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National Park Service Vegetation Inventory Program

Pictured Rocks National Lakeshore, Michigan

Natural Resource Report NPS/GLKN/NRR—2010/201



ON THE COVER
The Grand Sable Dunes at Pictured Rocks National Lakeshore, overlapping with the northern hardwood forests further inland.
Photograph by: Kevin Hop

National Park Service Vegetation Inventory Program

Pictured Rocks National Lakeshore, Michigan

Natural Resource Report NPS/GLKN/NRR—2010/201

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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 Program. The NPS VIP is managed by the NPS Biological Resources Management Division and provides baseline vegetation information to the NPS Natural Resource Inventory and Monitoring 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 Pictured Rocks National Lakeshore have completed vegetation classification and mapping of Pictured Rocks National Lakeshore (PIRO) 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 158 vegetation sampling plots within the PIRO project extent. Furthermore, data from 837 accuracy assessment (AA) sites were collected (of which 813 were used to test accuracy of the vegetation map layer). These data sets led to the identification of 56 vegetation associations in the NVCS at the PIRO. Additional vegetation types are recognized at the alliance and group levels of the NVCS.

A total of 74 map classes were developed to map the vegetation and general land cover of PIRO and environs, including the following: 68 map classes representing natural/semi-natural vegetation types at various levels in the NVCS, two map classes representing cultural vegetation (e.g., developed, orchard) in the NVCS, and four map classes representing non-vegetated units (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 photos dated May 2005 (during leaf-off conditions) covering the entire PIRO 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 PIRO vegetation map provides 4,820 polygons of detailed attribute data covering 33,772.9 ha, with an average polygon size of 7.0 ha. Of the area mapped, 4,712 polygons (97.8%) represent natural/semi-natural types in the NVCS, encompassing 29,972.9 ha (88.7%) of the total map extent.

Summary reports generated from the vegetation map layer indicate that forest types dominate the vegetation landscape (NVCS types), populating 82.3% of polygons and covering 95.3% of area, and are largely dominated by the Maple - Yellow Birch Northern Hardwoods Forest community. A thematic AA study was conducted of map classes representing floristic types in the NVCS. Results present an overall accuracy of 77.1% (kappa index of 76.0%) based on data from 813 of the 837 AA sites. Most individual map-class themes exceed the NPS VIP standard of 80% with a 90% confidence interval.

The PIRO 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. They also include ground photos of vegetation types; a database of vegetation plots and AA sites; field data sheets; aerial photographic prints and images; hardcopy maps; and a geodatabase of vegetation types (map layer), fieldwork locations (vegetation plots and AA sites), aerial photographic indexes, and project boundary. All geospatial products are projected in Universal Transverse Mercator, Zone 16, using the North American Datum of 1983. More NPS VIP information and products of completed park mapping projects are on the Internet at <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) Pictured Rocks National Lakeshore (PIRO) 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 PIRO vegetation mapping project, Mike Mulligan (USGS VCP Coordinator) for providing additional funding support for the vegetation mapping effort, and Chris Lea 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 PIRO staff—particularly Bruce Leustcher—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 PIRO 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 thank Mike Kost of the Michigan Natural Features Inventory for providing classification assistance and for supervising field crews collecting data at vegetation plots and accuracy assessment (AA) sites. We recognize Adrien Bozic, our lead ecologist for the vegetation plot collection, who was assisted by Wilf Previant. We also recognize our field team for the data collection at AA sites, including Denny Albert, Kevin Allen, April Chiriboga, and Liana May. In addition, we are grateful to PIRO staff for assisting in AA data collection, including K. Farkas and B. Leutscher.

We finally thank our colleagues from within our own offices—the USGS Upper Midwest Environmental Sciences Center and NatureServe. Of the USGS, we acknowledge Eric Seeger for assisting with field work and quality control of the photointerpretative mapping, as well as his role in the analysis for AA; Janis Ruhser for orthorectification and map automation; and JC Nelson and the student geographic information system lab for quality control of map automation, as well as JC's assistance with random site selection for AA, geodatabase building, and metadata creation. Of NatureServe, we acknowledge Mary Russo for getting classification data into and out of the central database of NatureServe with ease and speed and Pat Comer and Don Faber-Langendoen for consulting with us on the vegetation classification.

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

Pictured Rocks National Lakeshore Vegetation Mapping Project

The Pictured Rocks National Lakeshore (PIRO) 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 PIRO. The goals of the project are to adequately describe and map plant communities of PIRO and 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 PIRO vegetation mapping project is also part of a cluster approach to classify and map plant communities 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. 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 PIRO 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 GLKN, the NPS PIRO, NatureServe, and the USGS. Common to all NPS VIP projects, the three major components of the PIRO 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. Spatial products include aerial photographs, spatial databases of vegetation (including metadata), map classification description or key, hard-copy maps of vegetation, and accuracy assessment of the vegetation map. Vegetation products include vegetation classification, 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. In producing vegetation maps, the NPS VIP also provides a listing of plant species derived from its mapping projects, contributing yet another inventory product for the I&M Program baseline. More information on the I&M Program is 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 to 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. 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. Definitions to these various Levels are detailed within Section 2 of the NVCS (FGDC 2008). Tables 2 and 3 show hierarchical structures for both natural and cultural vegetation.

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

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.)
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).

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. For spatial data sets involving biological components, the NPS VIP uses the FGDC-endorsed Biological Data Profile (a profile is a set of information specific to a discipline, in this instance the biological sciences discipline), which is a biological metadata standard developed by the National Biological Information Infrastructure. This is known as the Biological Data Profile of the Content Standard for Digital Geospatial Metadata, FGDC-STD-001.1-1999 (FGDC 1999).

Pictured Rocks National Lakeshore

Location and Brief History

The PIRO (Figure 1) is located in Upper Peninsula of Michigan in Alger County, along the southern shores of Lake Superior between Munising and Grand Marais. The PIRO has two zones, including the Lakeshore Zone (LZ), which is owned and managed by the NPS, and the Inland Buffer Zone (IBZ), which is a mosaic of NPS, state, and private ownerships. Both zones together, along with a ~400 m surface water jurisdiction into Lake Superior, comprise an area of 29,637 ha. The LZ (without the water jurisdiction) is over 12,000 ha, and the IBZ is just under 16,000 ha. Of the IBZ, nearly 5% of lands are in NPS ownership, and the remaining are in state and private ownerships.

The PIRO preserves more than 67.5 km of pristine lakeshore and was authorized in October 1966, by the 89th U.S. Congress, to preserve the natural resource, becoming the first National Lakeshore in the United States. In past, the area was home to the Ojibwe people, with fur trading, mining, extensive logging, farm pasturing, commercial fishing, and tourism occurring from European exploration and American settlement onward.

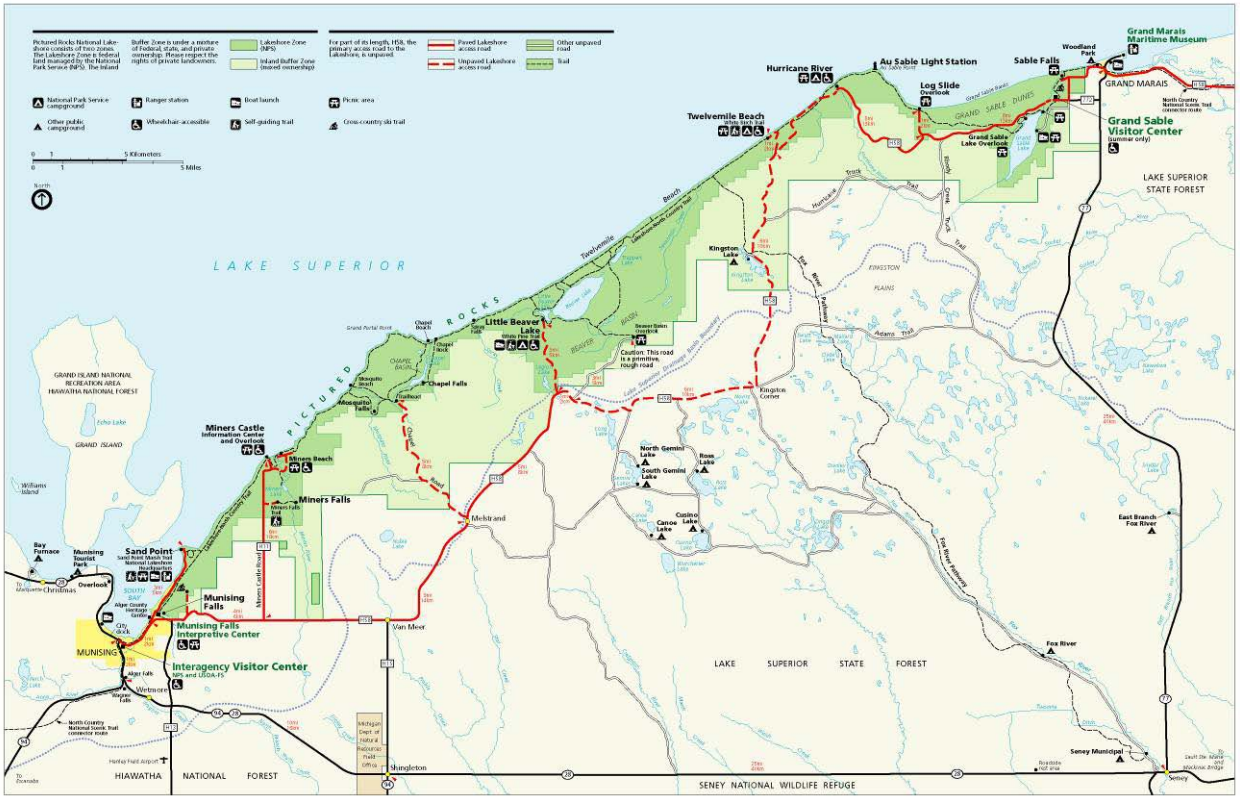


Figure 1. Pictured Rocks National Lakeshore, Michigan (courtesy nps.gov).

Landscape Setting

The PIRO is named after its tall picturesque sandstone cliffs (Figure 2), reaching heights of 60 m. These cliffs extend over 19 km of shoreline. The eastern end of PIRO, near Grand Marais, hosts the Grand Sable Dunes (Figure 3), an extensive, active dune perched high above Lake Superior. Several miles of sand beach stretch from one end of PIRO to the other (Figure 4). The sandscape at the PIRO offers a home to dunal vegetation, such as American beachgrass (*Ammophila breviligulata*), sand cherry (*Prunus pumila*), and jack pine (*Pinus banksiana*).



Figure 2. Picturesque sandstone cliffs at the Pictured Rocks National Lakeshore.



Figure 3. The Grand Sable Dunes at the Pictured Rocks National Lakeshore.



Figure 4. A view of Twelvemile Beach, Pictured Rocks National Lakeshore.

More interior, the landscape is predominantly upland forest on sandy soil, with numerous wetland basins and drainages throughout. The PIRO is located in transition between boreal and northern hardwood forest regions. Although deciduous hardwood forests are predominant (Figure 5), boreal-like conifers, such as balsam fir (*Abies balsamea*) and black spruce (*Picea mariana*) are common in some areas (Figure 6), particularly in cool or mesic sites and within peatland basins. Sugar maple (*Acer saccharum*) and yellow birch (*Betula alleghaniensis*) characterize the majority of the upland forest landscape, with American beech (*Fagus grandifolia*) integrating at various sites. Eastern hemlock (*Tsuga Canadensis*) and white pine (*Pinus strobus*) mingle the hardwood forests, sometimes becoming dominant (Figure 7). Jack pine and red pine (*Pinus resinosa*) are prevalent on well-drained sand flats (Figure 8), like those found at Miners Beach and Kingston.



Figure 5. Northern hardwood forest with lush understory floristics.



Figure 6. Black spruce-dominant forest with a dense feathermoss carpet.



Figure 7. White pine and eastern hemlock trees along a shore margin of Legion Lake.



Figure 8. Jack pine-dominant forest on the sand flats near Miners Beach.

The Beaver Basin, located midway along the shoreline, offers a diverse ecological setting for both flora and wildlife (Figure 9). Within the Beaver Basin is Beaver Lake, one of the larger natural lakes within PIRO. Peatland basins (Figure 10) and beaver pond complexes become more extensive interior from the lake where organic soils are well established.



Figure 9. Beaver meadow complex within the Beaver Basin.



Figure 10. Peatland basin of leatherleaf, with short black spruce trees along the margin.

Overall, Lake Superior has a large influence upon the entire PIRO area, bringing a cool maritime-like climate.

Project Overview

General Process

The three main components of the Pictured Rocks National Lakeshore (PIRO) 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 communities of PIRO and immediate environs.

Color-infrared (CIR) aerial photographs of the study area were collected during fall 2005, providing aerial photos for fieldwork and mapping. True-color (TC) aerial photographs were also collected during spring 2004. The scoping meeting for the PIRO vegetation mapping project was held May 31–June 1, 2006, at the headquarters of PIRO, in Munising, Michigan. At this meeting, primary partners met to discuss and plan the vegetation mapping project.

