forest (FHF)

The Floodplain Hardwood Forest (FHF) map class represents three associations in the NVCS, including *Fraxinus pennsylvanica* - *Ulmus americana* - (*Acer negundo*, *Tilia americana*) Northern Forest Association (CEGL002089), *Acer saccharinum* - *Ulmus americana* Forest Association (CEGL002586), and *Populus deltoides* - *Salix nigra* Forest Association (CEGL002018). These three floodplain hardwood forest associations were originally mapped in distinction; however, results from analysis for AA showed low accuracies caused by confusing the two. Therefore, after discussion with NPS staff, these three associations were merged into one map class.

The FHF map class was used abundantly throughout most of the SACN; however, no occurrences of FHF were mapped along the Namekagon River, except for in the lower reach near its confluence with the Saint Croix River. With the merging of these three forest associations, the extent for which this map class was applied is greater than it would be if each were successfully mapped distinctly. The CEGL002089 type reaches further north than does the CEGL002586 type, which reaches further south than does the CEGL002089 type. The CEGL002018 type only occurs in the southern half of the lower section of the SACN. However, the overlap (80–100%) between these three floodplain hardwood forest types is far too great to distinctly map these types on the basis of location and range.

The FHF map class captures floodplain forests that regularly flood and consist of hardwoods having any mixture of silver maple, cottonwood, black willow, green ash, American basswood, bur oak, and American elm. Of the tree-canopy layer, conifers are typically absent or only present in low density. Examples of these floodplain hardwood forests include the monotypic stands of silver maple on the low-floodplain terrace of the Saint Croix River; the hardwood mixture stands of green ash, basswood, bur oak, and elm on the high floodplain terrace (yet still regularly floods) of Saint Croix River; and the black willow-cottonwood stands along Trout Brook west of its confluence with the Saint Croix River at Afton State Park, Minnesota.

For AA, the FHF map class was assessed independently of all other map classes.









Ash - Elm - Mixed Lowland Hardwood Forest (FAL, FBL, and FQL)

The Ash - Elm - Mixed Lowland Hardwood Forest map class represents the *Fraxinus pennsylvanica* - *Celtis occidentalis* - *Tilia americana* - (*Quercus macrocarpa*) Forest Association (CEGL002081) in the NVCS. This map class consists of three phases, including ash - elm (FAL), bur oak (FBL), and aspen (FQL). Collectively, the Ash - Elm - Mixed Lowland Hardwood Forest map class was used commonly throughout the entire SACN.

The Ash - Elm - Mixed Lowland Hardwood Forest map class captures mixed-hardwood forests occurring along river sections having limited floodplain development, along small feeder streams, in seasonally-wet depressions and seepage areas, and on high floodplain terraces receiving no or only intermittent flood waters. (As a point of distinction, this map class does not depict saturated-wet hardwood swamps.) Given that the SACN includes the much limited floodplain on the upper reach of the Saint Croix River and almost the entire reach of the Namekagon River, the Ash - Elm - Mixed Lowland Hardwood Forest is a major hardwood forest type along the margins of these rivers.

Of the tree-canopy layer, the RD of hardwoods to conifers is >75%; however, a significant amount of subcanopy positioned short-statured (<5 m) conifers may be present, including balsam fir, northern white-cedar, and some white spruce and eastern white pine (this is more typical in the upper section of the SACN but less so in the middle and lower sections). The standard hardwood mix consists of green ash and American basswood. Some of these lowland sites can be dominated by bur oak or quaking aspen, but the map-class phases were developed to distinguish their dominance. Few, if any, silver maple are present. The RD of black ash and red maple to hardwoods is <50%.

The FAL phase captures lowland hardwood forests wherein the characteristic hardwoods consist of green ash, American basswood, and American elm. The FBL phase captures lowland hardwood forests wherein bur oak is a dominant or strongly co-dominant hardwood. The FQL phase captures lowland forests wherein quaking aspen is a strongly dominant hardwood. Further descriptions of each map-class phase are provided on the following pages.

For AA, the three map-class phases (FAL, FBL, and FQL) were combined because they collectively represent one association type. They were, however, left as separate entities in the vegetation map layer.

Ash - Elm - Mixed Lowland Hardwood Forest (ash - elm phase)–FAL

The ash - elm (FAL) map-class phase represents the Ash - Elm - Mixed Lowland Hardwood Forest map class (as described above) when any mixture of green ash, American basswood, American elm, and boxelder are the characteristic hardwood trees. The FAL phase was frequently used throughout the entire SACN, except for at the upper reach of the Namekagon River (in the upper section of the SACN) where it was used infrequently.

The RD of bur oak to hardwoods is <40%, and the RD of quaking aspen to hardwoods is <75%. Even within the FAL map-class phase, the lowland hardwood forest varies considerably in vegetation composition. In the lower section and in much of the middle section of the SACN, the typical hardwood mix is of green ash and basswood with an understory of open-canopy short-statured (<5 m) hardwood trees consisting of American hornbeam, American hazelnut, and hophornbeam. In the upper section and some of the middle section of the SACN, the hardwood mix often includes a greater presence of elm and box-elder and a lesser presence of basswood. In some instances, the forest canopy is open, with a dense understory of shrubs consisting mostly of gray alder. In other instances, the forest canopy is closed, with a significant presence of subcanopy, short-statured (<5 m) conifers, including balsam fir, northern white-cedar, and even some white spruce and eastern white pine. Despite variability in the FAL phase, green ash tends to be a consistent feature.

When stands dominated by basswood occurred in upland settings (even when the distinction between upland and lowland was subtle), an interpretative decision had to be made between using the FAL map-class phase or the Sugar Maple - American Basswood Forest (FMT) map class. This distinction was difficult to make by viewing the color-infrared aerial photographs; therefore, additional inspection of true-color aerial photographs acquired during leaf-off conditions was performed to help identify subtle changes in topography. (Even during field observations, it was difficult to distinguish the FAL map-class phase and the FMT map class.)





Ash - Elm - Mixed Lowland Hardwood Forest (bur oak phase)–FBL

The bur oak (FBL) map-class phase represents the Ash - Elm - Mixed Lowland Hardwood Forest map class (as described above) when the RD of bur oak to hardwoods is >40%. Throughout the middle section of the SACN, the FBL phase was commonly used. In the upper section of the SACN, it was infrequently used on the upper reach of the Saint Croix River but commonly used on the lower half of the Namekagon River; however, there were no occurrences mapped on the upper half of the Namekagon River (upstream from Hayward, Wisconsin). In the lower section of the SACN, the FBL phase was not used for mapping.

When stands of bur oak occurred in upland settings (even when the distinction between lowland and upland was subtle), an interpretative decision had to be made between using the (lowland) FBL map-class phase or the (upland) North-Central Dry-mesic Oak Woodland (WBO) map class. This distinction was difficult to make by viewing the color-infrared aerial photographs; therefore, additional inspection of true-color aerial photographs obtained during leaf-off conditions was performed to help identify subtle changes in topography. (Even during field observations, it was difficult to distinguish the FBL map-class phase and the WBO map class.)





Ash - Elm - Mixed Lowland Hardwood Forest (aspen phase)–FQL

The aspen (FQL) map-class phase represents the Ash - Elm - Mixed Lowland Hardwood Forest map class (as described above) when the RD of quaking aspen to hardwoods is >75%. It is important to note, however, that sites of FQL do not occur within saturated-wet swamps. The FQL phase was commonly used throughout the middle section of the SACN (beginning just north of Sunrise Ferry) and was infrequently used in the upper section. The FQL phase was not used for mapping in the lower section.

When stands dominated by aspen occurred in upland settings (even when the distinction between upland and lowland was subtle), an interpretative decision had to be made between using either the (upland) Aspen - Birch / Hardwood Forest (FAM) or (upland) Aspen - Birch / Boreal Conifer Forest (FAC) map class or using the (lowland) FQL map-class phase. This distinction was difficult to make by viewing the color-infrared aerial photographs; therefore, additional inspection of true-color aerial photographs obtained during leaf-off conditions was performed to help identify subtle changes in topography. (Even during field observations, it was difficult to distinguish the FQL map-class phase and the FAM and FAC map classes.)





Red Maple - Ash - Birch Swamp Forest (FRM)

The Red Maple - Ash - Birch Swamp Forest (FRM) map class represents the *Acer rubrum* - *Fraxinus* spp. - *Betula papyrifera* / *Cornus canadensis* Forest Association (CEGL002071) in the NVCS. The FRM map class was used infrequently throughout the upper section of the SACN as well as in the upper half of the middle section. The FRM map class was used rarely in the lower section of the SACN as well as in the lower half of the middle section.

The FRM map class captures red maple-mixed hardwood forests in saturated-swamp settings with muck-like soils; although sites of FRM can occur in sheltered or protected locations of the larger floodplain extent, they typically do not occur in locations where flood waters regularly encroach. Of the tree-canopy layer, the RD of hardwoods to conifers is >75%, wherein the hardwoods consist of varying mixtures of red maple, yellow birch, paper birch, quaking aspen, and even some tamarack; however, the RD of black ash to hardwoods is <50%. Bur oak is absent. Occasionally, the stands are dominated by quaking aspen within these saturated-swamp forest sites; however, seasonally wet lowland forests were mapped as the aspen phase (FQL) of the Ash - Elm - Mixed Lowland Hardwood Forest map class. The tree canopy closure is usually open with trees being both tall and emergent (>5 m) and/or short-statured (<5 m). Varying amounts of Canada bluejoint, skunk-cabbage, cinnamon fern, sedges, and gray alder are common understory components.

For AA, the FRM map class was assessed independently of all other map classes.



Black Ash - Mixed Hardwood Swamp (FBA)

The Black Ash - Mixed Hardwood Swamp (FBA) map class represents the *Fraxinus nigra* - Mixed Hardwoods - Conifers / *Cornus sericea* / *Carex* spp. Forest Association (CEGL002105) in the NVCS. The FBA map class was used commonly or frequently throughout the entire SACN, except for in the southern half of the lower section where no occurrences of FBA were mapped.

The FBA map class captures black ash-dominant forests in saturated-swamp settings with muck-like soils. Although sites of FBA can occur in sheltered or protected locations of the larger floodplain extent, they typically do not occur in locations where flood waters regularly encroach. Of the tree-canopy layer, the RD of hardwoods to conifers is >75%, wherein the RD of black ash to hardwoods is >50%; often times the RD of black ash to other hardwoods is nearing 90–100%. Some bur oak may be present, but the RD of bur oak to other hardwoods is <20%. Other hardwoods might consist of red maple, yellow birch, paper birch, quaking aspen, and even some tamarack. A significant amount of short-statured (<5 m) conifers may be present in the subcanopy, including balsam fir and northern white-cedar (this is more typical in the upper section of the SACN than in the middle and lower sections). The tree canopy can be either open or closed, with trees being both tall and emergent (>5 m) or short-statured (<5 m). In open-canopy sites, a dense understory of shrubs consisting mostly of gray alder is often established.

For AA, the FBA map class was assessed independently of all other map classes.



White-cedar - Black Ash Swamp (FCA)

The White-cedar - Black Ash Swamp (FCA) map class represents the *Thuja occidentalis* - *Fraxinus nigra* Forest Association (CEGL005165) in the NVCS. The FCA map class was used frequently in the upper reaches of the Saint Croix River and the Namekagon River, which are both in the upper section of the SACN. Mapping of FCA was infrequent elsewhere throughout the upper and middle sections of the SACN, with occurrences beginning near Marshland Center and continuing upstream.

The FCA map class captures mixed conifer and hardwood wetland forests in saturated-swamp settings with muck-like soils. Although sites of FCA can occur in sheltered or protected locations of the larger floodplain extent, they typically do not occur in locations where flood waters regularly encroach. Of the tree-canopy layer, the mutual RD of conifers and hardwoods is >25%, and the combined RD of northern white-cedar and balsam fir to other conifers is >25%; in some sites, the conifer component is nearly all balsam fir with very little to no white-cedar. The RD of black ash to other hardwoods is >50%. Other hardwoods might consist of red maple, yellow birch, paper birch, quaking aspen, and even some tamarack. The tree canopy can be either open or closed, with trees being both tall and emergent (>5 m) or short-statured (<5 m). The white-cedar and balsam fir can often be obscured by a slightly taller canopy of black ash; therefore, in more closed-canopy stands, the use of aerial photographs obtained during spring, leaf-off conditions was helpful in distinguishing FCA and the Black Ash - Mixed Hardwood Swamp (FBA) class during mapping. A significant amount of short-statured (<5 m) conifers may be present in the subcanopy, including balsam fir, northern white-cedar, and some white spruce and eastern white pine; however, short-statured conifers were not included in determining the RD in the tree-canopy layer unless the entire forest canopy was of short stature.