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

Before mapping, we performed field reconnaissance throughout the summer of 2007 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 summer of 2008, 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 points (containing vegetation sampling plots and AA sites), vegetation and land cover polygons (showing locations of vegetation types and general land cover features, such as non-vegetated open water), 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 16, using the North American Datum of 1983 (NAD83).

Scoping Meeting

We officially launched the mapping project with a scoping meeting held May 31–June 1, 2006, at the Headquarters of PIRO in Munising, Michigan. Various cooperators joined together to discuss the objectives and methods of the PIRO vegetation mapping project, receive

assignments, and view the landscape and vegetation of PIRO (Figure 11). Individuals from NPS PIRO, NPS GLKN, USGS UMESC, and NatureServe met to achieve the following objectives:

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



Figure 11. Participants of the scoping meeting viewing, firsthand, vegetation types at the Pictured Rocks National Lakeshore.

Project Boundary Extent

The PIRO vegetation mapping project boundary extent includes the entire Lakeshore Zone (LZ) and Inland Buffer Zone (IBZ), plus an additional 400 m of environs beyond the LZ and IBZ (Figure 12), which includes 400 m of surface water jurisdiction into Lake Superior. The total map extent is 33,772.9 ha, including all PIRO lands, surface water jurisdiction, in-holdings, and extended environs. The LZ and IBZ comprise about 83% of the total map area, with the remaining area being surface water jurisdiction and environs. We produced a feature-class layer showing the extent of the project boundary and incorporated it into the PIRO vegetation mapping project geodatabase.

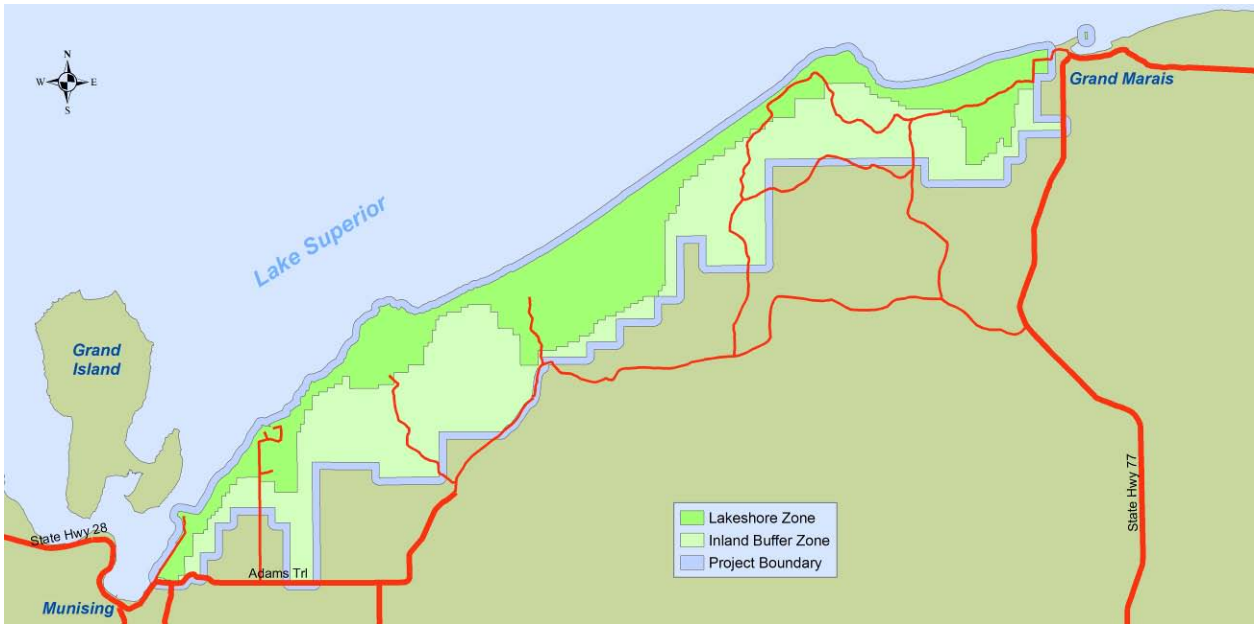


Figure 12. Project boundary for the Pictured Rocks National Lakeshore vegetation mapping project.

Aerial Photography

Aerial photographs provide the baseline imagery data for mapping plant communities 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 plant communities, the ability to view aerial photographs in this way is fundamental.

A variety of film emulsions from to choose are available, and Avery (1978) concludes that no single film emulsion serves all purposes. Our aim with collecting aerial photography for the PIRO 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 9, 2005 (funded by the NPS VIP, and the photo mission was supervised by GLKN staff). This set of photography covered the full project boundary extent and was the primary imagery used in photointerpretative mapping.

In addition to the CIR photos, a set of 1:12,000-scale TC aerial photographs were collected May 11, 2004, providing deciduous leaf-off viewing of the entire extent. 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 statement regarding lack of a single all-purpose film emulsion.

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.

Table 4 gives details to the aerial photography acquired for the PIRO vegetation mapping project.

Table 4. Aerial photography sets for the Pictured Rocks National Lakeshore vegetation mapping project.

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

Photography date	Film type	Scale	Photos	Products	Company
October 9, 2005	CIR Transparency (Positive)	1:12,000	343	Contact Print Diapositive Orthophotograph	Aerial Services, Inc.
May 11, 2004	TC Transparency (Positive)	1:12,000	349	Contact Print Orthophotograph	Great Lakes Aerial Survey, Inc. for Ayers Associates

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 PIRO vegetation mapping project geodatabase. In addition, a digital orthophotographic mosaic of the CIR aerial photographs from October 2005 has been produced by the aerial photo contractor.

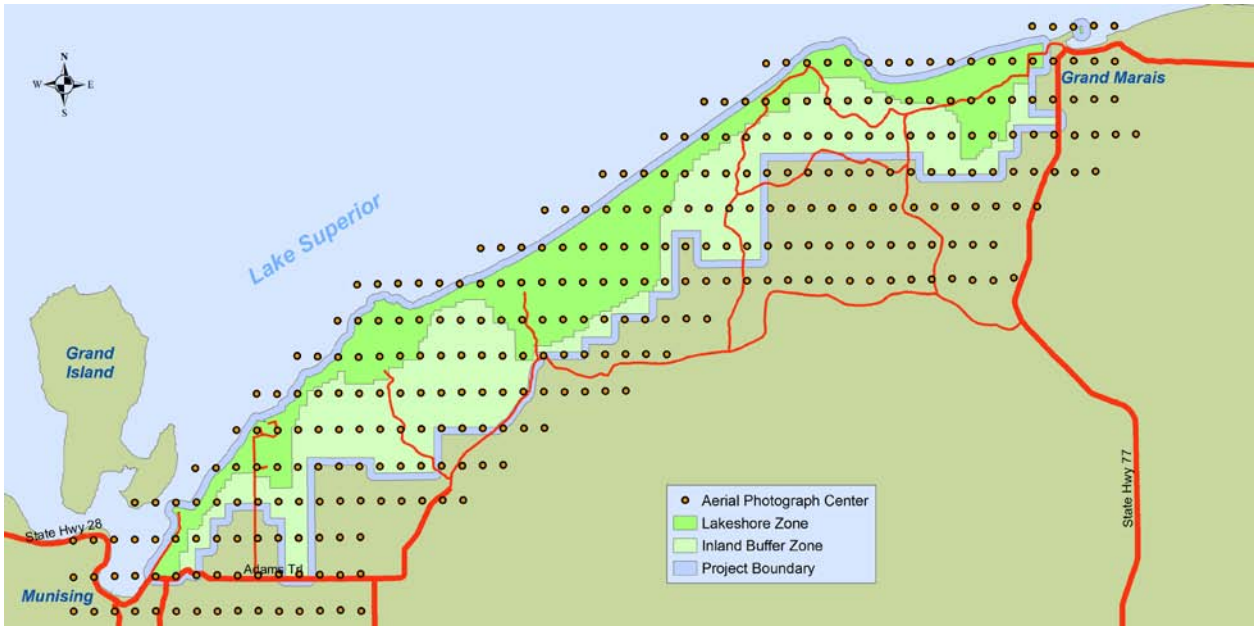


Figure 13. Centers of color-infrared aerial photographs (1:12,000-scale) obtained in October 2005 for the Pictured Rocks National Lakeshore vegetation mapping project.

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 forest). 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, and slight scale changes from high ridges to valley bottoms, we applied our MMU standards liberally.

Classification Organization

Throughout this project report and the final products related to the PIRO vegetation mapping project (e.g., the geodatabase), we have 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 with live vegetation cover are classified within the NVCS. The NVCS excludes non-vegetated natural lands (e.g., rock) and waters (e.g., lakes, rivers). For these, we employ the classification as provided by the 2001 National Land Cover Database (Homer et al. 2004).

Throughout this report, the term “vegetation type” is used to name 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.

Vegetation Classification

Methods

Preliminary Classification

The first step in classifying the vegetation of Pictured Rocks National Lakeshore (PIRO) was to prepare a preliminary classification report prior to the May 2006 scoping meeting. This report for the PIRO area was generated by reviewing all (NVCS) associations and alliances in the National Vegetation Classification Standard that are attributed to Wisconsin, Michigan, or Ontario in the Great Lakes Ecoregion (ECO48). This listing was derived by by The Nature Conservancy (TNC), and covered a much broader area than the PIRO project area, including many vegetation types that were very unlikely to occur there. The initial list of possible associations and alliances was reviewed by NatureServe and PIRO staff to remove vegetation types thought unlikely to occur at the PIRO. The resulting, preliminary classification report included 131 associations (NatureServe 2005a) and 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 determine how much data 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), on average. The preliminary classification listed 131 possible associations in the project area. Several of those were similar to each other, though, and we expected only one to actually be present in the project area. For example, we knew there would be *Typha*-dominated wetlands in the project area. There are three *Typha*-dominated associations that occur in the region near Lake Superior, and those three were listed in the preliminary classification. 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 in only one. So, although we had three *Typha*-dominated marshes in the preliminary classification, we estimated that we would need only three plots to adequately characterize those marshes. We did this kind of analysis for all associations in the preliminary classification and estimated there would be approximately 45 unique vegetation associations at the PIRO. Thus, our initial plan was to sample at least 135 plots.

Some vegetation types in the preliminary classification (e.g., pine forests on dunes, red oak-maple forests) 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., cattail swamps, water-lily marshes) were well described and/or compositionally simpler; therefore, we targeted those for 1–3 plots. We looked into using existing data to supplement our plots or reduce our data collection needs but did not find any suitable data.

All sampling was done within the PIRO boundary. Although the project area extends beyond the PIRO boundary, the extended environs are mostly of private lands. Also, we limited sampling only to public access lands within the Inland Buffer Zone (IBZ). Obtaining permission to work on private lands would have required significant planning and preparation, and we determined the added benefit of accessing these lands was low in comparison to the extensive lands with public access.

Our field team faced the problem of finding every vegetation type at the PIRO without knowing where they all were or even exactly what they all were. Our approach to this problem was to attempt to get the field team to all habitat types, with the assumption that this would allow the field crew to find as many different vegetation types as possible. They had three primary resources to help with this. These resources were as follows: (1) aerial photographs (October 2005, color-infrared, 1:12,000-scale) of the project area, (2) local NPS staff, and (3) the field crew's own knowledge of the project area gained from prior experience and reconnaissance during this project.

Field Sampling

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 since two adjacent stands may be floristically very similar but are separated in the NVCS based on physiognomic criteria (e.g., amount of shrub cover, which may be determined by one or two species).

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

Table 5. Plot sizes used for vegetation plot sampling for the Pictured Rocks National Lakeshore 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., fen, bog, 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 was recorded as well.

Table 6. Cover classes and vegetation strata used during vegetation plot sampling for the Pictured Rocks National Lakeshore 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 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 Pictured Rocks National Lakeshore vegetation mapping project.

Data Analyses and Results

Field teams collected plot information from June through September 2006, sampling 140 plots. An additional 18 plots were sampled in the summer of 2007. The classification analyses were completed by using these 158 plots. The plots were located throughout both the PIRO Zone (LZ) and the IBZ of the PIRO (Figure 15). All field data were entered into the NPS PLOTS Database Version 2.0, a Microsoft Access database designed for the NPS VIP (NatureServe 2005b).

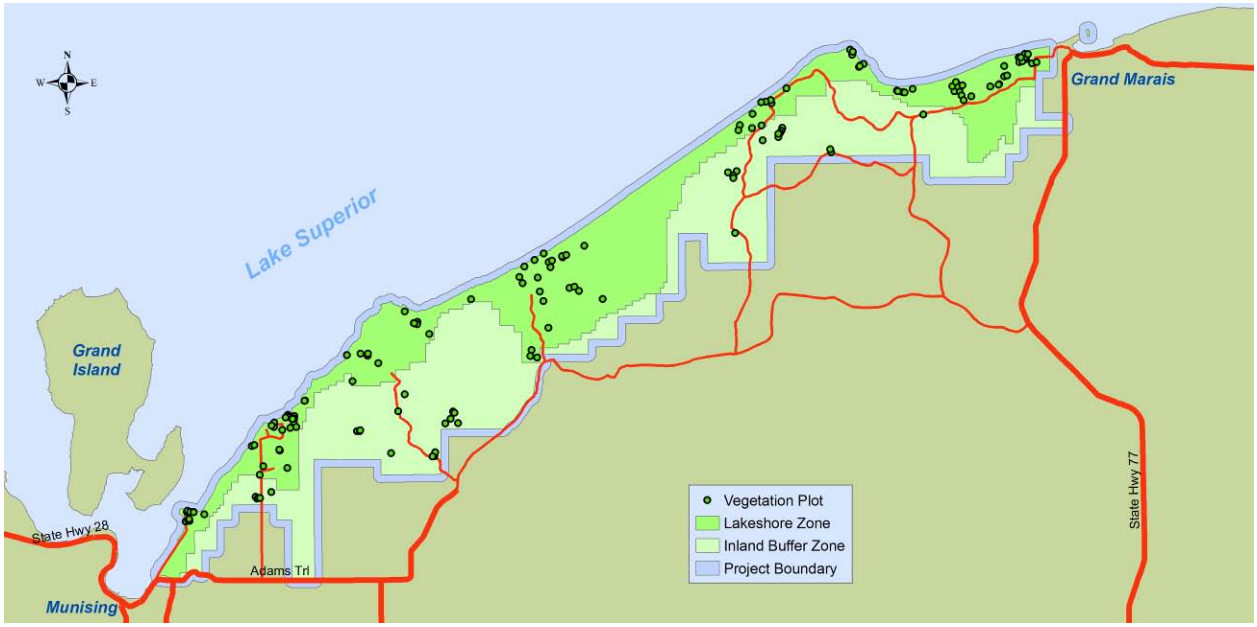


Figure 15. Locations of the 158 vegetation plots sampled for the Picture Rocks National Lakeshore vegetation mapping project.

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). The initial groups were based on a distinction between primarily wetland and primarily upland plots (Figure 16). The wetland set of plots was further subdivided based on the predominance of woody species (tree and/or shrub species) versus those plots that were primarily herbaceous. Woody species dominating wetlands were divided into wet forests and wet shrublands. Analyses showed the wet forests could be further divided into those dominated by conifers and those dominated by hardwoods. Wet shrublands were linked to the NVCS based on dominant shrub species.

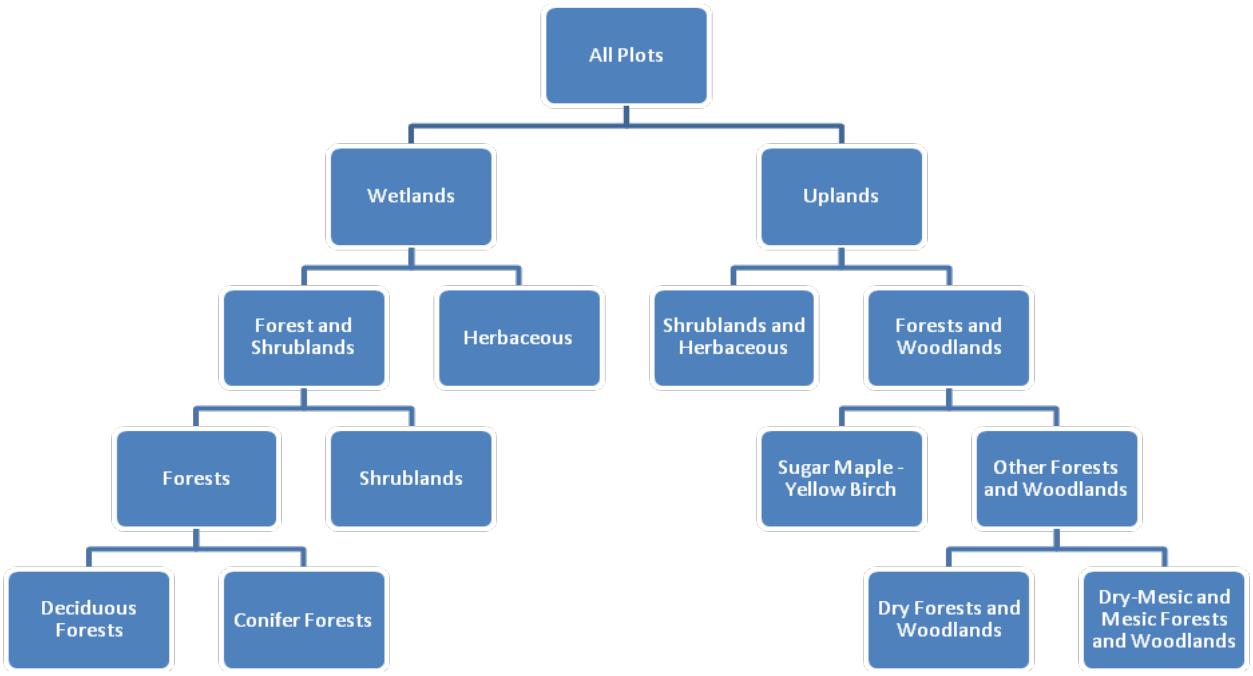


Figure 16. General vegetation groups as defined by cluster and ordination analyses for the vegetation classification of the Pictured Rocks National Lakeshore.

Upland communities were analyzed similarly by using NMS and Flexible Beta. Forests and woodlands were separated from shrublands, dwarf shrublands, and herbaceous plots. Our analyses of the woodlands and forests showed a distinction between the sugar maple (*Acer saccharum*) - yellow birch (*Betula alleghaniensis*) forest type and all other forest types. The rest of the forests were divided according to dry forests and dry-mesic to mesic forest types. Dominant canopy species were used to further divide the forest types. Understory species were then used to further parse forest types into associations. In order to better comprehend 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 helped to further characterize and differentiate the forest types for those that were highly variable. Shrublands and herbaceous plots were distinguished by using NMS and Flexible Beta along with using dominant species.

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

Through the analyses of our summer 2006 sampling plots, we identified 48 plant communities (NVCS associations). During our summer 2007 field reconnaissance for the mapping effort, we discovered other communities that had not been characterized by plot data. Additional plots were collected in 2007 to verify some of these communities. For others, informal field data and aerial

photo study were used. An additional eight plant communities were defined, with definitions further supported by data from the accuracy assessment (AA) collected in the field in 2008. These communities were fairly well described from a regional perspective, so assigning them to vegetation associations was fairly straightforward, even without full vegetation plots. The composition and location of these communities were often well known to the staff working on this project.

In all, a total of 56 natural/semi-natural associations from the NVCS were identified for PIRO. Table 7 lists these associations and includes the number of times each type was sampled with a vegetation plot or an AA site. It is worth noting that there were over five times as many AA sites sampled as vegetation plots (837 versus 158); most of the field observations were from AA sites. Data from AA sites provide information on distribution and dominant species but do not have the detail of a full vegetation plot. Also, seven vegetation plots were not used in the classification and 10 AA sites were not assigned to any vegetation type. The unused data were collected in areas that were either too small for mapping or were composed of mixtures of species not representing a distinct community (common to disturbed locations). Another eight AA sites were assigned at the NVCS group level and do not appear in Table 7.

Table 7. List of vegetation communities of Pictured Rocks National Lakeshore, with number of field observations.

[NVCS, National Vegetation Classification Standard; CEGL, Community Element Global]

Group	Association Name	NVCS Code	Observations
Forest and Woodland			
Northern Hardwood - Hemlock - White Pine Forest Group			
	Maple - Yellow Birch Northern Hardwoods Forest	CEGL002457	86
	Great Lakes White Pine - Hemlock Forest	CEGL002590	11
	White-cedar - Boreal Conifer Mesic Forest	CEGL002449	36
	Hemlock Mesic Forest	CEGL002598	25
	North-Central Hemlock - Hardwood Forest	CEGL005044	37
	Great Lakes Hemlock - Beech - Hardwood Forest	CEGL005042	30
White Pine - Red Pine - Oak Forest & Woodland Group			
	Red Pine - Aspen - Birch Forest	CEGL002520	13
	Red Pine / Blueberry Dry Forest	CEGL002443	43
	White Pine - Red Oak Forest	CEGL002480	11
	White Pine - Mixed Deciduous / Bracken Barren Forest and Scrub	CEGL005563	65
	White Pine - Aspen - Birch Forest	CEGL002479	24
	White Pine / Blueberry Dry-Mesic Forest	CEGL002444	23
Great Lakes Pine Barrens Group			
	Great Lakes Dune Pine Forest	CEGL002589	7
Northern & Central Alkaline Conifer & Hardwood Swamp Group			
	Black Ash - Mixed Hardwood Swamp	CEGL002105	18
	White Pine - Red Maple Swamp	CEGL002482	3
	White-cedar Seepage Swamp	CEGL002455	0
	White-cedar - Black Ash Swamp	CEGL005165	16
	Hemlock - Yellow Birch Swamp Wet-Mesic Forest	CEGL005003	12

Group	Association Name	NVCS Code	Observations
Northern & Central Shrub Swamp Group			
	Gray Alder Swamp Shrubland	CEGL002381	38
Jack Pine - (Black Spruce) Forest Group			
	Black Spruce / Feathermoss Forest	CEGL002447	6
	Jack Pine - Aspen / Bush-honeysuckle Forest	CEGL002518	9
	Jack Pine / Balsam Fir Forest	CEGL002437	12
	Jack Pine / Blueberry / Feathermoss Forest	CEGL002441	26
White Spruce - Balsam Fir Forest Group			
	Balsam Fir - Paper Birch Forest	CEGL002474	15
	Paper Birch / Fir Forest	CEGL002463	9
	Spruce - Fir - Aspen Forest	CEGL002475	13
	Spruce - Fir / Mountain Maple Forest	CEGL002446	6
Black Spruce - Tamarack Acidic Swamp Group			
	Black Spruce - Tamarack / Labrador-tea Poor Swamp	CEGL005271	18
Tamarack - Conifer Alkaline Swamp Group			
	White-cedar - (Mixed Conifer) / Alder Swamp	CEGL002456	52
Shrubland and Grassland			
Eastern Shrub-Herb Sand Barrens Group			
	Bracken Grassland	CEGL005142	13
Eastern North American Boreal Shrubland Group			
	Thimbleberry Shrubland	CEGL005248	1
Great Lakes Coast Grassland & Shrubland Group			
	Great Lakes Beachgrass Dune	CEGL005098	31
	Great Lakes Beach-heather Dune Dwarf-shrubland	CEGL004024	5
	Great Lakes Juniper Dune Shrubland	CEGL005064	7
	Great Lakes Coast Pine Barrens	CEGL005125	66
	Cottonwood Dune Open Woodland	CEGL005119	8
	Sand Cherry Dune Shrubland	CEGL005075	12
Boreal Alkaline Peatland Group			
	Wiregrass Sedge Shore Fen	CEGL005229	8
	Sweet Gale Shrub Fen	CEGL005141	7
North American Boreal Acidic Peatland Group			
	Northern Sedge Poor Fen	CEGL002265	8
	Leatherleaf - Sweetgale Shore Fen	CEGL005228	25
	Leatherleaf Poor Fen	CEGL005277	20
Eastern North American Freshwater Marsh Group			
	Water Horsetail - Spikerush Marsh	CEGL005258	6
	Midwest Mixed Emergent Deep Marsh	CEGL002229	14
Eastern North American Wet Meadow Group			
	Bluejoint Wet Meadow	CEGL005174	20
	Northern Sedge Wet Meadow	CEGL002257	21
	Dogwood - Willow Swamp	CEGL002186	9

Group	Association Name	NVCS Code	Observations
Aquatic Vegetation			
Eastern North American Freshwater Aquatic Vegetation Group [Placeholder]			
	Northern Water-lily Aquatic Wetland	CEGL002562	5
	Midwest Pondweed Submerged Aquatic Wetland	CEGL002282	0
Nonvascular and Sparse Vascular Rock Vegetation			
Eastern North American Lake Flat & Beach Group			
	Inland Freshwater Strand Beach	CEGL002310	3
	Lake Mudflats	CEGL002313	3
Eastern North American Lake & River Bluff Group [Placeholder]			
	Eroding Clay Bank	CEGL002584	4
Great Lakes Cliff & Shore Group [Placeholder]			
	Inland Limestone Pavement	CEGL002570	0
	Great Lakes Sandstone Bedrock Shore	CEGL002507	2
	Great Lakes Shore Sandstone Cliff	CEGL002503	6
	Midwest Moist Sandstone Cliff	CEGL002287	1

For NVCS types above the association level (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 field, dynamic beaver meadow).

All floristic types within the NVCS (mostly association, one alliance) that we identified at the PIRO are described in Appendix B: Descriptions of Vegetation Types. 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.