For AA, the FCA map class was assessed independently of all other map classes.





Gray Alder Swamp (SAS)

The Gray Alder Swamp (SAS) map class represents the *Alnus incana* Swamp Shrubland Association (CEGL002381) in the NVCS. Although SAS is a shrubland, it is located within the Forest & Woodland Class hierarchy of the NVCS. The SAS map class was used somewhat frequently throughout the middle and upper sections of the SACN and rarely in the lower section (with occurrences mapped only in the upper half).

The SAS map class captures wetland shrublands having >25% shrub cover wherein the combined RD of gray alder, dogwoods, willows (other than sandbar willow), bog birch, and/or spirea to other shrubs is >50%, and the RD of gray alder to all other shrubs is >40%. Trees may be present with <25% canopy cover and can include, but are not limited to, any mixture of black ash, red maple, northern white-cedar, balsam fir, tamarack, green ash, American elm, and even some bur oak. A common feature of these shrub wetlands is tall, dense stands where alder is monotypic, with few other shrub species (such as willows) present. The SAS map class was mapped in a variety of environments, including basins, margins of lakes and ponds, beaver complexes, and riparian corridors. Although SAS can occur in sheltered or protected locations of the larger floodplain extent, they typically do not occur in locations where flood waters regularly encroach.

For AA, the SAS map class was assessed independently of all other map classes.





Jack Pine Forest (FJP)

The Jack Pine Forest (FJP) map class represents the *Pinus banksiana* Forest Alliance (A.116) in the NVCS; an association type within the NVCS was not determined. This map class was used only upstream from Riverside Landing; the upper section of the SACN. The FJP map class was used commonly along most of the Namekagon River and along the upper reach of the Saint Croix River, where it was mapped only in two areas.

The FJP map class captures dry-mesic and dry jack pine-conifer forests on well-drained, sandy, infertile soils wherein jack pine is typically the dominant tree. Of the tree-canopy layer, the RD of conifers to hardwoods is generally >75%, but the RD of conifers to northern pin oak-hardwoods is >85%. The RD of pines to other conifers is >25%, wherein the RD of eastern white pine to jack pine and red pine is <25% and the RD of red pine to jack pine is <75%.

The FJP can have a closed or open tree canopy (even with an open-woodland physiognomy) and are of moderate height (5–15 m) but are rarely taller. The FJP map class was used to map only tree-height (>5 m) stands, not those of shrub-height (<5 m). The understory floristics of early-successional stands (likely regeneration from recent clear-cutting events) are usually not developed enough to be a viable association type. Although using tree height as a conventional gage to determine ecological transitions can be somewhat arbitrary, it was used to promote consistency in mapping.

Planted jack pine stands were captured with the Conifer Plantation (FPE) map class.

For AA, the FJP map class was assessed independently of all other map classes.





Jack Pine - Quaking Aspen Forest (FJA)

The Jack Pine - Quaking Aspen Forest (FJA) map class represents the *Pinus banksiana - Populus tremuloides* Forest Alliance (A.390) in the NVCS; an association type within the NVCS was not determined. This map class was used only upstream from Riverside Landing; the upper section of the SACN. Within the upper section, the FJA map class was used rarely along the upper reach of the Saint Croix River and commonly along the lower reach of the Namekagon River (less commonly along the upper reach).

The FJA map class captures dry to dry-mesic jack pine-aspen forests, usually occurring on well-drained and sandy soils, wherein of the tree-canopy layer, the mutual RD of conifers and hardwoods is >25%. The RD of pines to other conifers is >50%, wherein the RD of eastern white pine to jack pine and red pine is <25% and the RD of red pine to jack pine is <75%. Hardwoods consist predominantly of aspens and/or paper birch; the RD of aspens and/or paper birch to other hardwoods, including red maple and oaks, is >75%.

The FJA map class was used to map jack pine-aspen stands that were tall and emergent (>5 m), as well as those of shrub-height (<5 m) and early successional due to recent clear-cutting events. The FJA can have a closed or open tree canopy. In some cases, partial harvesting of pines and aspens has significantly opened the forest canopy. Physiognomic modifiers were applied to all FJA map classes and can be used to help gage the physiognomic structure of these forests.

For AA, the FJA map class was assessed independently of all other map classes.





Spruce - Fir - Aspen Forest (FCP)

The Spruce - Fir - Aspen Forest (FCP) map class represents the *Picea glauca* - *Abies balsamea* - *Populus tremuloides* / Mixed Herbs Forest Association (CEGL002475) in the NVCS. The FCP map class was used throughout the upper section of the SACN and in the upper reach of the middle section. The FCP was mapped infrequently or rarely, except the entire upper reach of the Saint Croix River and the upper reach of the Namekagon River beginning at Hayward, Wisconsin where it was mapped commonly.

The FCP map class captures conifer-hardwood forests that are mesic to dry-mesic and wherein, of the tree-canopy layer, the mutual RD of conifers and hardwoods is >25%. Balsam fir and white spruce make up the dominant conifer component, and aspens and paper birch make up the dominant hardwood component. Other conifers (including pines and northern white-cedar) and hardwoods (including red maple, yellow birch, and oaks) can be present but are not dominant.

The tree canopy can be either open or closed with trees being both tall and emergent (>5 m) or short-statured (<5 m). Physiognomic modifiers were applied to all FCP map classes and can be used to help gage the physiognomic structure of these forests.

For AA, the FCP map class was assessed independently of all other map classes.





Spruce - Fir / Mountain Maple Forest (FSF)

The Spruce - Fir / Mountain Maple Forest (FSF) map class represents the *Picea glauca* - *Abies balsamea* / *Acer spicatum* / *Rubus pubescens* Forest Association (CEGL002446) in the NVCS. The FSF map class was used throughout the upper section of the SACN and the far upper reach of the middle section. The FSF was mapped infrequently or rarely, except the upper-most reaches of both the Saint Croix River and the Namekagon River where it was mapped commonly.

The FSF map class captures spruce-fir forests that are often mesic but not occurring in wetlands, on sandy shores, or in old-field settings. Some white spruce can be present, but balsam fir is typically the dominant conifer tree. Of the tree-canopy layer, the RD of white spruce and/or balsam fir to all other trees (either conifer or hardwood) is >75%. Northern white-cedar, eastern white pine, aspens, and paper birch can be and often are present in low densities.

The tree canopy can be either open or closed with trees being both tall and emergent (>5 m) or short-statured (<5 m). Physiognomic modifiers were applied to all FSF map classes and can be used to help gage the physiognomic structure of these spruce-fir forests.

For AA, the FSF map class was assessed independently of all other map classes.



Aspen - Birch / Boreal Conifer Forest (FAC)

The Aspen - Birch / Boreal Conifer Forest (FAC) map class represents the *Populus tremuloides* - *Betula papyrifera* / (*Abies balsamea*, *Picea glauca*) Forest Association (CEGL002466) of the NVCS. The FAC map class was used throughout the upper section of the SACN and the far upper reach of the middle section. The FAC was mapped rarely, except for the entire upper reach of the Saint Croix River where it was mapped infrequently, and the upper reach of the Namekagon River beginning at Hayward, Wisconsin where it was mapped commonly.

The FAC map class captures aspen-birch forests with a significant layer of conifer trees in the short-tree and tall-shrub layers of the understory. Sites are wet-mesic to mesic but not wetland. Of the tree-canopy layer, the RD of hardwoods to conifers is >75%. The combined RD of aspens and paper birch to other hardwoods is >75%, wherein the RD of aspen to all hardwoods is >10%. Red maple is often a component tree to some degree. The short-tree and tall-shrub conifers in the understory consist mostly of balsam fir, with some white spruce and northern white-cedar.

The tree canopy can be either open or closed with trees that are typically of moderate height (10–15 m). Physiognomic modifiers were applied to all FAC map classes and can be used to help gage the physiognomic structure of these forests.

For AA, the FAC map class was assessed independently of all other map classes.





Black Spruce and/or Tamarack Swamp (FST)

The Black Spruce and/or Tamarack Swamp (FST) map class represents the *Picea mariana* - (*Larix laricina*) / *Ledum groenlandicum* / *Sphagnum* spp. Forest Association (CEGL005271) and the Larix laricina / Alnus incana Forest Association (CEGL002471) in the NVCS. Although the latitude range for the CEGL002471 type extends further south than does the CEGL005271 type, they both extend to the same northern latitudes of the SACN. These two conifer-swamp forest associations, one being a poor-minerotrophic swamp and the other being a rich-minerotrophic swamp, were originally mapped distinctly; however, results from the AA analysis indicated confusion in the mapping of these vegetation types. Therefore, these two associations were merged into one map class.

The FST map class was used commonly in the upper section of the SACN, infrequently in the middle section, and rarely in the lower section, where the only few occurrences are in the upper half (these few southern-most occurrences can be assumed as the CEGL002471 type).

The FST map class captures poor- and rich-minerotrophic conifer-swamp forests that are dominated by black spruce and/or tamarack. The FST map class can occur in basin settings as well as along river and stream corridors; however, it does not typically occur in floodplain locations where flood waters encroach, whether regularly or intermittently. The RD of black spruce and/or tamarack to northern white-cedar and other conifers is >50%. The rich-minerotrophic swamps tend to have open canopies, with tamarack as the dominant tree but also including some short-statured (<5 m) trees, such as red maple and black ash. The shrub understory is typically dominated by gray alder and can contain some bog birch. The poor-minerotrophic swamps have open and closed tree canopies, with trees being both tall and emergent (>5 m) or short-statured (<5 m). Sphagnum and peatland ericads, including leatherleaf and Labrador-tea, typically dominate the ground flora.

For AA, the FST map class was assessed independently of all other map classes.









White-cedar - (Mixed Conifer) / Alder Swamp (FCS)

The White-cedar - (Mixed Conifer) / Alder Swamp (FCS) map class represents the *Thuja occidentalis* - (*Picea mariana*, *Abies balsamea*) / *Alnus incana* Forest Association (CEGL002456) in the NVCS. The FCS map class was used infrequently and discontinuously throughout the upper section of the SACN and rarely in the far upper half of the middle section.

The FCS map class captures mixed conifer and hardwood wetland forests in saturated-swamp settings with muck-like soils. Although sites of FCS can occur in sheltered or protected locations of the larger floodplain extent, they typically do not occur in locations where regular flood waters encroach. Of the tree-canopy layer, the RD of conifers and hardwoods is >75%, and the combined RD of northern white-cedar and balsam fir to black spruce and tamarack is >50%; in some sites, the conifer component is nearly all balsam fir with very little to no white-cedar. The few hardwoods that can be present include black ash, red maple, yellow birch, paper birch, and quaking aspen. The tree canopy can be either open or closed, with trees being both tall and emergent (>5 m) or short statured (<5 m). The understory shrub is often gray alder. Sphagnum and other peatland flora can be common.

For AA, the FCS map class was assessed independently of all other map classes.





Midwest Dry-Mesic Grassland Prairie (HMP)

The Midwest Dry-Mesic Grassland Prairie (HMP) map class represents both the *Schizachyrium scoparium* - *Sorghastrum nutans* - *Bouteloua curtipendula* Herbaceous Vegetation Association (CEGL002214) and the *Schizachyrium scoparium* - *Sorghastrum nutans* - *Andropogon gerardii* - *Lespedeza capitata* Sand Herbaceous Vegetation Association (CEGL002210) in the NVCS. Distinguishing these two grassland types from each other by viewing aerial photographs was not possible because the vegetation components of these grasslands are too similar, with only minor species composition differences. Although the CEGL002214 type exists on loamy soils and the CEGL002210 type exists on sandy soils, these soil types can grade into each other; thus, the soil layers did not provide a viable point of distinction. The HMP map class was used rarely throughout the SACN, with all occurrences but one in the lower section of the SACN. The other occurrence was mapped in the upper section of the SACN, in an area being restored to prairie grassland near Trego Lake.

The HMP map class captures dry-mesic grasslands on both loamy and sandy soils. These grasslands are characterized by little bluestem and big bluestem and, with minor differences in composition, may include poverty oatgrass, porcupinegrass, Indiangrass, and prairie dropseed. Total tree canopy is <10% when provided by jack pine and/or red pine and <25% when provided by other trees. Locations of HMP are assumed to be in areas where restoration to prairie grassland is ongoing. Some HMP are under management of the Standing Cedars Community Land Conservancy and exist on lands in Wisconsin that are southeast and across the river from Marine on St. Croix, Minnesota.