Discussion

The dominant plant community recognized was the sugar maple - yellow birch forest, but several other temperate and boreal communities were identified. For example, boreal jack pine (*Pinus banksiana*) woodlands and barrens were found at the Grand Sable Dunes and on sandplains. The management practices, climate, and geology of the area have strongly influenced the types, expression, and distribution of communities throughout PIRO. In particular, the unique jurisdictional and management practices of the LZ (managed by the National Park Service) and the IBZ (managed mostly by other public agencies and private entities for timber) contribute much of the variability in vegetation types across the entire PIRO. For example, the sugar maple-yellow birch forest was the most common vegetation type at the PIRO. These forests were also the most variable. As seen in Figure 16 above, even though the sugar maple-yellow birch forest became separate from other forest and woodland types at an intermediate level, there was a lot of variability in the understory and subcanopy species. This variability was primarily due to differences in logging history, with no logging allowed in the LZ and a variety of logging practices allowed in the IBZ. Stands in the IBZ contained higher species diversity in the understory because of tree removal and resulting gaps in the overstory canopy. For example, a significant proportion of Canada yew (*Taxus canadensis*) grew in the understory of some sugar

maple-yellow birch forests in the IBZ, but Canada yew was very uncommon under the denser forest canopies in the LZ.

Along with different management strategies in the IBZ, drought was another issue that changed the expression of some communities at the PIRO. For the past seven years, PIRO and surrounding areas have experienced several years of less-than-average rainfall. As a result, many of the wetland communities at the PIRO were very dry and losing some of their obligate wetland species. Figure 17 shows a bluejoint (*Calamagrostis canadensis*) wet meadow in the summer of 2007. Grasses and sedges were already beginning to senesce and very few associated species remained. Analyses of some of these wetlands became very difficult because many of them started to cluster closer to the upland groups and many of the diagnostic species were missing or muted.



Figure 17. Bluejoint wet meadow, showing effects of drought, at the Pictured Rocks National Lakeshore.

A unique feature found within the PIRO is the Grand Sable Dunes. This is a perched dune similar to those found at Sleeping Bear Dunes National Lakeshore that shares many of its characteristic communities. Many of these communities were not originally documented for this area of the Great Lakes. In particular, the Great Lakes Dune Pine Forest was found throughout the Grand Sable Dunes. This forest type is dominated by a mixture of jack pine, red pine (*Pinus resinosa*), and white pine (*Pinus strobus*), with an understory containing many dune species, such as American beachgrass (*Ammophila breviligulata*) and creeping juniper (*Juniperus horizontalis*). Although attributed to dunes further south along Lake Michigan, this community type was not previously documented in areas along Lake Superior. Likewise, communities of beach heather (*Hudsonia tomentosa*) and American searocket (*Cakile edentula*) were identified within the Grand Sable Dunes area and also on sandplains in other areas of PIRO. These communities are well known along the Atlantic Coastal Dune and sandplains, but were relatively unknown for this region of the Great Lakes.

Vegetation Mapping

Methods

Mapping vegetation of Pictured Rocks National Lakeshore (PIRO) and environs involved five primary steps: (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. As well, 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.

The vegetation classification for PIRO had been developed via analyses of the vegetation sampling data collected the prior year. Thus, we met as classifiers and mappers in Redwing, Minnesota, during May 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, photointerpreters invested several days in the field investigating ground conditions with aerial photographs in hand. This process is necessary, as Hershey and Befort (1995) explain, because color-infrared (CIR) photography is not consistent between photo sets to allow a species to be described precisely. Film batch, printing process, sun angle, light intensity, shadow, and exposure can all affect the appearance. Hence, even as experienced 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) to vegetation on the ground (Figure 18).



Figure 18. Field reconnaissance to correlate aerial photo signatures to ground vegetation.

Field reconnaissance also allowed photointerpreters to become more familiar with the local ecology of plant communities, 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 (e.g., soil) to determine if vegetation types could be consistently separated by environmental elements.

We performed our field reconnaissance throughout the summer of 2007. 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 assignment 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 them 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.

The photo contact prints were taken into the field, with notes recorded onto photo jackets. These field notes included map-class assignment, if known, as well as noting significant species to promote proper perspective of species composition for photointerpretation (e.g., heterogeneous versus monotypic forest stand). In essence, we would build a photo signature and environmental model to base our decisions on 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 plant communities to associations in the National Vegetation Classification Standard (NVCS), as identified by NatureServe. Some vegetation types could not be assigned to an association because of disturbance (e.g., human or beaver activities). For those map classes, we assigned the appropriate type further up the hierarchy (e.g., group) 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-vegetated features (e.g., open water bodies), we derived map classes corresponding closely with the classification from NLCD 2001.

For those map classes representing associations in the NVCS, we used synonym names as established by in the classification database of NatureServe (e.g., Great Lakes White Pine - Hemlock Forest) from their database. For alliance types, we used the direct translation to the scientific name within the database of NatureServe; e.g., Bog Birch - (Willow species) Saturated Shrubland. For map classes with phases, we used the synonym names, followed by, and in parenthesis, the phase name we derived, such as Great Lakes Coast Pine Barrens (barrens 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-vegetated features, we derived generic names to describe the feature.

[1] The NLCD 2001 is a land cover database produced by the Multi-Resolution Land Characterization 2001 Consortium.

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 vegetation map-class code begins with the first alpha representing the major physiognomic characteristic of the vegetation type, as follows:

- F = Forest,
- W = Woodland,
- S = Shrubland,
- H = Herbaceous Vegetation, and
- V = Sparse Vegetation.

For developed cultural vegetation and non-vegetated features, map class codes begin with an N. 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 8 lists the physiognomic modifiers we used for mapping the PIRO.

Table 8. Physiognomic modifiers assigned to polygons during photointerpretation for the Pictured Rocks National Lakeshore 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)	2	15-30 m
	3	5-15 m
	4	0.5-5 m

An example of a map-attribute code is "FCM-1A3." This code describes given map polygons as the conifer - hardwood phase (FCM) of the map class White-cedar - Boreal Conifer Mesic Forest, which represents the *Thuja occidentalis* / *Abies balsamea* - *Acer spicatum* Forest Association (CEGL002449) in the NVCS. This code also indicates that the vegetation has a coverage density of 60–100%, a coverage pattern that is evenly distributed, and an average tree height of 5–15 m throughout the mapped polygon. Presenting this series of map classification and physiognomic information can greatly enhance the interpretation of the map layer for managers and researchers, particularly when introducing other geospatial data sets.

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 photointerpretative 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 photo-identification information. 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) were allowed for map-class units with vegetation unique to the immediate surroundings (e.g., herbaceous wetland within an upland forest)[2]. Interpreted data—map polygons and attributes—were applied to photo overlays covering the CIR photos. True-color aerial photos (1:12,000-scale) from April 2004 were viewed digitally on computer and/or by using a Topcon (MS-3) mirror stereoscope with 3x binocular stereoscopes to aid the interpretation of the CIR photos.

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 to not only 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. A second photointerpreter reviewed the interpreted work for quality.

Digital Map Automation and Database Development

We converted the photointerpreted data into a format usable in a geographic information system (GIS) by employing three fundamental processes: (1) orthorectify, (2) digitize, and (3) develop

[2]It should also be noted that we allowed polygons as low as 0.1 ha once clipped by the project boundary.

the geodatabase. All digital map automation was projected in Universal Transverse Mercator (UTM), Zone 16, 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 unrectified imagery (Image Processing Software, Inc., 2002). The 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 based on the reference information provided.

Digitize: To produce a polygon vector layer for use in ArcGIS (Environmental Systems Research Institute [ESRI], Redlands, California), we converted each raster-based image mosaic of orthorectified overlays containing the photointerpreted data into a grid format by using ArcGIS. 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 codes 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 has 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 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 74 map classes (including map-class phases) to map the PIRO and environs. Of these 74 map classes, 68 represent natural/semi-natural vegetation types within the NVCS, two represent cultural vegetation types (agriculture and developed) within the NVCS, and four represent non-vegetated units (open water, barren land). Table 9 provides a breakdown of these map classes in regards to the finer levels of the NVCS, including the floristic (association), group and macrogroup. The units not included in the NVCS are listed as well. Explanations to each are provided after the table.

Table 9. Map class distribution within the National Vegetation Classification Standard for the Pictured Rocks National Lakeshore vegetation mapping project.

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

NVCS Classes	Map Class	Floristic	Group	Macrogroup
FOREST & WOODLAND	40	29	11	6
SHRUBLAND & GRASSLAND	22	19	8	6
AQUATIC VEGETATION	2	2	1	1
NONVASCULAR & SPARSE VASCULAR ROCK VEGETATION	4	7	3	2
AGRICULTURAL VEGETATION CULTURAL	1	n/a	n/a	n/a
DEVELOPED VEGETATION CULTURAL	1	n/a	n/a	n/a
NVCS TOTAL	**70**	**57***	**23**	**15**

Non-NVCS Units (NLCD 2001)	Map Class
Open Water	3
Barren Land	1
Non-NVCS Total	**4**
Map Class Grand Total	**74**

*Five of the 57 floristic types designated for this project were not captured directly by any one map class, including the following: (1) *Thuja occidentalis* - (*Larix laricina*) Seepage Forest Association (CEGL002455), (2) *Rubus parviflorus* Shrubland [Provisional] Association (CEGL005248), (3) Eroding Clay Bank Sparse Vegetation Association (CEGL002584), (4) Inland Limestone Pavement Sparse Vegetation Association (CEGL002570), and (5) Sandstone Midwest Moist Cliff Sparse Vegetation Association (CEGL002287). Occurrences of these vegetation types were in areas too small to map.

Map Classes in the NVCS

Sixty-eight map classes represent natural/semi-natural types in the NVCS and two represent cultural types in the NVCS (agriculture and developed, which is modified into further detail by using the NLCD 2001 units). Seven map classes rest at the group level in the NVCS. Sixty-one map classes represent 52 floristic types (five associations are not captured directly by any one map class) in the NVCS, of which 16 are phases to 7 association types. One of the 52 floristic types is an alliance, and the remaining 51 are associations. The following is a breakdown of map classes and their relation to the NVCS, organized by NVCS class:

Forest & Woodland: Forty map classes represent 30 natural/semi-natural vegetation types. Four map classes rest at two group types, three being a ruderal forest group and one being a plantation group. Thirty-six map classes represent 28 association types; 14 of these map classes are phases to six of the associations.

It is worth noting that one association type—*Thuja occidentalis* - (*Larix laricina*) Seepage Forest Association (CEGL002455)—was not captured directly by any one map class. These seep forests were in areas too small to map. We believe this type to be most common as an inclusion to the White-cedar - Boreal Conifer Mesic Forest map class, which represents the *Thuja occidentalis* / *Abies balsamea* - *Acer spicatum* Forest Association (CEGL002449).

Shrubland & Grassland: Twenty-two map classes represent 20 natural/semi-natural vegetation types. Three map classes rest at two group types, with one group being ruderal and one group

being wet meadow. One map class represents an alliance type. Eighteen map classes represent 17 associations; two of these map classes are phases to one association.

It is worth noting that one association type—*Rubus parviflorus* Shrubland [Provisional] Association (CEGL005248)—was not captured directly by any one map class. These shrublands were in areas too small to map. We believe this type to be most common as an inclusion to either the Ruderal Grassland or the Ruderal Shrubland map classes, which both represent the Eastern Ruderal Shrubland & Grassland Group [Placeholder] (G059.)

Aquatic Vegetation: Two map classes represent two natural/semi-natural vegetation types, with both being associations.

Nonvascular & Sparse Vascular Rock Vegetation: Four map classes represent four natural/semi-natural vegetation types, with all three being associations.

It is worth noting that three association types were not captured directly by any one map class. These types include the Eroding Clay Bank Sparse Vegetation Association (CEGL002584), Inland Limestone Pavement Sparse Vegetation Association (CEGL002570), and Sandstone Midwest Moist Cliff Sparse Vegetation Association (CEGL002287). These vegetation types were too small to map.

Agricultural Vegetation Cultural: One map class—fruit orchards—represents one cultural vegetation type at the subgroup level.

Developed Vegetation Cultural: One map class—developed areas—represents one cultural vegetation type at the formation level. This map class is modified into further detail by using NLCD 2001 classification units.

Map Classes Not in the NVCS

Four map classes represent non-vegetation features not described in the NVCS, which correlate to the NLCD 2001 classification. We have categorized these map classes into the two following groups: Non-vegetated Water and Non-vegetated Land.

Map Classification Link to Types in the NVCS

Table 10 lists the map classes (map-class phases included) as they relate to the NVCS. It is organized first by class, then division, macrogroup, group, and finally floristic (mostly association). Map classes rest in the finest possible level of the NVCS.

Table 10. Map classification with crosswalk to the National Vegetation Classification Standard (Version 2) for the Pictured Rocks National Lakeshore vegetation mapping project.