For AA, the HMP map class was assessed independently of all other map classes.





Little Bluestem Bedrock Bluff Prairie (N/A)

Because areas of the Little Bluestem Bedrock Bluff Prairie type are too small to map (well below the size of a MMU), no map class was derived to represent the *Schizachyrium scoparium* - *Bouteloua curtipendula* Bedrock Bluff Herbaceous Vegetation Association (CEGL002245) in the NVCS. Therefore, the Little Bluestem Bedrock Bluff Prairie type is captured as an inclusion by other map classes that were used to map the surroundings of these bluff prairies; these map classes are likely ones that represent forest and woodland types common to sedimentary, limestone bluffs.

Sites of Little Bluestem Bedrock Bluff Prairie occur in dry grasslands with bedrock outcrops located on limestone bluffs, with a total tree canopy of <10% when provided by jack pine and/or red pine or <25% when provided by other trees. This vegetation type is characterized by the presence of big bluestem, sideoats grama, little bluestem, and prairie dropseed.

For AA, because of the lack of a map class, the Little Bluestem Bedrock Bluff Prairie type was not used to assess any map class.



Midwest Dry Sand Prairie (HDP)

The Midwest Dry Sand Prairie (HDP) map class represents the *Schizachyrium scoparium* - *Danthonia spicata* - *Carex pensylvanica* - (*Viola pedata*) Herbaceous Vegetation Association (CEGL002318) in the NVCS. The HDP map class was used infrequently at one localized area within the very southern extent of the middle section of the SACN (in Wisconsin, across from the Wild River State Park, Minnesota). Most occurrences of the HDP type were too small to map (well below the size of a MMU) and are likely mapped as inclusions to the forest and woodland types surrounding them.

The HDP map class captures dry grasslands on sandy soils. These grasslands are characterized by the presence of hairy grama, Pennsylvania sedge, porcupinegrass, prairie Junegrass, and little bluestem. Total tree canopy is <10% when provided by jack pine and/or red pine and <25% when provided by other trees.

For AA, the HDP map class was assessed independently of all other map classes.



Deciduous Ruderal Shrubland (SDX)

The Deciduous Ruderal Shrubland (SDX) map class represents, in part, the Northern & Central Ruderal Meadow & Shrubland Group (G059) of the NVCS. Because of disturbance from human activity and the inherent variability of floristic vegetation in these ruderal shrublands, a floristic type was not determined. The SDX map class was used commonly throughout the upper section of the SACN and infrequently for the most part throughout the middle and lower sections.

The SDX map class captures ruderal upland shrublands that are often a result from past human disturbance (e.g., old field, forest clear cut). Shrubs consist of any species common or unique to the SACN area. Shrubs contribute >25% cover wherein the RD of deciduous shrubs to conifer shrubs and/or shrub-height trees (<5 m) is >75%. Conifer and hardwood trees, including hardwoods that are shrub height in stature, contribute <25% cover; however, shrub-height conifers are seen with the shrub layer. Noteworthy, when shrub-height hardwood trees were >25% cover, other hardwood forest map classes were considered, depending on hardwood species present. For example, a field of shrub-height northern pin oak in stump regeneration as a result of a clear cut of a pin oak forest.

Because of the variability of vegetation inherent to ruderal shrublands, the SDX map class was not assessed for accuracy.



Conifer - Deciduous Ruderal Shrubland (SMX)

The Conifer - Deciduous Ruderal Shrubland (SMX) map class represents, in part, the Northern & Central Ruderal Meadow & Shrubland Group (G059) of the NVCS. Because of disturbance from human activity and the inherent variability of floristic vegetation in these ruderal shrublands, a floristic type was not determined. The SMX map class was used infrequently throughout most of the upper section of the SACN and rarely for throughout most of the middle and lower sections.

The SMX map class captures ruderal upland shrublands that are often resultant from past human disturbance (e.g., old fields, clear-cut forests). Shrubs consist of any species common or unique to the SACN area. Shrubs contribute >25% cover, wherein the mutual RD of deciduous shrubs to conifer shrubs and/or shrub-height trees (<5 m) is >25%. Conifer and hardwood trees, including hardwoods that are of shrub height, contribute <25% cover; however, shrub-height conifers are seen within the shrub layer. When shrub-height hardwood trees provided >25% cover, other map classes capturing conifer-hardwood forests were considered, depending on the hardwood species present.

Because of the disturbance regime inherent to ruderal forests, the SMX map class was not assessed for accuracy.

No representative pictures are provided.

Ruderal Grassland (HMX)

The Ruderal Grassland (HMX) map class represents, in part, the Northern & Central Ruderal Meadow & Shrubland Group (G059) of the NVCS. Because of disturbance from human activity and the inherent variability of floristic vegetation in these ruderal herbaceous lands, a floristic type was not determined. The HMX map class was used commonly throughout most of the SACN.

The HMX map class captures ruderal herbaceous fields in upland (not wetland) sites wherein shrubs and trees each contribute <25% cover. Herbaceous vegetation consists of various grasses and herbs common or unique to the SACN area; however, the classification emphasis is on non-native vegetation. Sites of HMX are typically left fallow and idle; however, in mapping they can be mistaken for the Pasture and Hay Field (HPF) map class, which captures herbaceous lands that are used primarily for pasturing or haying of perennial vegetation.

Because of the disturbance regime inherent to ruderal herbaceous fields, the HMX map class was not assessed for accuracy.









Hazelnut - Serviceberry Ruderal Shrubland (SHZ)

The Hazelnut - Serviceberry Ruderal Shrubland (SHZ) map class represents the *Corylus cornuta* - *Amelanchier* spp. Ruderal Shrubland Association (CEGL005562) in the NVCS. The SHZ map class was used mostly in the upper section of the SACN, with only a pair of occurrences located in the far upper reach of the middle section. Of the upper section of the SACN, the SHZ was mapped infrequently in the upper half of the Namekagon River and mapped rarely throughout the remaining upper section.

The SHZ map class captures ruderal upland shrublands that are dominant with hazelnuts, including American hazelnut and beaked hazelnut; the RD of hazelnuts to other shrubs is >50%. Shrubs contribute >25% cover, wherein the RD of deciduous shrubs to conifer shrubs and/or shrub-height trees (<5 m) is >75%. Sites of SHZ are usually on well-drained, sandy soils and are resultant from recent disturbance, including wind-throw events, extensive beaver harvesting of hardwoods, and clear-cut logging. The herbaceous component is typically graminoid. Quaking aspen is a common mix in the shrub layer. Total hardwood tree coverage—whether tree height (>5 m) or shrub-height (>5 m)—is <25%.

For AA, the SHZ map class was assessed independently of all other map classes.



Riverine Cobble - Gravel - Sand Shore (VSB)

The Riverine Cobble - Gravel - Sand Shore (VSB) map class represents both the Igneous - Metamorphic Cobble - Gravel River Shore Sparse Vegetation Association (CEGL002304) and the Riverine Sand Flats - Bars Sparse Vegetation Association (CEGL002049) in the NVCS. The VSB map class was used only in the lower section of the SACN. Although the VSB was mapped infrequently throughout most of the lower section, it was mapped commonly on the shores of Lake Saint Croix.

The VSB map class captures cobble, gravel, and sand bars in and along rivers, streams, and lakeshores. The total cover of vegetation is <1% and consists mostly of herbaceous plants. The sparse vegetation present is in response to dynamic water-level fluctuations, receiving frequent flooding.

Most sites of VSB were inundated with flood waters on the date aerial photography was acquired (October 10, 2005) for the SACN vegetation mapping project. (The October 2005 imagery captured flood waters of the lower reach of the Saint Croix River from north of St. Croix Falls, Wisconsin to its confluence with the Mississippi River.) Therefore, the mapping of VSB was interpreted onscreen by using true-color digital orthophotographic imagery acquired summer 2006 by the National Agriculture Imagery Program (NAIP).

The VSB map class was difficult to discern by viewing the NAIP imagery for the following two reasons: (1) the cobble, gravel, and sand would overexpose the imagery, diffusing even moderate density covers of herbaceous vegetation, and (2) the imagery source was of insufficient resolution to confidently identify vegetation species and density. Essentially, all shoreline areas along the Saint Croix River and Lake Saint Croix that appeared to be mostly exposed cobble, gravel, and/or sand were mapped by using the VSB map class.

Many sites of VSB were too small to map (well below the size of a MMU).

For AA, the VSB map class was assessed independently of all other map classes.





Skunk-cabbage Seepage Meadow (N/A)

Because areas of the Skunk-cabbage Seepage Meadow type are too small to map (well below the size of a MMU), no map class was derived to represent the *Symplocarpus foetidus* Herbaceous Vegetation Association (CEGL002385) in the NVCS. Therefore, the Skunk-cabbage Seepage Meadow type is captured as an inclusion by other map classes that were used to map the surroundings of these seepage meadows.

Sites of the Skunk-cabbage Seepage Meadow type typically occur in saturated, poorly drained, muck soils and are dominated by skunk-cabbage in the herbaceous layer. With these seeps always being small in area (typically <0.25 ha), the tree canopy from the surrounding forest overhangs most or all of the wetland. Trees and shrubs, including yellow birch, black ash, and gray alder, may be present (although in low density) within these small seeps.

For AA, because of the lack of a map class, the Skunk-cabbage Seepage Meadow type was not used to assess any map class.



Northern Sedge Poor Fen (HSP)

The Northern Sedge Poor Fen (HSP) map class represents the *Carex lasiocarpa* - *Carex oligosperma* / *Sphagnum* spp. Herbaceous Vegetation Association (CEGL002265) in the NVCS. The HSP map class was used only in the middle and upper sections of the SACN; it was not intended for use in the lower section. The HSP was mapped rarely throughout the middle and upper sections, except for in the middle two-thirds (along the Namekagon River) of the upper section, throughout which it was mapped infrequently.

The HSP map class captures sedge-dominated, seasonally-saturated, nutrient-poor fens occurring on sphagnum peat, receiving low minerotrophic influence from adjacent water sources. When occurring next to lakes and ponds, these nutrient-poor fens do not receive flooding. Sites of HSP are dominated by narrow-leaved sedges (with some element of ericads), and other nutrient-poor vegetation types are typically present, although they contribute <25% cover. Sites of HSP are common to low-flow peatland drainages and kettle basins, often in proximity to sites that were mapped as Leatherleaf Poor Fen (DLF) and Black Spruce and/or Tamarack Swamp (FST) map classes. It is assumed that sites of HSP that are smaller than the size of a MMU) were often mapped as inclusions of the DLF and FST map classes.

For AA, the HSP map class was assessed independently of all other map classes.



Leatherleaf Poor Fen (DLF)

The Leatherleaf Poor Fen (DLF) map class represents the *Chamaedaphne calyculata* / *Carex oligosperma* / *Sphagnum* spp. Poor Fen Dwarf-shrubland Association (CEGL005277) in the NVCS. The DLF map class was used only in the middle and upper sections of the SACN; it was not intended for use in the lower section. The DLF was mapped rarely throughout the middle section and infrequently throughout the upper section.

The DLF map class captures nutrient-poor fens within peatlands that are dominated by dwarf-shrub (<0.5 m) ericads, including leatherleaf and bog Labrador-tea. The total coverage of short and tall shrubs (0.5–5 m) is <25%. These dwarf-shrublands are located within low-flow peatland drainages and kettle basins receiving low minerotrophic influence from surrounding water sources, but they do not occur in shorefen locations. Scattered instances of black spruce, tamarack, and eastern white pine are commonly present, but canopy cover—even as tall shrubs (2–5 m)—is <25%. The herbaceous vegetation component is dominated by narrow-leaved sedges. Tall shrubs of gray alders and willows are common along the wetter margins of these poor fens. Sites of DLF are often located in proximity to sites that were mapped by using the Black Spruce and/or Tamarack Swamp (FST) and Northern Sedge Poor Fen (HSP) map classes. It is assumed that sites of HSP that are smaller than the size of a MMU were often mapped as inclusions of the DLF map class.

For AA, the DLF map class was assessed independently of all other map classes.



Tamarack Scrub Poor Fen (STS)

The Tamarack Scrub Poor Fen (STS) map class represents the *Larix laricina* / *Chamaedaphne calyculata* / *Carex lasiocarpa* Shrubland Association (CEGL005226) in the NVCS. The STS map class was used rarely and only in the upper section of the SACN. The only mapped occurrences are located along the upper-most reach of Namekagon River.

The STS map class captures nutrient-poor fens within peatlands of tamarack scrub (<2 m tall) over dwarf-shrub (<0.5 m) ericads, including leatherleaf and bog Labrador-tea. Sites of STS occur within flat basins that are very poorly drained; saturated peat soils and mossy hummocks are typical. The density of scrub tamarack can be very low, even as low as 10% cover. The total coverage of other short and tall shrubs (0.5–5 m), including gray alder, willow, and bog birch, is <25%.

For AA, the DLF map class was assessed independently of all other map classes.



Woolly-fruit Sedge Shore Fen (HSS)

The Woolly-fruit Sedge Shore Fen (HSS) map class represents the *Carex lasiocarpa* - (*Carex rostrata*) - *Equisetum fluviatile* Herbaceous Vegetation Association (CEGL005229) in the NVCS. The HSS map class was used rarely and at only a few locations in the upper section of the SACN.

The HSS map class captures seasonally saturated, sedge-dominated shorefens on sphagnum peat that receive minerotrophic influence from adjacent water sources; these can even form into floating peat mats. These minerotrophic-rich, herbaceous shorefens often receive flooding. Woollyfruit sedge, along with some bluejoint and cattails, are the characteristic herbaceous components; however, the RD of sedges to other herbaceous emergent vegetation is >25%. Ericads, including leatherleaf and bog Labrador-tea, are often present; however, ericad cover is <25%. The total coverage of short and tall shrubs combined is <25%. Sites of HSS are often located in proximity to sites that were mapped by using the Leatherleaf - Sweetgale Shore Fen (DLS) map class. It is assumed that sites of HSS that are smaller than the size of a MMU were often mapped as inclusions of the DLS class.

For AA, the HSS map class was assessed independently of all other map classes.



Leatherleaf - Sweetgale Shore Fen (DLS)

The Leatherleaf - Sweetgale Shore Fen (DLS) map class represents the *Chamaedaphne calyculata* - *Myrica gale* / *Carex lasiocarpa* Dwarf-shrubland Association (CEGL005228) in the NVCS. The DLS map class was used rarely and at only a few locations in the upper section of the SACN and in the far upper reach of the middle section.

The DLS map class captures seasonally saturated shorefens on sphagnum peat wherein the dominant shrubs are sweetgale and/or leatherleaf. Other short and tall shrubs (0.5–5 m), including gray alder, willow, and bog birch, may be present but contribute <25% cover. Trees, including tamarack, black spruce, and northern white-cedar, may also be present but contribute <25% canopy cover. These minerotrophic-rich shorefens are typically located along streams and small lake or pond basins receiving seasonal flooding. Sites of DLS are often located in proximity to sites that were mapped by using the Woolly-fruit Sedge Shore Fen (HSS) map class. It is assumed that sites of HSS that are smaller than the size of a MMU were often mapped as inclusions of the DLS class.

For AA, the DLS map class was assessed independently of all other map classes.



Sandbar Willow Shrubland (SWL)

The Sandbar Willow Shrubland (SWL) map class represents the *Salix interior* Temporarily Flooded Shrubland Association (CEGL008562) in the NVCS. The SWL map class was used rarely and at only a few locations in the lower section of the SACN and in the far lower reach of the middle section.

The SWL map class captures wet shrublands that have >25% shrub cover, wherein the dominant shrub is sandbar willow, and occur within the floodplain of the Saint Croix River. The RD of sandbar willow to other shrubs is >50%. Hardwood trees, including silver maple and green ash, may be present but contribute <25% canopy cover. Sites of SWL that are smaller than the size of a MMU were often mapped as inclusions of other map classes capturing forest and herbaceous types commonly occurring in wet locations within the floodplain.

For AA, the SWL map class was assessed independently of all other map classes.



Reed Canarygrass Eastern Marsh (HPH)

The Reed Canarygrass Eastern Marsh (HPH) map class represents the *Phalaris arundinacea* Eastern Herbaceous Vegetation Association (CEGL006044) in the NVCS. The HPH map class was used infrequently or rarely throughout the entire SACN; however, in the lower section of the SACN, sites of HPH were far more abundant than what was mapped. This is because flood waters were present when (October 10, 2005) color-infrared aerial photography for the SACN vegetation mapping project was collected. Most sites of HPH within the floodplain of the Saint Croix River in the lower section of the SACN were either completely or nearly inundated with flood waters and could not be recognized by using the October 2005 aerial photographs. In these instances, the CEGL006044 type is represented by the Flooded Meadow, Marsh, and Aquatic Herbaceous Vegetation Complex (HME) map class. The HME map class was used only in the lower section of the SACN to map several herbaceous vegetation types that were inundated with flood waters. An ancillary imagery source showing normal water conditions in lower section of the SACN was used to map the HME map class. For a fuller explanation of the mapping of herbaceous vegetation types that were affected by the flood event of October 2005, please refer to the description for the HME map class.

The HPH map class captures nearly monotypic stands of reed canary grass wherein the RD of reed canarygrass to other emergent herbaceous vegetation is >80%. Sites of HPH are prolific within floodplains zones that regularly flood. Scattered trees, including silver maple and green ash, can be present but contribute <25% cover. Likewise, scattered shrubs, including willows, dogwoods, spirea, and gray alders, can be present but contribute <25% cover.

In the lower section of the SACN, sites of HPH are abundant within the floodplain corridor of the Saint Croix River, commonly located between the silver maple floodplain forests and either the river itself or other emergent vegetation types common in deeper wetlands.

In the middle section of the SACN, sites of HPH tended to be ecotonal with the vegetation type that is represented by the Bluejoint Wet Meadow (HCC) map class. Given the parameter of the RD of bluejoint to reed canary grass of only >20%, distinctly mapping the HPH and HCC map classes was problematic.

In the upper section of the SACN, along the Namekagon River, sites of HPH do not typically occur, except for in locations affected by flowage lakes where the river is held back and water-level changes occur. Such sites usually occur at the tail ends of flowage lakes. All other such sites tend toward the HCC type.

Overall, sites of HPH are more abundant in the southern latitudes and less common northward.

For AA, the HPH map class was assessed independently of all other map classes.







Eastern Reed Marsh (HPG)

The Eastern Reed Marsh (HPG) map class represents the *Phragmites australis* Eastern North America Temperate Semi-natural Herbaceous Vegetation Association (CEGL004141) in the NVCS. The only location where the HPG map class was used was within the St. Croix Islands Wildlife Area (Wisconsin Department of Natural Resources), in the lower section of the SACN.

Although there was only one site mapped with the HPG map class, sites of HPG were more common than what was mapped. This is because flood waters were present when (October 10, 2005) color-infrared aerial photography for the SACN vegetation mapping project was collected. Most sites of HPG within the floodplain of the Saint Croix River in the lower section of the SACN were either completely or nearly inundated with flood waters and could not be recognized by using the October 2005 aerial photographs. In these instances, the CEGL004141 type is represented by the Flooded Meadow, Marsh, and Aquatic Herbaceous Vegetation Complex (HME) map class. The HME map class was used only in the lower section of the SACN to map several herbaceous vegetation types that were inundated with flood waters. An ancillary imagery source showing normal water conditions in lower section of the SACN was used to map the HME map class. For a fuller explanation of the mapping of herbaceous vegetation types that were affected by the flood event of October 2005, please refer to the description for the HME map class. The one stand of HPG that was mapped was emergent above the level of flood waters and was recognizable on the aerial photographs.

The HPH map class captures nearly monotypic stands of common reed wherein the RD of common reed to other emergent herbaceous vegetation is >80%. These common reed stands occur in deep marsh wetlands of the floodplain of the Saint Croix River.

For AA, the HPG map class was assessed independently of all other map classes.



Sedge Meadow and/or Emergent Herbaceous Marsh (HMM)

The Sedge Meadow and/or Emergent Herbaceous Marsh (HMM) map class represents three associations in the NVCS, including the *Schoenoplectus tabernaemontani* - *Typha* spp. - (*Sparganium* spp., *Juncus* spp.) Herbaceous Vegetation Association (CEGL002026), the *Typha* spp. Midwest Herbaceous Vegetation Association (CEGL002233), and the *Carex* (*rostrata*, *utriculata*) - *Carex lacustris* - (*Carex vesicaria*) Herbaceous Vegetation Association (CEGL002257). These wetland herbaceous vegetation types were originally mapped distinctly; however, results from the AA indicated confusion in mapping these types. Therefore, after discussion with NPS staff, these three association types were merged into one map class.

The HMM map class was used throughout the entire SACN. The mapping of HMM was most frequent in the middle section of the SACN, common in the upper section, and rare in the lower section; however, in the lower section of the SACN, sites of HMM were more abundant than what was mapped. This is because flood waters were present when (October 10, 2005) color-infrared aerial photography for the SACN vegetation mapping project was collected. Most sites of HMM within the floodplain of the Saint Croix River in the lower section of the SACN were either completely or nearly inundated with flood waters and could not be recognized by using the October 2005 aerial photographs. In these instances, the CEGL002026, CEGL002233, and CEGL002257 types are represented by the Flooded Meadow, Marsh, and Aquatic Herbaceous Vegetation Complex (HME) map class. The HME map class was used only in the lower section of the SACN to map several herbaceous vegetation types that were inundated with flood waters. An ancillary imagery source showing normal water conditions in lower section of the SACN was used to map the HME map class. For a fuller explanation of the mapping of herbaceous vegetation types that were affected by the flood event of October 2005, please refer to the description for the HME map class.

The HMM map class captures herbaceous meadow and marsh wetlands that are dominated by broad-leaved sedges, woolgrass, bulrushes, cattails, and/or bur-reed. The RD of sedges and woolgrass to other herbaceous vegetation (including bluejoint and reed canarygrass) is >25%, and/or the RD of bulrushes, cattails, and bur-reed to other herbaceous vegetation (including common reed, rice cutgrass, and arrowhead) is >50%. Locations of HMM can be either within floodplains of rivers or on perched basins and slow flowing drainages. Sites are rich in minerotrophics and occur on muck-substrate soils, but they do not occur on peat-substrate soils with sphagnum (e.g., fen).

For AA, the HMM map class was assessed independently of all other map classes.









Wild Rice Marsh (HWR)

The Wild Rice Marsh (HWR) map class represents the *Zizania* (*aquatica*, *palustris*) Herbaceous Vegetation Association (CEGL002382) in the NVCS. The HWR map class was rarely used and only in the upper section of the SACN. Sites of HWR do exist in the lower section of the SACN; however, they were not mapped because flood waters were present when (October 10, 2005) color-infrared aerial photography for the SACN vegetation mapping project was collected. Most sites of HWR within the floodplain of the Saint Croix River in the lower section of the SACN were either completely or nearly inundated with flood waters and could not be recognized by using the October 2005 aerial photographs. In these instances, the CEGL002382 type is represented by the Flooded Meadow, Marsh, and Aquatic Herbaceous Vegetation Complex (HME) map class. The HME map class was used only in the lower section of the SACN to map several herbaceous vegetation types that were inundated with flood waters. An ancillary imagery source showing normal water conditions in lower section of the SACN was used to map the HME map class. For a fuller explanation of the mapping of herbaceous vegetation types that were affected by the flood event of October 2005, please refer to the description for the HME map class.

The HWR map class captures deep emergent marshes dominated by wild rice. The RD of wild rice to other emergent herbaceous vegetation is >50%, wherein the RD of wild rice to floating aquatic vegetation is >25%. Sites of HWR are common to the shallow marsh areas of flowage lakes of the Namekagon River. Stands of wild rice were senescent when the color-infrared aerial photographs were obtained (in October 2005), thus requiring careful review to map HWR. Furthermore, there was greater senescence of wild rice in the northern latitudes.

For AA, the HWR map class was assessed independently of all other map classes.



Wet Meadow Mixed Herbaceous (HWM)

The Wet Meadow Mixed Herbaceous (HWM) map class represents mixed herbaceous wetlands within the Eastern North American Wet Meadow Group (G112) in the NVCS. The HWM map class was used throughout the entire SACN, commonly in the middle section, infrequently in the lower section, and rarely to infrequently in the upper section.

This HWM class captures wetland meadows receiving disturbance from dynamic hydrology—from human or beaver activities—and wherein there is a diverse mix of emergent herbaceous vegetation (pioneering and persistent). Locations of HWM are typically on perched basins and slow flowing drainages, usually outside of floodplain areas that regularly flood. The disturbance is such that the community of vegetation is non-distinct from any single established herbaceous vegetation type, particularly Bluejoint Wet Meadow (HCC) and Northern Sedge Wet Meadow (HSG). Although bluejoint and sedges are common to HWM sites, the RDs of each to the mix of herbaceous vegetation is <25%. Woolgrass can be a common component of HWM. Herbaceous beaver meadows can be classified as HWM, HCC, or HSG, depending on beaver activity and subsequent vegetation response. Those beaver meadows with frequent or recent changes were likely assigned to the HWM map class.