[NVCS, National Vegetation Classification Standard; NLCD, National Land Cover Database; MMU, minimum mapping unit]

Map-class Code	Map-class Name
1. FOREST & WOODLAND CLASS	
1.C.2.a. Eastern North American Cool Temperate Forest Division	
MG014. Northern Hardwood & Conifer Forest Macrogroup	
G163. Northern Hardwood - Hemlock - White Pine Forest Group	
	Acer saccharum - *Betula alleghaniensis* - (*Tilia americana*) Forest Association (CEGL002457)
FMB	Maple - Yellow Birch Northern Hardwoods Forest (classic phase)
FMY	Maple - Yellow Birch Northern Hardwoods Forest (yew phase)
FMF	Maple - Yellow Birch Northern Hardwoods Forest (balsam fir shrub phase)
FMM	Maple - Yellow Birch Northern Hardwoods Forest (sugar maple phase)
	Pinus strobus - *Tsuga canadensis* Great Lakes Forest Association (CEGL002590)
FWH	Great Lakes White Pine - Hemlock Forest
	Thuja occidentalis / *Abies balsamea* - *Acer spicatum* Forest Association (CEGL002449)
FCC	White-cedar - Boreal Conifer Mesic Forest (conifer phase)
FCM	White-cedar - Boreal Conifer Mesic Forest (conifer - hardwood phase)
	Tsuga canadensis - (*Betula alleghaniensis*) Forest Association (CEGL002598)
FHC	Hemlock Mesic Forest
	Tsuga canadensis - *Acer saccharum* - *Betula alleghaniensis* Forest Association (CEGL005044)
FHM	North-Central Hemlock - Hardwood Forest
	Tsuga canadensis - *Fagus grandifolia* - (*Acer saccharum*) Great Lakes Forest Association (CEGL005042)
FHB	Great Lakes Hemlock - Beech - Hardwood Forest
G025. White Pine - Red Pine - Jack Pine - Oak Forest & Woodland Group	
	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)
FWO	White Pine - Red Oak Forest

Map-class Code	Map-class Name
	Pinus strobus - *Populus tremuloides* - (*Acer rubrum*) / *Pteridium aquilinum* Forest Association (CEGL005563)
FPB	White Pine - Mixed Deciduous / Bracken Barren Forest and Scrub (forest phase)
SSS	White Pine - Mixed Deciduous / Bracken Barren Forest and Scrub (scrub phase)
	Pinus strobus - *Populus tremuloides* / *Corylus cornuta* Forest Association (CEGL002479)
FWA	White Pine - Aspen - Birch Forest
	Pinus strobus / *Vaccinium* spp. Forest Association (CEGL002444)
FWP	White Pine / Blueberry Dry-Mesic Forest
	MG159. Northern Pine - Oak Woodland & Barrens Macrogroup
	G160. Great Lakes Pine Barrens Group
	Pinus banksiana - *Pinus resinosa* - *Pinus strobus* Dune Forest Association (CEGL002589)
FPD	Great Lakes Dune Pine Forest
	MG013. Eastern North American Ruderal Forest & Plantation Macrogroup
	G030. Northern & Central Hardwood & Conifer Ruderal Forest Group
FCX	Conifer Ruderal Forest
FDX	Hardwood Ruderal Forest
FMX	Conifer - Hardwood Ruderal Forest
	G032. Northern & Central Conifer & Hardwood Plantation Group
FPE	Conifer Plantation
	1.C.3.a. Northeastern & Central North American Flooded & Swamp Forest Division
	MG030. Northern & Central Swamp Forest Macrogroup
	G046. Northern & Central Alkaline Conifer & Hardwood Swamp Group
	Fraxinus nigra - Mixed Hardwoods - Conifers / *Cornus sericea* / *Carex* spp. Forest Association (CEGL002105)
FBA	Black Ash - Mixed Hardwood Swamp (black ash phase)
FLD	Black Ash - Mixed Hardwood Swamp (lowland phase)
	Pinus strobus - (*Acer rubrum*) / *Osmunda* spp. Forest Association (CEGL002482)
FWM	White Pine - Red Maple Swamp (swamp phase)
FWW	White Pine - Red Maple Swamp (swamp - dune mosaic phase)
	Thuja occidentalis - (*Larix laricina*) Seepage Forest Association (CEGL002455)
N/A	White-cedar Seepage Swamp
	Thuja occidentalis - *Fraxinus nigra* Forest Association (CEGL005165)
FCA	White-cedar - Black Ash Swamp

Map-class Code	Map-class Name
	Tsuga canadensis - *Betula alleghaniensis* Saturated Forest Association (CEGL005003)
FHS	Hemlock - Yellow Birch Swamp Wet-Mesic Forest
	MG160. Northern & Central Tall Shrub Wetland Macrogroup
	G167. Northern & Central Shrub Swamp Group
	Alnus incana Swamp Shrubland Association (CEGL002381)
SAS	Gray Alder Swamp Shrubland
	1.D.1.a. North American Lowland Boreal Forest Division
	MG037. Eastern & Central North American Boreal Conifer & Hardwood Forest Macrogroup
	G047. Jack Pine - Black Spruce Forest Group
	Picea mariana / *Pleurozium schreberi* Forest Association (CEGL002447)
FBS	Black Spruce / Feathermoss Forest
	Pinus banksiana - *Populus tremuloides* / *Diervilla lonicera* Forest Association (CEGL002518)
FJM	Jack Pine - Aspen / Bush-honeysuckle Forest
	Pinus banksiana / *Abies balsamea* Forest Association (CEGL002437)
FJF	Jack Pine / Balsam Fir Forest
	Pinus banksiana / *Vaccinium* spp. / *Pleurozium schreberi* Forest Association (CEGL002441)
FJB	Jack Pine / Blueberry / Feathermoss Forest
	G048. White Spruce - Balsam Fir Forest Group
	Abies balsamea - *Betula papyrifera* / *Diervilla lonicera* Forest Association (CEGL002474)
FFB	Balsam Fir - Paper Birch Forest
	Betula papyrifera / *Diervilla lonicera* - (*Abies balsamea*) Forest Association (CEGL002463)
FGF	Paper Birch / Fir Forest
	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

Map-class Code	Map-class Name
1.D.2.a. North American Boreal Flooded & Swamp Forest Division	
MG038. Central & Eastern Boreal Flooded & Swamp Forest Macrogroup	
G050. Black Spruce - Tamarack Acidic Swamp Group	
Picea mariana - (*Larix laricina*) / *Ledum groenlandicum* / *Sphagnum* spp. Forest Association (CEGL005271)	
FSS	Black Spruce - Tamarack / Labrador-tea Poor Swamp (black spruce phase)
FTS	Black Spruce - Tamarack / Labrador-tea Poor Swamp (tamarack phase)
G051. Tamarack - Conifer Alkaline Swamp Group	
Thuja occidentalis - (*Picea mariana*, *Abies balsamea*) / *Alnus incana* Forest Association (CEGL002456)	
FCS	White-cedar - (Mixed Conifer) / Alder Swamp
2. SHRUBLAND & GRASSLAND CLASS	
2.C.1.c. Eastern North American Grassland, Meadow & Shrubland Division	
MG164. Eastern Temperate Forest Region Savanna & Barrens Macrogroup	
G063. Eastern Shrub-Herb Sand Barrens Group	
Pteridium aquilinum - *Bromus kalmii* Herbaceous Vegetation Association (CEGL005142)	
HBF	Bracken Grassland
MG123. Eastern Ruderal Shrubland & Grassland Macrogroup	
G059. Eastern Ruderal Shrubland & Grassland Group [Placeholder]	
SMX	Ruderal Shrubland
HMX	Ruderal Grassland
2.C.2.a. North American Boreal Grassland, Meadow & Shrubland Division	
MG055. North American Boreal Shrubland & Grassland Macrogroup	
G339. Eastern North American Boreal Shrubland Group	
Rubus parviflorus Shrubland [Provisional] Association (CEGL005248)	
N/A	Thimbleberry Shrubland
2.C.3.a. Eastern North American Coastal Grassland & Shrubland Division	
MG057. Eastern North American Coastal Grassland & Shrubland Macrogroup	
G089. Great Lakes Coast Grassland & Shrubland Group	
Ammophila breviligulata - (*Schizachyrium scoparium*) Herbaceous Vegetation (CEGL005098)	
HAB	Great Lakes Beachgrass Dune
Hudsonia tomentosa Dune Dwarf-shrubland Association (CEGL004024)	
DBH	Great Lakes Beach-heather Dune Dwarf-shrubland

Map-class Code	Map-class Name

Juniperus horizontalis - *Arctostaphylos uva-ursi* - *Juniperus communis* Dune Dwarf-shrubland Association (CEGL005064)

DJD Great Lakes Juniper Dune Shrubland

Pinus banksiana - (*Pinus resinosa*) - *Pinus strobus* / *Juniperus horizontalis* Wooded Herbaceous Vegetation Association (CEGL005125)

HPB Great Lakes Coast Pine Barrens (barrens phase)

HPW Great Lakes Coast Pine Barrens (woodland phase)

Populus deltoides - (*Juniperus virginiana*) Dune Woodland Association (CEGL005119)

WCD Cottonwood Dune Open Woodland

Prunus pumila - (*Ptelea trifoliata*) Dune Shrubland Association (CEGL005075)

SCW Sand Cherry Dune Shrubland

2.C.4.a. North American Bog & Fen Division

MG062. North American Boreal Bog & Fen Macrogroup

G185. Boreal Alkaline Peatland Group

Betula pumila - (*Salix* spp.) Saturated Shrubland Alliance (A.1021)

SBB Bog Birch - (Willow species) Saturated Shrubland

Carex lasiocarpa - (*Carex rostrata*) - *Equisetum fluviatile* Herbaceous Vegetation Association (CEGL005229)

HSS Wiregrass Sedge Shore Fen

Myrica gale Fen Shrubland Association (CEGL005141)

SSF Sweet Gale Shrub Fen

G053. North American Boreal Acidic Peatland Group

Carex lasiocarpa - *Carex oligosperma* / *Sphagnum* spp. Herbaceous Vegetation Association (CEGL002265)

HSP Northern Sedge Poor Fen

Chamaedaphne calyculata - *Myrica gale* / *Carex lasiocarpa* Dwarf-shrubland Association (CEGL005228)

DLS Leatherleaf - Sweetgale Shore Fen

Chamaedaphne calyculata / *Carex oligosperma* / *Sphagnum* spp. Poor Fen Dwarf-shrubland Association (CEGL005277)

DLF Leatherleaf Poor Fen

2.C.5.a. Eastern North America Freshwater Wet Meadow, Riparian & Marsh Division

MG069. Eastern & North-Central North American Marsh & Wet Meadow Macrogroup

G125. Eastern North American Freshwater Marsh Group

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

HHT Water Horsetail - Spikerush Marsh

Map-class Code	Map-class Name
	Typha spp. - *Schoenoplectus acutus* - Mixed Herbs Midwest Herbaceous Vegetation Association (CEGL002229)
HCM	Midwest Mixed Emergent Deep Marsh
	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)
HSG	Northern Sedge Wet Meadow
	Cornus sericea - *Salix* spp. - (*Rosa palustris*) Shrubland Association (CEGL002186)
SDW	Dogwood - Willow Swamp
5. AQUATIC VEGETATION CLASS	
5.B.1.a. North American Freshwater Aquatic Vegetation Division	
MG108. Eastern North American Freshwater Aquatic Vegetation Macrogroup	
G114. Eastern North American Freshwater Aquatic Vegetation Group [Placeholder]	
	Nymphaea odorata - *Nuphar* (*microphylla*, *variegata*) Herbaceous Vegetation Association (CEGL002562)
HFA	Northern Water-lily Aquatic Wetland
	Potamogeton spp. - *Ceratophyllum* spp. Midwest Herbaceous Vegetation Association (CEGL002282)
HSV	Midwest Pondweed Submerged Aquatic Wetland
6. NONVASCULAR & SPARSE VASCULAR ROCK VEGETATION CLASS	
6.B.2.a. Eastern North American Temperate Cliff, Scree & Rock Vegetation Division	
MG176. Eastern North American Beach, Shoreline & Flat Macrogroup	
G342. Eastern North American Lake Flat & Beach Group	
	Inland Freshwater Strand Beach Sparse Vegetation Association (CEGL002310)
VAV	Inland Freshwater Strand Beach
	Lake Mudflats Sparse Vegetation Association (CEGL002313)
VMF	Lake Mudflats
MG111. Eastern North American Cliff & Rock Vegetation Macrogroup	
G340. Eastern North American Lake & River Bluff Group [Placeholder]	
	Eroding Clay Bank Sparse Vegetation Association (CEGL002584)
N/A	Eroding Clay Bank

Map-class Code	Map-class Name
	G341. Great Lakes Cliff & Shore Group [Placeholder]
	Inland Limestone Pavement Sparse Vegetation Association (CEGL002570)
N/A	Inland Limestone Pavement
	Sandstone Bedrock Great Lakes Shore Sparse Vegetation Association (CEGL002507)
VBS	Great Lakes Sandstone Bedrock Shore
	Sandstone Great Lakes Shore Cliff Sparse Vegetation Association (CEGL002503)
VSC	Great Lakes Shore 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)	
Orchard (tree) Subformation (L4)	
Fruit - Orchards Subgroup (L6)	
FOD	Deciduous Orchard
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)	
NDV	Developed Area
NON-NVCS UNITS	
Non-Vegetated Water & Land (<1% vegetated)	
Non-Vegetated Water	
Open Water (NLCD 2001; 11)	
NSR	Stream & River
NWP	Open Water Pond
NWL	Open Water Lake
Non-Vegetated Land	
Barren Land (NLCD 2001; 31)	
NSB	Sand & Cobble Beach

Map Classification Descriptions

We provide descriptions of map classes (and their phases) representing those vegetation types in the NVCS, as well as of non-vegetated units. These descriptions are provided in Appendix E: Descriptions of Map Classes. These descriptions 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 PIRO 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 group 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) represented in the vegetation map layer for the Pictured Rocks National Lakeshore vegetation mapping project.