Trees and shrubs are often present, but they each contribute <25% cover. Shrubs and trees common to sites of HWM include gray alder, willows, spirea, red maple, quaking aspen, and paper birch.

For AA, the HWM map class was assessed independently of all other map classes.



Bluejoint Wet Meadow (HCC)

The Bluejoint Wet Meadow (HCC) map class represents the *Calamagrostis canadensis* - *Eupatorium maculatum* Herbaceous Vegetation Association (CEGL005174) in the NVCS. The HCC map class was used throughout the middle and upper sections of the SACN and only in the far upper reach of the lower section. Mapping occurrences of HCC was rare to infrequent throughout the SACN; however, the mapping occurrence was somewhat common throughout the upper reach of the Saint Croix River, in the upper section of the SACN.

The HCC map class captures herbaceous wetland meadows that are characterized by bluejoint. Reed canarygrass is a common associate to bluejoint. The combined RD of bluejoint and reed canarygrass to all other emergent herbaceous vegetation is >50%; however, the RD of sedges to other herbaceous vegetation is <25%. It is not uncommon to have a significant amount of reed canarygrass present, even dominant to bluejoint; however, the RD of reed canarygrass to bluejoint is <80%.

In the middle section of the SACN, sites of HCC tend to be ecotonal, represented by the Reed Canarygrass Eastern Marsh (HPH) map class. Given the classification parameter that the RD of bluejoint to reed canary grass need only be >20%, the distinct mapping of the HPH and HCC map classes was problematic. In the upper section of the SACN, along the Namekagon River, sites of HPH do not typically occur except for in locations affected by flowage lakes where the river is held back and water-level changes occur. Such sites usually occurred at the tail ends of these flowage lakes. Thus, mapping confusion was limited in the upper section of the SACN.

For AA, the HCC map class was assessed independently of all other map classes.



Upright Sedge Wet Meadow (HUS)

The Upright Sedge Wet Meadow (HUS) map class represents the *Carex stricta* - *Carex* spp. Herbaceous Vegetation Association (CEGL002258) in the NVCS. The HUS map class was used rarely and only in the upper section of the SACN.

The HUS map class captures herbaceous meadows that are dominated by upright sedge. Other graminoids commonly present include bluejoint, Bebb's sedge, Hayden's sedge, hop sedge, Tuckerman's sedge, and whitegrass. Most occurrences of HUS mapped within the SACN were located along the Namekagon River, but one occurrence of HUS was mapped along the Saint Croix River near Riverside Landing. By viewing the aerial photographs, it was difficult to discern HUS from other sedge meadows, particularly the sedge meadow type represented (in part) by the Sedge Meadow and/or Emergent Herbaceous Marsh (HMM) map class. Sites of HUS are poorer minerotrophically than the sedge meadows of HMM, but they are not as poor as those supporting the sedge vegetation type represented by the Northern Sedge Poor Fen (HSP) map class. Sites of HUS may have sphagnum present, but they are not fen-like on peat substrate.

For AA, the HUS map class was assessed independently of all other map classes.



Mixed Shrub Swamp and/or Fen (SMW)

The Mixed Shrub Swamp and/or Fen (SMW) map class represents both the *Cornus sericea* - *Salix* (*bebbiana*, *discolor*, *petiolaris*) / *Calamagrostis stricta* Shrubland Association (CEGL002187) and the *Betula pumila* / *Chamaedaphne calyculata* / *Carex lasiocarpa* Shrubland Association (CEGL002494) in the NVCS. Overall, the occurrence of the CEGL002187 type is much more common than the CEGL002494 type. These two types were originally mapped distinctly; however, results from the AA indicated confusion in mapping between these two types. Therefore, after discussion with NPS staff, these two association types were merged into one map class.

The SMW map class was used throughout the entire SACN, infrequently to commonly in the middle and upper sections. Only a few occurrences of SMW were mapped in the far upper reach of the lower section of the SACN. Occurrences of the CEGL002494 are only at a few locations in the upper section of the SACN, whereas occurrences of CEGL002187 are common throughout both the middle and upper sections.

The SMW map class captures shrub swamps and/or shrub fens having >25% shrub cover and wherein dogwoods, willows, spirea, and/or bog birch with leatherleaf are dominant. The RD of the aforementioned shrubs to other shrubs is >50%, wherein the RD of gray alder to all other shrubs should be <40%. The substrate of SMW can range from muck to sphagnum over peat. The swamp-muck sites typically occur on flat depressions and areas within floodplains that only periodically flood. Dogwoods, willows, and spirea are the dominant shrubs, with a definitive graminoid layer present that includes sedges, bluejoint, and reed canarygrass. The fen-peat sites can occur in locations similar to those of the muck-swamp sites, yet a layer of sphagnum peat is present and bog birch is the dominant shrub, with a definitive dwarf-shrub ericad layer that includes leatherleaf.

For AA, the SMW map class was assessed independently of all other map classes.













Central Cordgrass Wet Prairie (N/A)

Because areas of the Central Cordgrass Wet Prairie type are too small to map (well below the size of a MMU), no map class was derived to represent the *Spartina pectinata* - *Carex* spp. - *Calamagrostis canadensis* - *Lythrum alatum* - (*Oxypolis rigidior*) Herbaceous Vegetation Association (CEGL002224) in the NVCS. Therefore, the Central Cordgrass Wet Prairie type is captured as an inclusion by other map classes, likely by the Floodplain Hardwood Forest (FHF) map class or the Flooded Meadow, Marsh, and Aquatic Herbaceous Vegetation Complex (HME) map class. The only locations known (from vegetation sampling plots) of Central Cordgrass Wet Prairie are in the lower section of the SACN.

Sites of the Central Cordgrass Wet Prairie type are dominated by prairie cordgrass situated along riverbanks and seepage meadows. Reed canarygrass can be a common associate to cordgrass, and a diverse mix of other graminoids and forbs is typically interspersed throughout the stand.

For AA, because of the lack of a map class, the Central Cordgrass Wet Prairie type was not used to assess any map class.

No representative pictures are provided.

Arrowhead - Rice Cutgrass Marsh (N/A)

No map class was derived to represent the *Sagittaria latifolia* - *Leersia oryzoides* Herbaceous Vegetation Association (CEGL005240) in the NVCS, even though sites of this association were common throughout the lower section of the SACN. This is because flood waters were present when (October 10, 2005) color-infrared aerial photography for the SACN vegetation mapping project was collected. Because all sites of the Arrowhead - Rice Cutgrass Marsh type occur within the floodplain of the Saint Croix River in the lower section of the SACN, they were either completely or nearly inundated with flood waters and could not be recognized by using the October 2005 aerial photographs. The CEGL005240 type is, however, represented by the Flooded Meadow, Marsh, and Aquatic Herbaceous Vegetation Complex (HME) map class. The HME map class was used only in the lower section of the SACN to map several herbaceous vegetation types that were inundated with flood waters. An ancillary imagery source showing normal water conditions in lower section of the SACN was used to map the HME map class. For a fuller explanation of the mapping of herbaceous vegetation types that were affected by the flood event of October 2005, please refer to the description for the HME map class.

Sites of the Arrowhead - Rice Cutgrass Marsh type are dominated by broadleaf arrowhead and/or rice cutgrass situated along wetland zones of the Saint Croix River, including both main channel embankments and backwater oxbows and pools.

For AA, the Arrowhead - Rice Cutgrass Marsh type was used to assess the HME map class.






Water-lily Aquatic Wetland (HFA)

The Water-lily Aquatic Wetland (HFA) map class represents the *Nuphar advena - Nymphaea odorata* Herbaceous Vegetation Association (CEGL002386) in the NVCS. The HFA map class was used throughout the entire SACN, infrequently in the upper section and rarely in the middle and lower sections; however, in the lower section of the SACN, sites of HFA were far more abundant than what was mapped. This is because flood waters were present in the lower section of the SACN when (October 10, 2005) color-infrared aerial photography for the SACN vegetation mapping project was collected. Sites of HFA within the floodplain of the Saint Croix River were inundated with flood waters and could not be recognized by using the October 2005 aerial photographs. In these instances, the CEGL002386 type is represented by the Flooded Meadow, Marsh, and Aquatic Herbaceous Vegetation Complex (HME) map class. The HME map class was used only in the lower section of the SACN to map several herbaceous vegetation types that were inundated with flood waters. An ancillary imagery source showing normal water conditions in lower section of the SACN was used to map the HME map class. For a fuller explanation of the mapping of herbaceous vegetation types that were affected by the flood event of October 2005, please refer to the description for the HME map class.

This HFA class captures deep-water marshes wherein floating-leaved aquatic vegetation (mostly variegated yellow pond-lily and American white waterlily) contributes >10% cover, with herbaceous emergent vegetation contributing <25% cover. Submergent vegetation, such as floating pondweed and watermilfoil, may be of high density. The vegetation of HFA is customary to small ponds, deep-water margins of flowage lakes, and river backwaters.

Some of the floating aquatic vegetation had senesced before aerial photography was collected in October, thus limiting the capacity to detect HFA via photography. This was true particularly in the northern latitudes. Sites of HFA were mapped when floating aquatic vegetation was observable on the fall aerial photographs. It is assumed that sites of HFA covering areas greater than the size of a MMU existed at the time photography was obtained than what could actually be observed on the photographs. It is most likely that these unveiled areas of HFA were captured in the Midwest Pondweed Submerged Aquatic Wetland (HSV) map class, because HSV shares the same deep-water marsh environment as HFA. Please refer to the HSV map-class description to understand the aggressive approach in mapping HSV and how HFA might be further represented.

For AA, the HFA map class was assessed independently of all other map classes.



Midwest Pondweed Submerged Aquatic Wetland (HSV)

The Midwest Pondweed Submerged Aquatic Wetland (HSV) map class represents the *Potamogeton* spp. - *Ceratophyllum* spp. Midwest Herbaceous Vegetation Association (CEGL002282) in the NVCS. The HSV map class was used throughout the entire SACN, infrequently in the middle and upper sections and rarely in the lower section; however, in the lower section of the SACN, sites of HSV were far more abundant than what was mapped. This is because flood waters were present in the lower section of the SACN when (October 10, 2005) color-infrared aerial photography for the SACN vegetation mapping project was collected. Sites of HSV within the floodplain of the Saint Croix River were inundated with flood waters and could not be recognized by using the October 2005 aerial photographs. In these instances, the CEGL002282 type is represented by the Flooded Meadow, Marsh, and Aquatic Herbaceous Vegetation Complex (HME) map class. The HME map class was used only in the lower section of the SACN to map several herbaceous vegetation types that were inundated with flood waters. An ancillary imagery source showing normal water conditions in lower section of the SACN was used to map the HME map class. For a fuller explanation of the mapping of herbaceous vegetation types that were affected by the flood event of October 2005, please refer to the description for the HME map class.

The HSV map class captures deep-water marshes wherein submergent vegetation (e.g., pondweed, watermilfoil) contributes >10% cover, with floating-leaved aquatic vegetation contributing <10% cover and herbaceous emergent vegetation contributing <25% cover. Sites of HSV is customary to small ponds, deep-water margins of flowage lakes, and river backwaters.

Some of the submergent and floating aquatic vegetation had senesced before aerial photography was collected in October, thus limiting the capacity to detect of HSV via photography. Sites of HSV were mapped when submergent vegetation was observable on the fall aerial photographs. It is assumed, however, that sites of HSV covering areas greater than the size of a MMU existed at the time photography was obtained than what could actually be observed on the photographs. The approach in mapping most ponds was to assign them to the HSV map class even when appearance of submergent vegetation was lacking. This strategy was part of an aggressive effort to map HSV based on likely locations. This mapping decision was based on field experience, which indicated that most ponds contained submergent vegetation. When the HSV map class was assigned to ponds appearing as open water on the aerial photographs, the 10–25% cover density (physiognomic modifier) was applied to the map-class attribute.

For AA, the HSV map class was assessed independently of all other map classes.