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

Map Code	Map-class Name	Freq	Area (Ha)	Ave (Ha)	Area (Ac)	Ave (Ac)
FOREST & WOODLAND CLASS						
Northern Hardwood - Hemlock - White Pine Forest Group						
FMB	Maple - Yellow Birch Northern Hardwoods Forest (classic phase)	667	14,667.5	22.0	36,244.1	54.3
FMY	Maple - Yellow Birch Northern Hardwoods Forest (yew phase)	41	585.4	14.3	1,446.6	35.3
FMF	Maple - Yellow Birch Northern Hardwoods Forest (balsam fir shrub phase)	140	502.6	3.6	1,242.0	8.9
FMM	Maple - Yellow Birch Northern Hardwoods Forest (sugar maple phase)	92	1,966.3	21.4	4,858.8	52.8
FWH	Great Lakes White Pine - Hemlock Forest	16	41.8	2.6	103.4	6.5
FCC	White-cedar - Boreal Conifer Mesic Forest (conifer phase)	7	19.9	2.8	49.1	7.0
FCM	White-cedar - Boreal Conifer Mesic Forest (conifer - hardwood phase)	473	1,818.4	3.8	4,493.3	9.5
FHC	Hemlock Mesic Forest	32	88.7	2.8	219.3	6.9
FHM	North-Central Hemlock - Hardwood Forest	203	736.1	3.6	1,818.9	9.0
FHB	Great Lakes Hemlock - Beech - Hardwood Forest	276	1,318.1	4.8	3,257.1	11.8
White Pine - Red Pine - Jack Pine - Oak Forest & Woodland Group						
FRA	Red Pine - Aspen - Birch Forest	43	118.0	2.7	291.7	6.8
FRP	Red Pine / Blueberry Dry Forest	162	764.2	4.7	1,888.4	11.7
FWO	White Pine - Red Oak Forest	10	40.6	4.1	100.2	10.0
FPB	White Pine - Mixed Deciduous / Bracken Barren Forest and Scrub (forest phase)	42	134.0	3.2	331.1	7.9
SSS	White Pine - Mixed Deciduous / Bracken Barren Forest and Scrub (scrub phase)	35	41.4	1.2	102.3	2.9
FWA	White Pine - Aspen - Birch Forest	167	682.0	4.1	1,685.3	10.1
FWP	White Pine / Blueberry Dry-Mesic Forest	192	1,205.7	6.3	2,979.2	15.5
Great Lakes Pine Barrens Group						
FPD	Great Lakes Dune Pine Forest	4	6.2	1.5	15.2	3.8
Northern & Central Hardwood & Conifer Ruderal Forest Group						
FCX	Conifer Ruderal Forest	38	103.4	2.7	255.5	6.7
FDX	Hardwood Ruderal Forest	79	202.7	2.6	500.8	6.3
FMX	Conifer - Hardwood Ruderal Forest	93	241.1	2.6	595.8	6.4

Map Code	Map-class Name	Freq	Area (Ha)	Ave (Ha)	Area (Ac)	Ave (Ac)
Northern & Central Conifer & Hardwood Plantation Group						
FPE	Conifer Plantation	10	11.6	1.2	28.6	2.9
Northern & Central Alkaline Conifer & Hardwood Swamp Group						
FBA	Black Ash - Mixed Hardwood Swamp (black ash phase)	56	81.7	1.5	201.9	3.6
FLD	Black Ash - Mixed Hardwood Swamp (lowland phase)	82	116.2	1.4	287.1	3.5
FWM	White Pine - Red Maple Swamp (swamp phase)	5	20.8	4.2	51.5	10.3
FWW	White Pine - Red Maple Swamp (swamp - dune mosaic phase)	2	11.7	5.8	28.9	14.4
N/A	White-cedar Seepage Swamp	0	0.0	0.0	0.0	0.0
FCA	White-cedar - Black Ash Swamp	224	864.8	3.9	2,137.0	9.5
FHS	Hemlock - Yellow Birch Swamp Wet-Mesic Forest	5	14.2	2.8	35.1	7.0
Northern & Central Shrub Swamp Group						
SAS	Gray Alder Swamp Shrubland	139	129.7	0.9	320.5	2.3
Jack Pine - Black Spruce Forest Group						
FBS	Black Spruce / Feathermoss Forest	14	44.0	3.1	108.8	7.8
FJM	Jack Pine - Aspen / Bush-honeysuckle Forest	27	38.8	1.4	95.9	3.6
FJF	Jack Pine / Balsam Fir Forest	18	30.9	1.7	76.5	4.2
FJB	Jack Pine / Blueberry / Feathermoss Forest	109	440.8	4.0	1,089.2	10.0
White Spruce - Balsam Fir Forest Group						
FFB	Balsam Fir - Paper Birch Forest	9	46.2	5.1	114.1	12.7
FGF	Paper Birch / Fir Forest	2	4.0	2.0	9.9	5.0
FCP	Spruce - Fir - Aspen Forest	68	164.7	2.4	407.1	6.0
FSF	Spruce - Fir / Mountain Maple Forest	7	25.4	3.6	62.9	9.0
Black Spruce - Tamarack Acidic Swamp Group						
FSS	Black Spruce - Tamarack / Labrador-tea Poor Swamp (black spruce phase)	49	142.2	2.9	351.5	7.2
FTS	Black Spruce - Tamarack / Labrador-tea Poor Swamp (tamarack phase)	12	34.9	2.9	86.2	7.2
Tamarack - Conifer Alkaline Swamp Group						
FCS	White-cedar - (Mixed Conifer) / Alder Swamp	227	1,069.6	4.7	2,643.0	11.6
SHRUBLAND & GRASSLAND CLASS						
Eastern Shrub-Herb Sand Barrens Group						
HBF	Bracken Grassland	137	217.3	1.6	536.9	3.9

Map Code	Map-class Name	Freq	Area (Ha)	Ave (Ha)	Area (Ac)	Ave (Ac)
Eastern Ruderal Shrubland & Grassland Group [Placeholder]						
SMX	Ruderal Shrubland	27	39.9	1.5	98.5	3.6
HMX	Ruderal Grassland	72	95.5	1.3	236.0	3.3
Eastern North American Boreal Shrubland Group						
N/A	Thimbleberry Shrubland	0	0.0	0.0	0.0	0.0
Great Lakes Coast Grassland & Shrubland Group						
HAB	Great Lakes Beachgrass Dune	64	535.3	8.4	1,322.7	20.7
DBH	Great Lakes Beach-heather Dune Dwarf-shrubland	4	3.0	0.7	7.4	1.8
DJD	Great Lakes Juniper Dune Shrubland	24	16.6	0.7	41.0	1.7
HPB	Great Lakes Coast Pine Barrens (barrens phase)	34	21.2	0.6	52.4	1.5
HPW	Great Lakes Coast Pine Barrens (woodland phase)	48	82.6	1.7	204.2	4.3
WCD	Cottonwood Dune Open Woodland	5	1.8	0.4	4.5	0.9
SCW	Sand Cherry Dune Shrubland	21	24.0	1.1	59.4	2.8
Boreal Alkaline Peatland Group						
SBB	Bog Birch - (Willow species) Saturated Shrubland	2	2.2	1.1	5.5	2.7
HSS	Wiregrass Sedge Shore Fen	8	14.1	1.8	34.9	4.4
SSF	Sweet Gale Shrub Fen	1	1.0	1.0	2.4	2.4
North American Boreal Acidic Peatland Group						
HSP	Northern Sedge Poor Fen	9	4.1	0.5	10.2	1.1
DLS	Leatherleaf - Sweetgale Shore Fen	69	60.0	0.9	148.2	2.1
DLF	Leatherleaf Poor Fen	14	7.5	0.5	18.6	1.3
Eastern North American Freshwater Marsh Group						
HHT	Water Horsetail - Spikerush Marsh	8	3.4	0.4	8.4	1.1
HCM	Midwest Mixed Emergent Deep Marsh	17	19.8	1.2	48.9	2.9
Eastern North American Wet Meadow Group						
HWM	Wet Meadow Mixed Herbaceous	84	98.0	1.2	242.2	2.9
HCC	Bluejoint Wet Meadow	16	12.3	0.8	30.4	1.9
HSG	Northern Sedge Wet Meadow	38	27.9	0.7	69.1	1.8
SDW	Dogwood - Willow Swamp	12	7.7	0.6	18.9	1.6

Map Code	Map-class Name	Freq	Area (Ha)	Ave (Ha)	Area (Ac)	Ave (Ac)
AQUATIC VEGETATION CLASS						
Eastern North American Freshwater Aquatic Vegetation Group						
HFA	Northern Water-lily Aquatic Wetland	8	4.4	0.5	10.8	1.4
HSV	Midwest Pondweed Submerged Aquatic Wetland	99	84.8	0.9	209.6	2.1
NONVASCULAR & SPARSE VASCULAR ROCK VEGETATION CLASS						
Eastern North American Lake Flat & Beach Group						
VAV	Inland Freshwater Strand Beach	3	1.2	0.4	2.9	1.0
VMF	Lake Mudflats	2	2.1	1.0	5.1	2.5
Eastern North American Lake & River Bluff Group						
N/A	Eroding Clay Bank	0	0.0	0.0	0.0	0.0
Great Lakes Cliff & Shore Group						
N/A	Inland Limestone Pavement	0	0.0	0.0	0.0	0.0
VBS	Great Lakes Sandstone Bedrock Shore	2	2.2	1.1	5.3	2.7
VSC	Great Lakes Shore Sandstone Cliff	7	6.6	0.9	16.3	2.3
N/A	Midwest Moist Sandstone Cliff	0	0.0	0.0	0.0	0.0
AGRICULTURAL VEGETATION CULTURAL CLASS						
Orchard (tree) Subformation						
FOD	Deciduous Orchard	1	1.5	1.5	3.6	3.6
DEVELOPED VEGETATION CULTURAL CLASS						
Developed Area						
NDV	Developed Area	59	311.7	5.3	770.1	13.1
NON-NVCS UNITS						
Open Water						
NSR	Stream & River	10	43.4	4.3	107.3	10.7
NWP	Open Water Pond	11	26.9	2.4	66.4	6.0
NWL	Open Water Lake	10	3,336.5	333.6	8,244.6	824.5
Barren Land						
NSB	Sand & Cobble Beach	17	80.2	4.7	198.1	11.7

Table 12. Frequencies and areas of map classes (compiled at the group level in the National Vegetation Classification Standard) represented in the vegetation map layer for the Apostle Islands National Lakeshore vegetation mapping project.

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

NVCS Class and Group Name	Freq	Area (Ha)	Ave (Ha)	Area (Ac)	Ave (Ac)
FOREST & WOODLAND CLASS	**3,877**	**28,576.4**	**7.4**	**70,613.8**	**18.2**
Northern Hardwood - Hemlock - White Pine Forest Group	1,947	21,744.9	11.2	53,732.7	27.6
White Pine - Red Pine - Jack Pine - Oak Forest & Woodland Group	651	2,985.9	4.6	7,378.2	11.3
Great Lakes Pine Barrens Group	4	6.2	1.5	15.2	3.8
Northern & Central Hardwood & Conifer Ruderal Forest Group	210	547.2	2.6	1,352.1	6.4
Northern & Central Conifer & Hardwood Plantation Group	10	11.6	1.2	28.6	2.9
Northern & Central Alkaline Conifer & Hardwood Swamp Group	374	1,109.4	3.0	2,741.4	7.3
Northern & Central Shrub Swamp Group	139	129.7	0.9	320.5	2.3
Jack Pine - Black Spruce Forest Group	168	554.6	3.3	1,370.4	8.2
White Spruce - Balsam Fir Forest Group	86	240.4	2.8	593.9	6.9
Black Spruce - Tamarack Acidic Swamp Group	61	177.1	2.9	437.7	7.2
Tamarack - Conifer Alkaline Swamp Group	227	1,069.6	4.7	2,643.0	11.6
SHRUBLAND & GRASSLAND CLASS	**714**	**1,295.3**	**1.8**	**3,200.7**	**4.5**
Eastern Shrub-Herb Sand Barrens Group	137	217.3	1.6	536.9	3.9
Eastern Ruderal Shrubland & Grassland Group	99	135.4	1.4	334.5	3.4
Eastern North American Boreal Shrubland Group	0	0.0	0.0	0.0	0.0
Great Lakes Coast Grassland & Shrubland Group	200	684.5	3.4	1,691.4	8.5
Boreal Alkaline Peatland Group	11	17.3	1.6	42.7	3.9
North American Boreal Acidic Peatland Group	92	71.7	0.8	177.1	1.9
Eastern North American Freshwater Marsh Group	25	23.2	0.9	57.4	2.3
Eastern North American Wet Meadow Group	150	145.9	1.0	360.6	2.4
AQUATIC VEGETATION CLASS	**107**	**89.2**	**0.8**	**220.4**	**2.1**
Eastern North American Freshwater Aquatic Vegetation Group	107	89.2	0.8	220.4	2.1
NONVASCULAR & SPARSE VASCULAR ROCK VEGETATION CLASS	**14**	**12.0**	**0.9**	**29.7**	**2.1**
Eastern North American Lake Flat & Beach Group	5	3.3	0.7	8.0	1.6
Eastern North American Lake & River Bluff Group	0	0.0	0.0	0.0	0.0
Great Lakes Cliff & Shore Group	9	8.8	1.0	21.6	2.4
NVCS Subtotal	**4,712**	**29,972.9**	**6.4**	**74,064.6**	**15.7**

NVCS Class and Group Name	Freq	Area (Ha)	Ave (Ha)	Area (Ac)	Ave (Ac)
AGRICULTURAL VEGETATION CULTURAL CLASS					
Orchard (tree) Subformation	1	1.5	1.5	3.6	3.6
DEVELOPED VEGETATION CULTURAL CLASS					
Developed Area	59	311.7	5.3	770.1	13.1
NVCS Cultural Subtotal	**60**	**313.1**	**5.2**	**773.8**	**12.9**
NON-NVCS UNITS					
Open Water	31	3,406.7	109.9	8,418.2	271.6
Barren Land	17	80.2	4.7	198.1	11.7
Non-NVCS Subtotal	**48**	**3,486.9**	**72.6**	**8,616.4**	**179.5**
Grand Total	**4,820**	**33,772.9**	**7.0**	**83,454.8**	**17.3**

Brief Analysis and Discussion

Collectively, the PIRO spatial database layer is composed of 4,820 polygons covering 33,772.9 ha, with an average polygon size of 7.0 ha. Map classes representing natural/semi-natural types in the NVCS apply to 4,712 polygons (97.8% of all polygons, with an average polygon size of 6.4 ha) and cover 29,972.9 ha (88.7% 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 3,877 polygons (82.3% of natural/semi-natural polygons, having an average polygon size of 7.4 ha) covering 28,576.4 ha (95.3% of area covered by the NVCS types). The Forest & Woodland Class is largely dominated by the Northern Hardwood - Hemlock - White Pine Forest Group (G163), both in polygon frequency (1,947 polygons or 50.2%) and in area (21,744.9 ha or 76.1%). This dominance by G163 is largely because the Maple - Yellow Birch Northern Hardwoods Forest map class (including all map-class phases) applies to 940 polygons (averaging 18.9 ha in polygon size), covering 17,721.8 ha. From this quick analysis, we begin to see that PIRO is largely made up of upland hardwood forests.

The non-vegetated landscape comprises about a tenth of the map layer area. Although this portion of the landscape consists of only 48 polygons, it covers 3,486.9 ha (1% of all polygons and 10.3% of the entire area). The average polygon size for map classes representing non-vegetated features (those not in the NVCS) is considerably larger than that of map classes representing NVCS types (map classes representing non-vegetated features have an average polygon size of 72.6 ha. This is largely due to the surface water jurisdiction into Lake Superior. Of the map classes representing non-vegetated features, the Open Water Lake (NWL) map class (although only 10 polygons, with an average polygon size of 333.6 ha) dominates in area (3,336.5 ha or 95.7% of the non-vegetated area).

The cultural landscape classified in the NVCS comprises a nominal portion of the map layer, consisting of a mere 60 polygons (1.2% of all polygons, with an average polygon size of 5.3 ha) and covering 313.1 ha (0.9% of the entire area). All but one of the polygons capturing the cultural landscape were classified as Developed Area (NDV), which represents cultural vegetation of campgrounds, homesteads, roads, etc. The remaining polygon was classified as Deciduous Orchard (FOD).

Considerable 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 PIRO lands excluding the environs or LZ lands versus IBZ lands) 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 the physiognomic modifiers—coverage, pattern, and height) or from introducing other spatial-data layers (e.g., invasive species, animal distribution, historical land use). By performing various exercises to the vegetation map layer, one can make further deductions regarding vegetation and its ecology.

Map Layer Presentation

Figure 19 presents the map layer produced for the PIRO 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 group level of the NVCS.

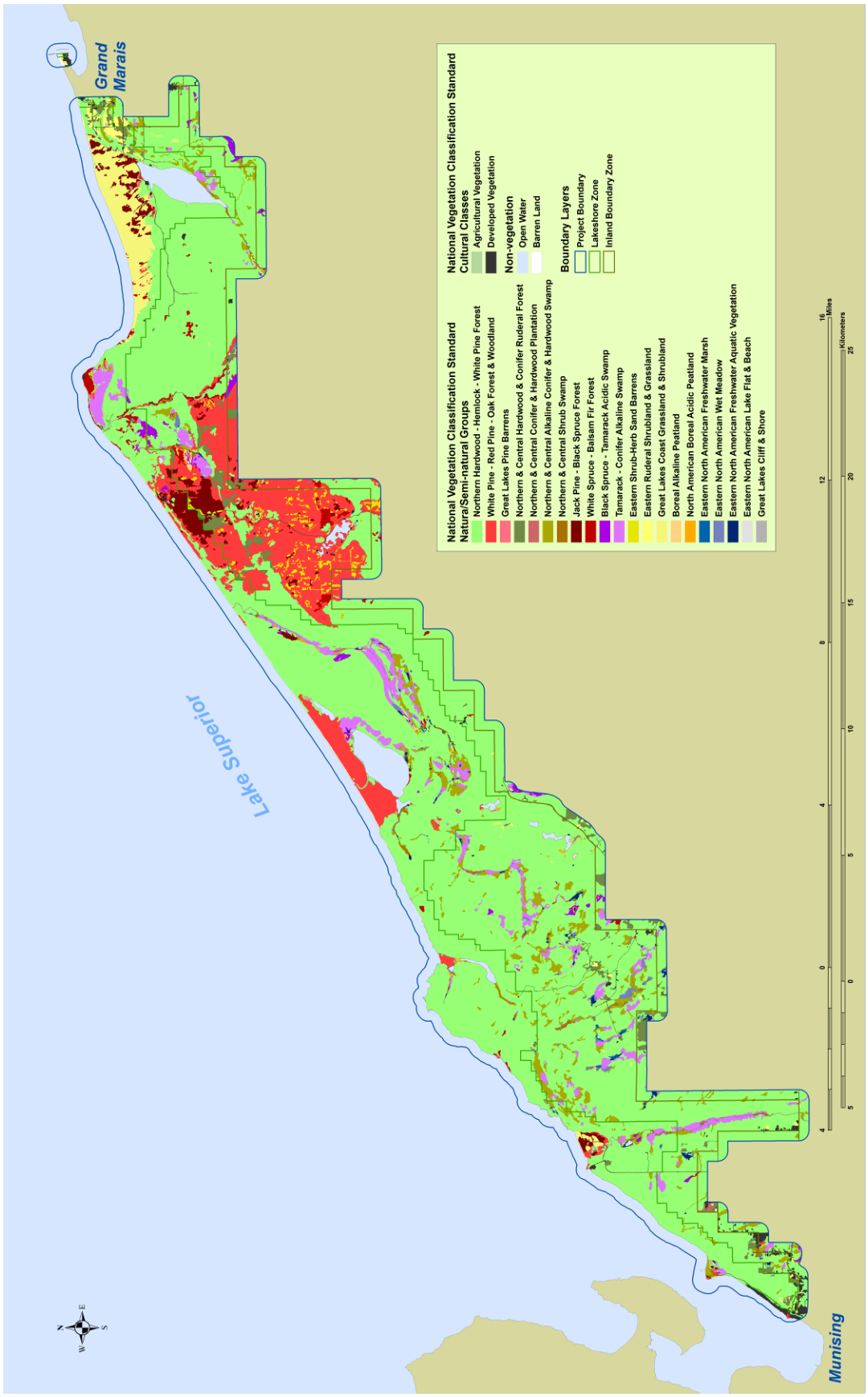


Figure 19. Vegetation of Pictured Rocks National Lakeshore and environs, presented at the natural/semi-natural group and the cultural class levels of the National Vegetation Classification Standard (Version 2).

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. An AA estimates 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 "producers' accuracy," which is the probability that an AA point has been mapped correctly (also referred to as an error of omission), and "users' accuracy," which is the probability that the map actually represents what was found on the ground (also referred to as error of commission). 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 Pictured Rocks National Lakeshore (PIRO). We included all primary map classes representing natural/semi-natural floristic vegetation types[3] 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 Lakeshore Zone and Inland Buffer Zone having public access were included in the sampling design.

The number of samples needed for each map class (theme) was determined by using Program 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.

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

[3] 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).

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 will, therefore, probably result in multiple sample sites within the same (small) polygon. Collecting five sample sites will allow 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 the recommendation is that with fewer than five sample sites (assuming one site per polygon), no estimate of 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 unlabelled 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, projected in Universal Transverse Mercator (UTM), Zone 16, 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. 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.

Data Analyses

Field data for 837 AA sites were collected and entered into the National Park Service (NPS) PLOTS Database Version 2 (NatureServe 2005b). The database was subsequently reviewed for data entry errors. Analyses of map accuracy included the following steps:

- Initial comparitive analysis of the field and map data,
- Review of all disagreements and correction of false errors as necessary,
- Final comparitive 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 GIS.

Initial Comparitive 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 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 explains our process further:

(1) Spatial error–A spatial error might occur in one of two of the following ways: (1) the GPS 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. Some areas of PIRO were difficult to orthoreference because of a lack of obvious ground controls, thus causing slight shifts in the map layer. These two phenomenon—GPS error and map-layer shift—caused many of the AA field coordinates to fall outside the intended map polygon. An AA site determined to have been spatially displaced was adjusted accordingly for the analysis.

(2) 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 comparitive analysis. (We also updated the PLOTS Database)

(3) Inclusion–The area assessed in the field during the AA might fall below the MMU for mapping (termed an inclusion). We discovered several instances where, after reviewing the aerial photographs, we could tell the site was an inclusion to the surrounding map class. Certain vegetation features can be quite apparent from each other on the 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 with smaller polygons adjacent to similar vegetation types, it sometimes difficult to determine if the assessed area actually fell within the intended polygon.

Final Comparison: Of the 837 AA sites originally collected, we dropped 24 sites because of problems with the data (e.g., missing UTM coordinates, unrectifiable spatial errors, or incomplete data). We used the remaining 813 AA sites for the final comparitive analysis of the vegetation map layer (Figure 20).

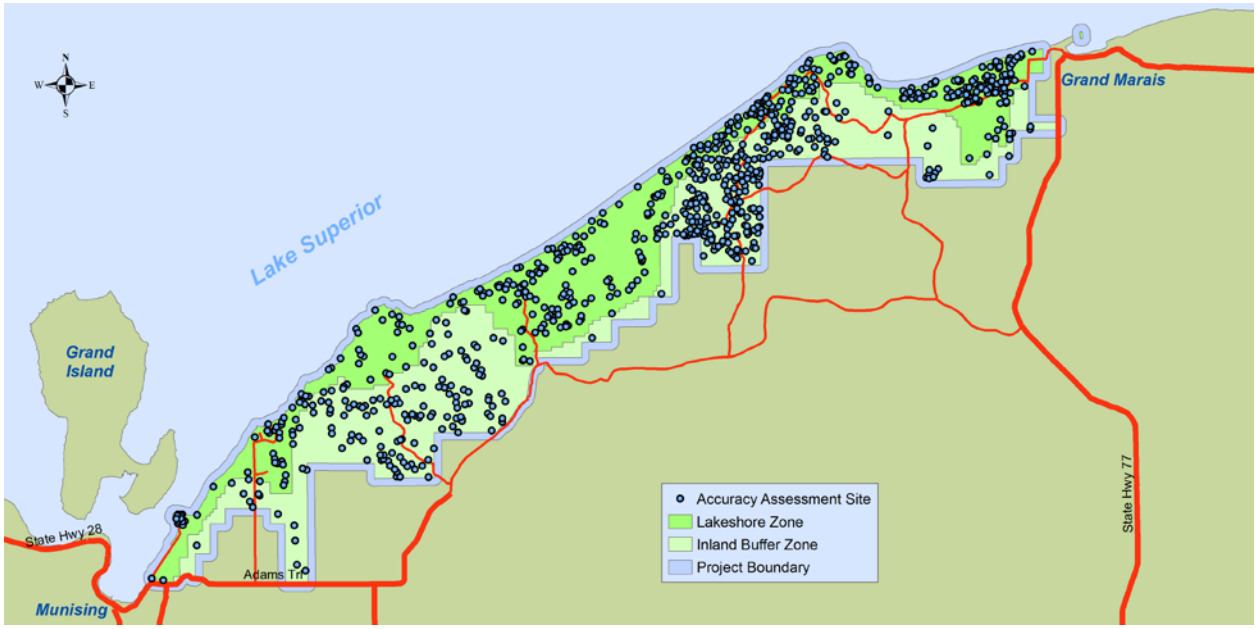


Figure 20. Locations of accuracy assessment sites used to validate the vegetation map layer for the Pictured Rocks National Lakeshore.

Individual Map Class Analysis: For individual map-class accuracies falling below standards of the NPS Vegetation Inventory Program (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 (PIRO 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 GIS, we produced a feature-class layer of the AA site locations, along with supporting tables, and incorporated them into the PIRO vegetation mapping project geodatabase. The field data are also included in the PLOTS Database for the project.