Flooded Meadow, Marsh, and Aquatic Herbaceous Vegetation Complex (HME)

The Flooded Meadow, Marsh, and Aquatic Herbaceous Vegetation Complex (HME) map class represents, in part, nine associations within the NVCS, including: *Phalaris arundinacea* Eastern Herbaceous Vegetation (CEGL006044), *Phragmites australis* Eastern North America Temperate Semi-natural Herbaceous Vegetation (CEGL004141), *Schoenoplectus tabernaemontani* - *Typha* spp. - (*Sparganium* spp., *Juncus* spp.) Herbaceous Vegetation (CEGL002026), *Typha* spp. Midwest Herbaceous Vegetation (CEGL002233), *Zizania* (*aquatica*, *palustris*) Herbaceous Vegetation (CEGL002382), *Carex* (*rostrata*, *utriculata*) - *Carex lacustris* - (*Carex vesicaria*) Herbaceous Vegetation (CEGL002257), *Sagittaria latifolia* - *Leersia oryzoides* Herbaceous Vegetation (CEGL005240), *Nuphar advena* - *Nymphaea odorata* Herbaceous Vegetation (CEGL002386), and *Potamogeton* spp. - *Ceratophyllum* spp. Midwest Herbaceous Vegetation (CEGL002282).

The HME map class was developed specifically for the SACN vegetation mapping project and applied to only the lower section of the SACN, which includes the area from Nevers Dam Landing south to the Mississippi River. The HME map class was used to map only the areas within the floodplain of the Saint Croix River where the herbaceous vegetation was obscured on the aerial photographs either completely or partially by flood waters such that classifying and mapping the herbaceous vegetation types were not possible. The aerial photography for the SACN vegetation mapping project was acquired during October 10, 2005, during a significant flooding event that affected the lower section of the SACN. Most herbaceous wetland types within the immediate riverine floodplain corridor were inundated with flood waters at the time of photography collection. This made it impossible (or extremely difficult at best) to interpret, classify, and delineate the herbaceous vegetation.

Some herbaceous vegetation was sufficiently visible to map and assign a map class. Locations that were on high terraces of the floodplain or were in the far upstream extent of the flooded zone provided enough visible vegetation to sufficiently classify and map vegetation by using the October 2005 aerial photographs. Where these herbaceous wetlands were not recognizable, onscreen, two-dimensional interpretation was performed by using true-color, digital-orthophotograph imagery acquired summer 2006 by the National Agriculture Imagery Program (NAIP).

Because NAIP imagery is acquired at a one-meter ground sample distance, it did not provide sufficient resolution to distinctly map individual vegetation types. The NAIP imagery did, however, provide sufficient resolution to map the extents of herbaceous vegetation in general. These mapped polygons were classified with the HME map class.

Most of the listed associations represented by the HME map class are also represented by other map classes, but the CEGL005240 type is not. All sites of CEGL005240 occurred within the flood-inundated portions of the lower section of SACN; therefore, no map class was developed.

For AA, the HME map class was assessed independently of all other map classes.

Because the HME map class represents vegetation types that are presented elsewhere in this appendix—most of which are represented by other map classes—no representative pictures are provided.

Northern (Laurentian) Igneous - Metamorphic Dry Cliff (N/A)

Because areas of the Northern (Laurentian) Igneous - Metamorphic Dry Cliff type are too small to map (well below the size of a MMU), no map class was derived to represent the Igneous - Metamorphic Northern Dry Cliff Sparse Vegetation Association (CEGL002300) in the NVCS. Therefore, the Northern (Laurentian) Igneous - Metamorphic Dry Cliff type is captured as an inclusion by other map classes that were used to map the surroundings of these dry cliffs.

Sites of Northern (Laurentian) Igneous - Metamorphic Dry Cliff occur on dry cliffs of the basalt dalles, which feature bedrock exposures and a covering of mosses and lichens. A sparse layer of eastern red-cedar can be present. These dry cliffs are located in the Interstate State Parks of Minnesota and Wisconsin.

For AA, because of the lack of a map class, the Northern (Laurentian) Igneous - Metamorphic Dry Cliff type was not used to assess any map class.





Midwest Moist Limestone - Dolostone Cliff (N/A)

Because areas of the Midwest Moist Limestone - Dolostone Cliff type are too small to map (well below the size of a MMU), no map class was derived to represent the Limestone - Dolostone Midwest Moist Cliff Sparse Vegetation Association (CEGL002292) in the NVCS; Therefore, the Midwest Moist Limestone - Dolostone Cliff type is captured as an inclusion by other map classes that were used to map the surroundings of these moist cliffs.

Sites of Midwest Moist Limestone - Dolostone Cliff occur on moist, siltstone cutbank cliffs located adjacent to streams and rivers. These cutbank cliffs are sparsely vegetated with trees, shrubs, and herbaceous vegetation and are moist due to seeps or shade.

For AA, because of the lack of a map class, the Midwest Moist Limestone - Dolostone Cliff type was not used to assess any map class.



Midwest Dry Sandstone Cliff (N/A)

Because areas of the Midwest Dry Sandstone Cliff type are too small to map (well below the size of a MMU), no map class was derived to represent the Sandstone Dry Cliff Sparse Vegetation Association (CEGL002045) in the NVCS. Therefore, the Midwest Dry Sandstone Cliff type is captured as an inclusion by other map classes that were used to map the surroundings of these dry cliffs.

Sites of Midwest Dry Sandstone Cliff occur on dry, sandstone cliffs and overhangs that feature bedrock exposures and a covering of mosses and lichens. These sandstone cliffs are sparsely vegetated with trees, shrubs, and herbaceous vegetation.

For AA, because of the lack of a map class, the Midwest Dry Sandstone Cliff type was not used to assess any map class.







Midwest Moist Sandstone Cliff (N/A)

Because areas of Midwest Moist Sandstone Cliff are too small to map (well below the size of a MMU), no map class was to represent the Sandstone Midwest Moist Cliff Sparse Vegetation Association (CEGL002287) in the NVCS. Therefore, the Midwest Moist Sandstone Cliff type is captured as an inclusion by other map classes that were used to map the surroundings of these moist cliffs.

Sites of Midwest Moist Sandstone Cliff occur on steep tali of bare-soiled slopes that feature minimal exposed bedrock and are sparsely vegetated with hardwood trees, including paper birch.

For AA, because of the lack of a map class, the Midwest Moist Sandstone Cliff type was not used to assess any map class.





Cranberry Crop Field (DCF)

The Cranberry Crop Field (DCF) map class falls under the Agricultural Vegetation Cultural Class (7) in the NVCS, wherein it is defined down to Level 6, the Berries Subgroup. The DCF map class was used once, in the upper section of the SACN just southwest of Hayward, Wisconsin.

This map class captures cranberry fields that are active for harvesting. Both the cranberry beds and levees are included in the mapping of DCF. The levees can include short-statured trees and shrubs.

Because the DCF map class represents a cultural vegetation type, it was not assessed for accuracy.

No representative pictures are provided.

Herbaceous Crop Field (HCF)

The Herbaceous Crop Field (HCF) map class falls under the Agricultural Vegetation Cultural Class (7) in the NVCS, wherein it is defined down to Level 3, the Cultivated Crop Formation. The HCF map class was used commonly in the lower section of the SACN and rarely in the middle and upper sections. The only occurrences mapped in the upper section of the SACN were near Trego, Wisconsin.

This map class captures areas cultivated for row crops (e.g., corn, soybeans) or improved pasture of monotypic or biennial herbaceous vegetation (e.g., alfalfa, clover). Improved pastures were sometimes difficult to distinguish from fields of perennial vegetation that are used for pasturing and haying and are represented by the Pasture and Hay Field (HPF) map class. Given the presence of dynamic land-use practices, distinctions between HCF and HPF can be subtle.

Because the HCF map class represents a cultural vegetation type, it was not assessed for accuracy.



Pasture and Hay Field (HPF)

The Pasture and Hay Field (HPF) map class falls under the Agricultural Vegetation Cultural Class (7) in the NVCS, wherein it is defined down to Level 4, the Permanent Pasture & Hayland Subformation. The HPF map class was used commonly in the lower section of the SACN as well as in the lower half of the middle section and along most of the Namekagon River in the upper section. In other areas of the SACN, mapped instances of the HPF map class were somewhat rare.

The HPF map class captures herbaceous lands of perennial grasses and forbs allowed to grow naturally and that are cut for hay and/or used for pasture. These perennial fields were sometimes difficult to distinguish from herbaceous fields that were improved for pasturing and haying. These improved lands consisted of monotypic or biennial herbaceous vegetation (e.g., alfalfa, clover) and are represented by the Herbaceous Crop Field (HCF) map class. Furthermore, perennial herbaceous fields were also difficult to distinguish from lands that were left idle (that is, that were not actively being used for agricultural purposes) and are represented by the Ruderal Grassland (HMX) map class. Given the presence of dynamic land-use practices, distinctions between HPF and the improved pastures of HCF, as well as between HPF and the fallow fields of HMX, can be subtle.

Because the HPF map class represents a cultural vegetation type, it was not assessed for accuracy.

No representative pictures are provided.



Developed Area (CDV)

The Developed Area (CDV) map class falls under the Developed Vegetation Cultural Class (8) in the NVCS, wherein it is defined down to Level 3, the Other Developed Urban / Built Up Vegetation Formation. From there, finer distinctions are defined with the use of modifiers to depict the amount of impervious surface of developed areas. These modifiers represent classes 21–24 in the NLCD. The CDV map class captures areas having regular human use. Examples at the SACN include roads and their right-of-ways, urban areas, homesteads and farmsteads, campgrounds, picnic areas, and various SACN grounds (such as visitor centers and building structures). The CDV map class was used throughout the entire SACN, although in varying degrees depending upon location and impervious-surface modifier.

The following sections describe classes 21–24 in the NLCD, which were used to further attribute (by using a special modifier) the CDV map class.

Open Space – 21 (O)

This class includes areas consisting mostly of vegetation in the form of lawn grasses but that also have a mixture of some constructed materials. Impervious surfaces account for less than 20% of total cover. These areas most commonly include large-lot, single-family housing units, parks, golf courses, and vegetation planted in developed settings for recreation, erosion control, or aesthetic purposes.

Low Intensity – 22 (L)

This class includes areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 20–49% of total cover. These areas most commonly include single-family housing units.

Medium Intensity – 23 (M)

This class includes areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 50–79% of total cover. These areas most commonly include single-family housing units.

High Intensity – 24 (H)

This class includes highly developed areas where people reside or work in high numbers. Examples include apartment complexes, row houses, and commercial/industrial facilities. Impervious surfaces account for 80–100% of the total cover.

Because the CDV map class represents cultural vegetation classification, it was not assessed for accuracy.









Stream and River (NSR)

The Stream and River (NSR) map class represents, in part, the Open Water (11) class in the NLCD. The NSR class captures open-water streams and rivers. Wetland vegetation—aquatic and/or emergent—may be present (usually in shallow waters close to shorelines) but should contribute <10–25% cover; however, small areas (below the size of a MMU) of wetland vegetation having >10–25% cover—including herbaceous vegetation, shrubs, and trees—may be present. These small vegetation areas would be captured as inclusions of NSR. When distinct from the immediate surroundings, wetland vegetation types occurring in areas less (even by half) than the size of the standard MMU were often mapped. Open rivers and streams are examples of such an environment.

The NSR map class was used throughout the entire SACN. Streams that were too narrow to map were mapped as inclusions of the map classes used for the surrounding lands. The rivers and streams mapped as the NSR map class include the following: Saint Croix River, Namekagon River, Kinnickinnic River, Valley Branch, Apple River, Trade River Creek, Sunrise River, Goose Creek, Rush Creek, Rock Creek, Wood River, Snake River, Redhorse Creek, Kettle River, Bear Creek, Sand Creek, Hay Creek, Barrett Creek, Clam River, Crooked Creek, Lower Tamarack River, Yellow River, Loon Creek, Upper Tamarack River, Chase Creek, Buddey Creek, Potter Creek, Moose River, Totagatic River, Webb Creek, Whalen Creek, and Bean Brook.

Because the NSR map class represents a non-vegetation unit, it was not assessed for accuracy.









Open Water Pond (NWP)

The Open Water Pond (NWP) map class represents, in part, the Open Water (11) class in the NLCD. This map class captures open water ponds that are <8 ha in area and have <10–25% cover of wetland vegetation present. Open water lakes that were >8 ha, were mapped as the Open Water Lake (NWL) map class. Open water ponds are usually deep enough such that vegetation is unable to take root. Wetland vegetation—aquatic and/or emergent—may be present (usually in shallow waters close to shorelines) but should contribute <10–25% cover; however, small areas (below the size of a MMU) of wetland vegetation having >10–25% cover—including herbaceous vegetation, shrubs, and trees—may be present. These small vegetation areas would be mapped as inclusions of NWP. When distinct from the immediate surroundings, wetland vegetation types occurring in areas less (even by half) than the size of the standard MMU were often mapped. Open water ponds are an example of such an environment. The NWP map class was used throughout the entire SACN.

Usually, shallow ponds within beaver meadows provide an environment for wetland vegetation to thrive, and some allow for aquatic vegetation. Some aquatic vegetation had senesced before aerial photography was collected in October; therefore, the capacity to detect it via photography was limited. This posed a problem for mapping the Midwest Pondweed Submerged Aquatic Wetland (HSV) and Northern Water-lily Aquatic Wetland (HFA) classes. Thus, the approach to mapping most shallow ponds appearing as open water on the aerial photographs was to assign such units to the HSV map class. This was an aggressive effort to map aquatic vegetation based on likely locations.

Because the NWP map class represents a non-vegetation unit, it was not assessed for accuracy.



Open Water Lake (NWL)

The Open Water Lake (NWL) map class represents, in part, the Open Water (11) class in the NLCD. This map class captures open water lakes that are >8 ha in area and have <10–25% cover of wetland vegetation present. Open water ponds that were <8 ha were mapped as the Open Water Pond (NWP) map class. Open water lakes are deep such that vegetation is unable to take root. Wetland vegetation—aquatic and/or emergent—may be present (usually in shallow waters close to shorelines) but should contribute <10–25% cover; however, small areas (below the size of a MMU) of wetland vegetation having >10–25% cover—including herbaceous vegetation, shrubs, and trees—may be present. These small vegetation areas would be mapped as inclusions of NWL. When distinct from the immediate surroundings, wetland vegetation types occurring in areas less (even by half) than the size of the standard MMU were often mapped. The shores of open water lakes are an example of such an environment.

Included with NWL are the series of flowage lakes along the Saint Croix and Namekagon Rivers. These flowage lakes are bodies of water that are held back, thus significantly slowing the flow of water across a broader basin. The NWL map class was used throughout the entire SACN. Lakes mapped as NWL include Lake Saint Croix, Indian Head Flowage, Saint Croix Flowage, Bass Lake, Pear Lake, Trego Lake, Lake Hayward, Phipps Flowage, and Namekagon Lake.

Because the NWL map class represents a non-vegetation unit, it was not assessed for accuracy.







Table E-2. Map classification listing, sorted alphabetically by map-class code, used for the Saint Croix National Scenic Riverway (Minnesota/Wisconsin) vegetation mapping project.

Map-class Code	Map-class Name
CDV	Developed Area
DCF	Cranberry Crop Field
DLF	Leatherleaf Poor Fen
DLS	Leatherleaf - Sweetgale Shore Fen
FAC	Aspen - Birch / Boreal Conifer Forest
FAL	Ash - Elm - Mixed Lowland Hardwood Forest (ash - elm phase)
FAM	Aspen - Birch / Hardwood Forest
FBA	Black Ash - Mixed Hardwood Swamp
FBL	Ash - Elm - Mixed Lowland Hardwood Forest (bur oak phase)
FCA	White-cedar - Black Ash Swamp
FCP	Spruce - Fir - Aspen Forest
FCS	White-cedar - (Mixed Conifer) / Alder Swamp
FCX	Conifer Ruderal Forest
FDX	Hardwood Ruderal Forest
FHF	Floodplain Hardwood Forest
FJA	Jack Pine - Quaking Aspen Forest
FJO	Jack Pine - Northern Pin Oak Forest
FJP	Jack Pine Forest
FMT	Sugar Maple - American Basswood Forest
FMX	Conifer - Hardwood Ruderal Forest
FOM	Northern Red Oak - Sugar Maple Forest
FPB	Northern Pin Oak - (Bur Oak) Forest
FPE	Conifer Plantation
FPH	Paper Birch / Sugar Maple - Mixed Hardwoods Forest
FPO	White Pine - (Red Pine) - Oak Forest
FPR	White Pine - (Red Pine) Driftless Bluff Forest
FQA	Aspen / American Hazel Forest
FQL	Ash - Elm - Mixed Lowland Hardwood Forest (aspen phase)
FRA	Red Pine - Aspen - Birch Forest
FRM	Red Maple - Ash - Birch Swamp Forest
FRP	Red Pine / Blueberry Dry Forest
FSF	Spruce - Fir / Mountain Maple Forest
FST	Black Spruce and/or Tamarack Swamp
FWA	White Pine - Aspen - Birch Forest
FWM	White Pine / Mountain Maple Mesic Forest
FWR	Midwestern White Oak - Red Oak Forest
HCC	Bluejoint Wet Meadow
HCF	Herbaceous Crop Field
HDP	Midwest Dry Sand Prairie
HFA	Water-lily Aquatic Wetland
HME	Meadow and/or Marsh Herbaceous Vegetation Complex
HMM	Sedge Meadow and/or Emergent Herbaceous Marsh
HMP	Midwest Dry-Mesic Grassland Prairie
HMX	Ruderal Grassland
HPF	Pasture and Hay Field
HPG	Eastern Reed Marsh

Map-class Code	Map-class Name
HPH	Reed Canarygrass Eastern Marsh
HSP	Northern Sedge Poor Fen
HSS	Woolly-fruit Sedge Shore Fen
HSV	Midwest Pondweed Submerged Aquatic Wetland
HUS	Upright Sedge Wet Meadow
HWM	Wet Meadow Mixed Herbaceous
HWR	Wild Rice Marsh
NSR	Stream and River
NWL	Open Water Lake
NWP	Open Water Pond
SAS	Gray Alder Swamp
SDX	Deciduous Ruderal Shrubland
SHZ	Hazelnut - Serviceberry Ruderal Shrubland
SMW	Mixed Shrub Swamp and/or Fen
SMX	Conifer - Deciduous Ruderal Shrubland
STS	Tamarack Scrub Poor Fen
SWL	Sandbar Willow Shrubland
VSB	Riverine Cobble - Gravel - Sand Shore
WBO	North-Central Dry-Mesic Oak Woodland
WJO	Jack Pine - Red Pine / Scrub Oak Woodland
WOR	Oak Driftless Bluff Woodland
WRC	Eastern Red-cedar - (Hardwood) Bluff Woodland

Appendix F: Accuracy Assessment Form

NATIONAL PARK VEGETATION MAPPING PROGRAM: ACCURACY ASSESSMENT POINT FORM

IDENTIFIERS/LOCATORS

Field Point Code _____ Database Point Code _____

State _____ Park Name _____ Park Site Name _____

Quad Name _____ Quad Code _____

Primary Veg Assoc Name _____

Secondary Veg Assoc Name _____

Other Veg Assoc within 50 m _____

Classification Comments:

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

GPS Error _____ m

please do not complete the following information when in the field

Corrected UTM X ___ ___ ___ ___ ___ ___ m E Corrected UTM Y ___ ___ ___ ___ ___ ___ ___ m N UTM Zone_____

Survey Date _____ Surveyors _____

ENVIRONMENTAL DESCRIPTION

Elevation _____ Slope _____ Aspect _____

Topographic Position

Landform

Environmental Comments (including hydrology):

Unvegetated Surface: *(please use the cover scale below)*
___Bedrock
___Litter, duff
___Wood (> 1 cm)
___Large rocks (cobbles, boulders > 10 cm)
___Small rocks (gravel, 0.2-10 cm)
___Sand (0.1-2 mm)
___Bare soil
___Other: _____

VEGETATION DESCRIPTION

Leaf phenology
(of dominant stratum)
Trees and Shrubs
___Evergreen
___Cold-deciduous
___Drought-deciduous
___Mixed evergreen - cold-deciduous
___Mixed evergreen - drought-deciduous

Herbs
___Annual
___Perennial

Leaf Type
(of dominant stratum)
___Broad-leaved
___Needle-leaved
___Mixed broad-leaved/Needle leaved
___Microphyllous
___Graminoid
___Forb
___Pteridophyte

Physiognomic class

___Forest
___Woodland
___Shrubland
___Dwarf Shrubland
___Herbaceous
___Nonvascular
___Sparsely Vegetated

Cover Scale for Unvegetated Surface

01	5%
02	10%
03	20%
04	30%
05	40%
06	50%
07	60%
08	70%
09	80%
10	90%
11	100%

Strata	Height	Cover Class	Dominant species (mark any known diagnostic species with a *)	Cover Class
T1 Emergent	_____	_____	_____	
T2 Canopy	_____	_____	_____	
T3 Sub-canopy	_____	_____	_____	
S1 Tall shrub	_____	_____	_____	
S2 Short Shrub	_____	_____	_____	
S3 Dwarf-shrub	_____	_____	_____	
H Herbaceous	_____	_____	_____	
N Non-vascular	_____	_____	_____	
V Vine/liana	_____	_____	_____	
E Epiphyte	_____	_____	_____	

Comments

Cover Scale: Strata and Species	
01	5%
02	10%
03	20%
04	30%
05	40%
06	50%
07	60%
08	70%
09	80%
10	90%
11	100%

Height Scale: Strata	
0	<0.5 m
02	0.5-1 m
03	1-2 m
04	2-5 m
05	5-10 m
06	10-15 m
07	15-20 m
08	20-35 m
09	35-50 m
10	>50 m

Appendix G: Accuracy Assessment Contingency Table

Explanation of the Contingency Matrix

The accuracy assessment (AA) contingency matrix for the Saint Croix National Scenic Riverway vegetation map layer is an array of numbers set out in rows and columns to compare results of vegetation types represented on the map layer to vegetation types as verified on the ground. Map-class codes are used to identify vegetation types for ease of comparison during the analysis and are listed at the side of each row and the top of each column. (A crosswalk between map classes and vegetation types is provided in the Main Report and in Appendix E: Descriptions of Map Classes. The crosswalk reveals the various vegetation types assigned to the map-class codes that are used to label vegetation types in this contingency table.) Map-class codes that are grouped together within parenthesis are map-class phases to one particular association type; these phases were assessed together because they were merged in order to meet program accuracy standards. In both cases, the map classes and map-class phases are kept separate within the map layer.

The columns represent vegetation types in the National Vegetation Classification Standard (NVCS), Version 2 (FGDC 2008). These columns tabulate the producers' accuracy by showing errors of exclusion (omission errors) present in the map. The rows represent the map classes listed by their respective map-class codes. (Again, refer to the crosswalk for map-class names and links to vegetation types.) These rows tabulate the users' accuracy by showing errors of inclusion (commission errors) present in the map.

The following contingency matrix is formatted to a tabloid-size page (11" x 17") in landscape orientation.

FIELD SAMPLES - REFERENCE DATA (columns) / **MAP DATA - PREDICTION DATA** (rows) / **COMISSION** / **OMISSION**

MAP CODES	FAC	FHF	(FAL, FBL, FQL)	FAM	FBA	FCA	FCP	FCS	FJA	FJO	FJP	FMT	FOM	WOR	FPB	FPH	FPO	FPR	FQA	FRA	FRM	FRP	FSF	FST	FWA	FWM	FWR	WBO	WJO	WRC	DLF	DLS	SAS	SMW	SHZ	STS	SWL	HCC	HDP	HME	HMP	HPH	HSV	HMM	HSP	HPG	HSS	HUS	HFA	HWM	HWR	TOTAL	USERS' ACCURACY	90% Confidence Intervals -	90% Confidence Intervals +	MAP CODES
FAC	20			2			5																		2																											29	69%	53%	85%	FAC
FHF		47	5																																									1								53	89%	81%	97%	FHF
(FAL, FBL, FQL)		2	15	2								2									1						1						1	1																		25	60%	42%	78%	(FAL, FBL, FQL)
FAM			1	22																1							1	3																								28	79%	64%	93%	FAM
FBA		2			21																												3																			26	81%	66%	95%	FBA
FCA	1				1	21	2	1																																												26	81%	66%	95%	FCA
FCP							23			1							1																																			25	92%	81%	103%	FCP
FCS								21															2	1																												24	88%	74%	101%	FCS
FJA									23	3	2									1																																29	79%	65%	93%	FJA
FJO									1	21							4			1									1						1																	29	72%	57%	88%	FJO
FJP									1	2	24									1		1																														29	83%	69%	96%	FJP
FMT		2	4	1								15					1										1								1																	25	60%	42%	78%	FMT
FOM			5	1					1				10		1										1		3	5																								27	37%	20%	54%	FOM
WOR			2									1		21			1																		1															1		27	78%	63%	93%	WOR
FPB			1										3		17		1				1	1				1	3																									28	61%	44%	78%	FPB
FPH	1															1																																				2	50%	-33%	133%	FPH
FPO														2			47			1							2																									52	90%	83%	98%	FPO
FPR																	1	3												1																						5	60%	14%	106%	FPR
FQA																			18								1																									19	95%	84%	106%	FQA
FRA									3	1							2			20		2			2																											30	67%	51%	82%	FRA
FRM		1	1	1	2								1								17												3																			26	65%	48%	83%	FRM
FRP											1						1			1		23				3																										29	79%	65%	93%	FRP
FSF					2		3	1													1		17	1		1																										26	65%	48%	83%	FSF
FST						1																		54																												55	98%	94%	102%	FST
FWA																	3			2					15	4																										24	63%	44%	81%	FWA
FWM																	2						1		1	24																										28	86%	73%	98%	FWM
FWR													1		2												20																									23	87%	73%	101%	FWR
WBO			5	1								3								1								18																								28	64%	48%	81%	WBO
WJO										1																		2	8																							11	73%	46%	99%	WJO
WRC			2										2	1													3			18																						26	69%	52%	86%	WRC
DLF																								1							18	1	1	3		2								1	1			1				29	62%	46%	79%	DLF
DLS																					1											16													1							18	89%	74%	104%	DLS
SAS			1		1																												27	1		1								1								32	84%	72%	96%	SAS
SMW			2																														9	40																		51	78%	68%	89%	SMW
SHZ				1			1																					2	1						13																	18	72%	52%	92%	SHZ
STS																																				5																5	100%	90%	110%	STS
SWL																																		1			5															6	83%	50%	117%	SWL
HCC			1																															1				12				3		1				1		2		21	57%	37%	77%	HCC
HDP																																							3		1											4	75%	27%	123%	HDP
HME																																								32												32	100%	98%	102%	HME
HMP																																							1		4											5	80%	41%	119%	HMP
HPH																																		1								22		1						2		26	85%	71%	98%	HPH
HSV																																											21	2					1	2		26	81%	66%	95%	HSV
HMM		1																															1	4				2				2		58						2		70	83%	75%	91%	HMM
HSP																															1			1				2						4	16			1		1		26	62%	44%	79%	HSP
HPG																																														1						1	100%	50%	150%	HPG
HSS																																2															0					2	0%	-25%	25%	HSS
HUS																																										1						4				5	80%	41%	119%	HUS
HFA																																										2	1	1					20			24	83%	69%	98%	HFA
HWM		1																										1						3	1			1				1		1				1		11		21	52%	32%	73%	HWM
HWR																																												2							19	21	90%	78%	103%	HWR
Total	22	56	45	31	27	22	34	23	29	29	27	21	17	24	20	1	64	3	18	29	21	27	20	57	21	33	35	31	10	19	19	19	45	56	17	8	5	17	4	32	5	31	22	73	18	1	0	8	21	21	19	1257				
PRODUCERS' ACCURACY	91%	84%	33%	71%	78%	95%	68%	91%	79%	72%	89%	71%	59%	88%	85%	100%	73%	100%	100%	69%	81%	85%	85%	95%	71%	73%	57%	58%	80%	95%	95%	84%	60%	71%	76%	63%	100%	71%	75%	100%	80%	71%	95%	79%	89%	100%	0%	50%	95%	52%	100%	971				
90% Confidence Interval -	79%	75%	21%	56%	63%	86%	53%	79%	65%	57%	77%	53%	36%	74%	69%	50%	64%	83%	97%	53%	64%	72%	69%	89%	53%	58%	42%	42%	54%	84%	84%	68%	47%	61%	57%	28%	90%	49%	27%	98%	41%	56%	86%	71%	74%	50%	0%	15%	85%	32%	97%	Total Samples = 1257				
90% Confidence Interval +	103%	93%	46%	86%	93%	105%	82%	103%	93%	88%	101%	90%	81%	101%	101%	150%	83%	117%	103%	85%	97%	98%	101%	100%	90%	87%	72%	74%	106%	106%	106%	101%	73%	82%	96%	97%	110%	92%	123%	102%	119%	86%	105%	88%	104%	150%	0%	85%	105%	73%	103%	Total Correct = 971				

OVERALL ACCURACY = 77.2% KAPPA INDEX = 76.4% KAPPA INDEX LOWER 90% CONFIDENCE LEVEL = 74.4% KAPPA INDEX UPPER CONFIDENCE LEVEL = 78.4%

Code	P(row 1)	P(col i)	P(chance i)
FAC	0.023071	0.017502	0.000404
FHF	0.042164	0.044551	0.001878
(FAL, FBL, FQL)	0.019889	0.035800	0.000712
FAM	0.022275	0.024662	0.000549
FBA	0.020684	0.021480	0.000444
FCA	0.020684	0.017502	0.000362
FCP	0.019889	0.027049	0.000538
FCS	0.019093	0.018298	0.000349
FJA	0.023071	0.023071	0.000532
FJO	0.023071	0.023071	0.000532
FJP	0.023071	0.021480	0.000496
FMT	0.019889	0.016706	0.000332
FOM	0.021480	0.013524	0.000290
WOR	0.021480	0.019093	0.000410
FPB	0.022275	0.015911	0.000354
FPH	0.001591	0.000796	0.000001
FPO	0.041368	0.050915	0.002106
FPR	0.003978	0.002387	0.000009
FQA	0.015115	0.014320	0.000216
FRA	0.023866	0.023071	0.000551
FRM	0.020684	0.016706	0.000346
FRP	0.023071	0.021480	0.000496
FSF	0.020684	0.015911	0.000329
FST	0.043755	0.045346	0.001984
FWA	0.019093	0.016706	0.000319
FWM	0.022275	0.026253	0.000585
FWR	0.018298	0.027844	0.000509
WBO	0.022275	0.024662	0.000549
WJO	0.008751	0.007955	0.000070
WRC	0.020684	0.015115	0.000313
DLF	0.023071	0.015115	0.000349
DLS	0.014320	0.015115	0.000216
SAS	0.025457	0.035800	0.000911
SMW	0.040573	0.044551	0.001808
SHZ	0.014320	0.013524	0.000194
STS	0.003978	0.006364	0.000025
SWL	0.004773	0.003978	0.000019
HCC	0.016706	0.013524	0.000226
HDP	0.003182	0.003182	0.000010
HME	0.025457	0.025457	0.000648
HMP	0.003978	0.003978	0.000016
HPH	0.020684	0.024662	0.000510
HSV	0.020684	0.017502	0.000362
HMM	0.055688	0.058075	0.003234
HSP	0.020684	0.014320	0.000296
HPG	0.000796	0.000796	0.000001
HSS	0.001591	0.000000	0.000000
HUS	0.003978	0.006364	0.000025
HFA	0.019093	0.016706	0.000319
HWM	0.016706	0.016706	0.000279
HWR	0.016706	0.015115	0.000253
P(chance)	Total	1.000	0.026

P(correct)	0.770
P(chance)	0.026

Kappa	0.764
90%CI -	0.744
90%CI+	0.784

Key to Map-class Codes and Crosswalk to NVCS Vegetation Types (organized alphabetically)

Code	Map-class Name	NVCS Code
DLF	Leatherleaf Poor Fen	CEGL005277
DLS	Leatherleaf - Sweetgale Shore Fen	CEGL005228
FAC	Aspen - Birch / Boreal Conifer Forest	CEGL002466
FAL	Ash - Elm - Mixed Lowland Hardwood Forest (ash - elm phase)	CEGL002081
FAM	Aspen - Birch / Hardwood Forest	CEGL002467, CEGL002468
FBA	Black Ash - Mixed Hardwood Swamp	CEGL002105
FBL	Ash - Elm - Mixed Lowland Hardwood Forest (bur oak phase)	CEGL002081
FCA	White-cedar - Black Ash Swamp	CEGL005165
FCP	Spruce - Fir - Aspen Forest	CEGL002475
FCS	White-cedar - (Mixed Conifer) / Alder Swamp	CEGL002456
FHF	Floodplain Hardwood Forest	CEGL002018, CEGL002586, CEGL002089
FJA	Jack Pine - Quaking Aspen Forest	A.390
FJO	Jack Pine - Northern Pin Oak Forest	CEGL002478
FJP	Jack Pine Forest	A.116
FMT	Sugar Maple - American Basswood Forest	CEGL002062, CEGL002458
FOM	Northern Red Oak - Sugar Maple Forest	CEGL002461
FPB	Northern Pin Oak - (Bur Oak) Forest	CEGL002077
FPH	Paper Birch / Sugar Maple - Mixed Hardwoods Forest	CEGL002464
FPO	White Pine - Oak Forest	CEGL002480, CEGL005561
FPR	White Pine - (Red Pine) Driftless Bluff Forest	CEGL002378
FQA	Aspen / American Hazel Forest	CEGL002063
FQL	Ash - Elm - Mixed Lowland Hardwood Forest (aspen phase)	CEGL002081
FRA	Red Pine - Aspen - Birch Forest	CEGL002520
FRM	Red Maple - Ash - Birch Swamp Forest	CEGL002071
FRP	Red Pine / Blueberry Dry Forest	CEGL002443
FSF	Spruce - Fir / Mountain Maple Forest	CEGL002446
FST	Black Spruce and/or Tamarack Swamp	CEGL002471, CEGL005271
FWA	White Pine - Aspen - Birch Forest	CEGL002479
FWM	White Pine / Mountain Maple Mesic Forest	CEGL002445
FWR	Midwestern White Oak - Red Oak Forest	CEGL002068
HCC	Bluejoint Wet Meadow	CEGL005174
HDP	Midwest Dry Sand Prairie	CEGL002318
HFA	Water-lily Aquatic Wetland	CEGL002386
HME	Meadow and/or Marsh Herbaceous Vegetation Complex	CEGL002026, CEGL002257, CEGL002282, CEGL002233, CEGL002382, CEGL002386, CEGL004141, CEGL005240, CEGL006044
HMM	Sedge Meadow and/or Emergent Herbaceous Marsh	CEGL002026, CEGL002233, CEGL002257
HMP	Midwest Dry-Mesic Grassland Prairie	CEGL002210, CEGL002214
HPG	Eastern Reed Marsh	CEGL004141
HPH	Reed Canarygrass Eastern Marsh	CEGL006044
HSP	Northern Sedge Poor Fen	CEGL002265
HSS	Woolly-fruit Sedge Shore Fen	CEGL005229
HSV	Midwest Pondweed Submerged Aquatic Wetland	CEGL002282
HUS	Upright Sedge Wet Meadow	CEGL002258
HWM	Wet Meadow Mixed Herbaceous	G112
HWR	Wild Rice Marsh	CEGL002382
SAS	Gray Alder Swamp	CEGL002381
SHZ	Hazelnut - Serviceberry Ruderal Shrubland	CEGL005562
SMW	Mixed Shrub Swamp and/or Fen	CEGL002187, CEGL002494
STS	Tamarack Scrub Poor Fen	CEGL005226
SWL	Sandbar Willow Shrubland	CEGL008562
WBO	North-Central Dry-Mesic Oak Woodland	CEGL002142
WJO	Jack Pine - Red Pine / Scrub Oak Woodland	CEGL002484
WOR	Oak Driftless Bluff Woodland	CEGL005560
WRC	Chinquapin Oak Bluff Woodland	CEGL002144

A few AA sites were not included in this contingency table. These sites were classified by the AA field crews as vegetation types that were not included in the AA site selection. These types were not included because either they represent ruderal/high disturbance or were thought to always be less than the minimum mapping unit (mmu). They are as follows:

1 site in a polygon that was mapped as FHF was assessed in the field as Riverine Cobble - Gravel - Sand Shore (CEGL002304 or CEGL002049, which are represented by the VSB map class).

3 sites in polygons that were mapped as FQA were assessed in the field as Northern & Central Hardwood & Conifer Ruderal Forest Group (G030, which is represented in part by the Conifer - Hardwood Ruderal Forest [FMX] map class).

1 site in a polygon that was mapped as FWR was assessed in the field as Northern & Central Hardwood & Conifer Ruderal Forest Group (G030, which is represented in part by the FMX map class).

Meadow & Shrubland Group (G059, which is represented in part by the Ruderal Grassland [HMX] map class).

2 sites in polygons that were mapped as HWM were assessed in the field as Northern & Central Ruderal Meadow & Shrubland Group (G059, which is represented in part by the HMX map class).

1 site in a polygon that was mapped as FMT was assessed in the field as Maple - Yellow Birch Northern Hardwoods Forest (CEGL002457, which is not represented by a map class because it was considered always less than mmu.

1 site in a polygon that was mapped as FWR was assessed in the field as Maple - Yellow Birch Northern Hardwoods Forest (CEGL002457, which is not represented by a map class because it was considered always less than mmu.

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

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