Results

Overall accuracy is 77.1% for primary map classes representing natural/semi-natural vegetation floristic types in the NVCS. A kappa adjustment for chance agreements resulted in a final overall accuracy of 76.0%. 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) present in the mapping. 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 remaining useful to users of the vegetation database layer. The most important factors affecting accuracy were disagreements in densities of conifers to deciduous trees, difficulties discerning conifer species from one other, and mapping too generally. Some individual accuracies did not meet the 80% requirement (taking into account the 90% confidence intervals). In general, errors of commission (users' accuracy) occurred in fewer map classes than did errors of omission (producers' accuracy). The following are map classes not meeting the required accuracy, either with the actual percentage or within the confidence intervals.

Users' Accuracy (Errors of Commission)

Black Spruce / Feathermoss Forest (FBS): The users' accuracy for this map class was 31%, with a 90% confidence interval of 9–53%. Of the 16 polygons mapped as FBS, 11 AA sites within those polygons were found to be different vegetation types, with errors attributed as follows: one error to Jack Pine / Balsam Fir Forest (FJF), four errors to Jack Pine / Blueberry / Feathermoss Forest (FJB), three errors to Black Spruce - Tamarack / Labrador Tea Poor Swamp (FSS), tow errors to Pine - Mixed Deciduous Bracken Barren Forest (FPB), and one error to Great Lakes Coast Pine Barrens (woodland phase, HPW). Errors were caused by misinterpreting jack pine as black spruce or mapping upland instead of wetland environments.

White-cedar - Boreal Conifer Mesic Forest (conifer - hardwood phase, FCM): The users' accuracy for this map class was 62%, with a 90% confidence interval of 47–77%. Of the 33 polygons mapped as FCM, 14 AA sites within those polygons were found to be different vegetation types, with errors attributed as follows: one error to White-cedar - (mixed Conifer) / Alder Swamp (FCS), two errors to Hemlock - Yellow Birch Swamp Wet-Mesic Forest (FHS), two errors to Maple - Yellow Birch Northern Hardwoods Forest (FMB), three errors to Black

Ash - Mixed Hardwood Swamp (FBA), three errors to North-central Hemlock - Hardwood Forest (FHM), and three errors to Spruce- Fir - Aspen Forest (FCP). Reasons for the errors were overestimating or underestimating the percentage of conifers or confusing cedar with hemlock, white spruce, or balsam fir. In a couple situations, the portion of the polygon where the AA site was located should have been included with an adjoining polygon.

Red Pine - Aspen - Birch Forest (FRA): The users' accuracy for this map class was 50%, with a 90% confidence interval of 33–67%. Of the 28 polygons mapped as FRA, 14 AA sites within those polygons were found to be other vegetation types, with errors attributed as follows: two errors to Red Pine / Blueberry Dry Forest (FRP), two errors to White Pine / Blueberry Dry-Mesic Forest (FWP), two errors to Balsam Fir - Paper Birch Forest (FFB), one error to Maple - Yellow Birch Northern Hardwoods Forest (FMB), one error to Paper Birch / Fir Forest (FGF), one error to Cottonwood Dune Open Woodland (WCD), two errors to (FPB), and three errors to White Pine - Aspen - Birch Forest (FWA). The errors were created when the AA teams determined different percentages of red pine than the mapper interpreted, when the AA site should have been included in an adjoining polygon, or when a smaller polygon of the correct type should have been mapped within a larger area classified as FRA.

White Pine - Aspen - Birch Forest (FWA): The users' accuracy for this map class was 53%, with a 90% confidence interval of 37–69%. Of the 32 polygons mapped as FWA, 15 AA sites within those polygons were found to be other vegetation types, with errors attributed as follows: two errors to Great Lakes White Pine - Hemlock Forest (FWH), one error to Balsam Fir - Paper Birch Forest (FFB), one error to Maple - Yellow Birch Northern Hardwoods Forest (FMB), three errors to Paper Birch / Fir Forest (FGF), one error to Red Pine - Aspen - Birch Forest (FRA), one error to Hemlock Mesic Forest (FHC), four errors to Great Lakes Hemlock - Beech - Hardwood Forest (FHB), one error to North-Central Hemlock - Hardwood Forest (FHM), and one error to White Pine - Mixed Deciduous / Bracken Barren Forest and Scrub (scrub phase, SSS). These errors occurred for a variety of reasons. In the misclassifications of hemlock types, hemlock was mistaken as white pine. The miss to FRA occurred because a smaller polygon of FRA should have been mapped within a larger area classified as FWA. The misses to FGF and FMB occurred because the AA team found less than 25% white pine at the sites, whereas the mapper interpreted more than 25%. The error to FFB was because the conifers were mistaken for white pine trees. The error to SSS was because a portion of the polygon should have been mapped with an adjoining polygon.

Spruce - Fir - Aspen Forest (FCP): The users' accuracy for this map class was 57%, with a 90% confidence interval of 40–74%. Of the 28 polygons mapped as FCP, 12 AA sites within those polygons were found to be other vegetation types, with errors attributed as follows: one error to Great Lakes Dune Pine Forest (FPD), one error to Hemlock - Yellow Birch Swamp Wet-Mesic Forest (FHS), four errors to Maple -Yellow Birch Northern hardwoods Forest (FMB), one error to Cottonwood Dune Open Woodland (WCD), tow errors to White Pine - Aspen - Birch Forest (FWA), one error to Sand Cherry Dune Shrubland (SCW), and two errors to Dogwood - Willow Swamp (SDW). In those missed to hemlock types, the hemlock was not recognized on the aerial photos and was, thus, mistaken for spruce and fir. Those points missed to FMB and WCD were found by the AA teams to not have a high enough percentage of conifers to be classified as FCP. The error to FPD was caused by miscalculation of relative amounts of jack pine to spruce/fir. Points missed to the shrub types (SCW and SDW) were found by the AA teams to not have

enough tree cover to be classified as FCP. Polygons mapped as SDW were actually small, subirrigated seeps within the forest matrix. In one case, shadows created difficulty in discerning the vegetation type.

White-cedar - Black Ash Swamp (FCA): The users' accuracy for this class 56%, with a 90% confidence interval of 38–73%. Of the 27 polygons mapped as FCA, 12 AA sites within those polygons were found to be other vegetation types, with errors attributed as follows: one error to White-cedar - Boreal Conifer Mesic Forest (conifer phase, FCC), one error to White-cedar - (Mixed Conifer) / Alder Swamp (FCS), seven errors to White-cedar - Boreal Conifer Mesic Forest (mixed phase, FCM), one error to Hemlock - Yellow Birch Swamp Wet-Mesic Forest (FHS), one error to North-Central Hemlock - Hardwood Forest (FHM), one error to Black Ash - Mixed hardwood Swamp (FBA). Errors were made because of miscalculating estimates of relative covers, confusing other deciduous species for black ash, mistaking hemlock for cedar, or not mapping other vegetation types found within part of a polygon classified as FCA.

Producers' Accuracy (Errors of Omission)

Great Lakes White Pine - Hemlock Forest (FWH): The producers' accuracy for this class was 44%, with a 90% confidence interval of 12–77%. Of the nine AA sites found to be FWH, five were mapped as other vegetation types, with errors attributed as follows: one error to White Pine / Blueberry Dry-Mesic Forest (FWP), two errors to White Pine - Aspen - Birch Forest (FWA), and two errors to Hemlock Mesic Forest (FHC). These errors were caused by underestimating the relative amount of hemlock in the canopy or mistaking white pine for hemlock.

Balsam Fir - Paper Birch Forest (FFB): The producers' accuracy for this class was 38%, with a confidence interval of 3–72%. Of the eight AA sites found to be FFB, five were mapped as other vegetation types, with errors attributed as follows: one error to Maple -Yellow Birch Northern Hardwoods Forest (FMB), two errors to Red Pine - Aspen - Birch Forest (FRA), one error to White Pine - Aspen - Birch Forest (FWA), and one error to North-Central Hemlock - Hardwood Forest (FHM). The errors were caused by mistaking balsam fir for other conifers or overestimating the percentage of conifers to deciduous trees in the canopy.

White-cedar - Boreal Conifer Mesic Forest (conifer phase, FCC, and mixed phase, FCM): The producers' accuracy for FCC and FCM was 53%, with a 90% confidence interval of 38–68%. Of the 40 AA sites found to be FCC or FCM, 16 polygons were mapped as other vegetation types, with errors attributed as follows: 8 errors to White-cedar - Black Ash Swamp (FCA), four errors to North-Central Hemlock - Hardwood Forest (FHM), one error to Black Ash - Mixed hardwood Swamp (FBA), one error to Maple -Yellow Birch Northern Hardwoods Forest (FMB), one error to Hemlock - Yellow Birch Swamp Wet-Mesic Forest (FHS), and one error to Black Spruce - Tamarack / Labrador Tea Poor Swamp (FSS). Some errors occurred because black ash was leaf-off at the time photos were taken, and was not, therefore, always a distinctive signature. Other errors were caused by differences in the AA team and photointerpreter in estimating the percentage of conifers present or in confusing hemlocks for cedars. Other errors were caused by mapping polygons too broadly or underestimating the amount of conifers present and, thus, mapping the polygon as a deciduous type instead of a mixed type.

Hemlock - Yellow Birch Swamp Wet-Mesic Forest (FHS): The producers' accuracy for FHS was 20%, with a 90% confidence interval of -6%–46%. Of the 10 AA sites found to be FHS,

eight polygons were mapped as other vegetation types, with errors attributed as follows: two errors to White-cedar - Boreal Conifer Mesic Forest (mixed phase, FCM), one error to Hemlock Mesic Forest (FHC), one error to North-Central Hemlock - Hardwood Forest (FHM), one error to Spruce - Fir - Aspen Forest (FCP), two errors to White Pine - Red Maple Swamp (FWM), and one error to White-cedar - Black Ash Swamp (FCA). Errors were caused by mistaking hemlocks for cedars, spruce, or white pine or by mapping areas as wetland forest instead of upland forest.

Paper Birch / Fir Forest (FGF): The producers' accuracy for FGF was 33%, with a 90% confidence interval of -7–73%. Of the six AA sites found to be FGF, four polygons were mapped as other vegetation types, with errors attributed as follows: one error to Red Pine - Aspen -Birch Forest (FRA), and three errors to White Pine - Aspen -Birch Forest (FWA). Errors were caused by mistaking balsam fir for red pine or overestimating the percentage of white pine.

Cottonwood Dune Open Woodland (WCD): The producers' accuracy for WCD was 29%, with a 90% confidence interval of -7–64%. Of the seven AA sites found to WCD, five polygons were mapped as other vegetation types, with errors attributed as follows: one error to Maple -Yellow Birch Northern Hardwoods Forest (FMB), one error to Red Pine - Aspen - Birch Forest (FRA), one error to Spruce - Fir - Aspen Forest (FCP), and two errors to Great Lakes Beachgrass Dune (HAB). Errors were caused by disagreements over the percentage of conifers or by mapping too generally.

Wiregrass Sedge shore Fen (HSS): The producer's accuracy for HSS was 33%, with a 90% confidence interval of -7%–73%. Of the six AA sites found to be HSS, two polygons were mapped as Northern Sedge Wet Meadow (HSG), and two polygons were mapped as Bluejoint Wet Meadow (HCC). Errors were caused by misinterpreting the percentages of herbaceous species to one another.

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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
	___Graminoid	___Nonvascular	05	50%	05	5-10 m
___Mixed evergreen - drought-deciduous	___Forb	___Sparsely Vegetated	06	60%	06	10-15 m
<u>Herbs</u>	___Pteridophyte		07	70%	07	15-20 m
___Annual			08	80%	08	20-35 m
___Perennial			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

Printed from Biotics on: 28 Oct 2009 Subset: Pictured Rocks National Lakeshore © 2009 NatureServe

U.S. NATIONAL VEGETATION CLASSIFICATION

ASSOCIATIONS AND ALLIANCES OF PICTURED ROCKS NATIONAL LAKESHORE

28 October 2009

by

NatureServe

1101 Wilson Blvd., 15th floor
Arlington, VA 22209

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

This subset of the International Ecological Classification Standard covers the associations and alliances attributed to Pictured Rocks National Lakeshore. 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 Shannon Menard, Senior Regional Ecologist, Minneapolis, MN <shannon_menard@natureserve.org>.



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Citations:

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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
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NatureServe also has partnered with many International and United States Federal and State organizations, which have also contributed significantly to the development of the International Classification. Partners include the following The Nature Conservancy; Provincial Forest Ecosystem Classification Groups in Canada; Canadian Forest Service; Parks Canada; United States Forest Service; National GAP Analysis Program; United States National Park Service; United States Fish and Wildlife Service; United States Geological Survey; United States Department of Defense; Ecological Society of America; Environmental Protection Agency; Natural Resource Conservation Services; United States Department of Energy; and the Tennessee Valley Authority. Many individual state organizations and people from academic institutions have also contributed to the development of this classification.

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1. Forest & Woodland

1.C.2. Cool Temperate Forest

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

MG014. Northern 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.a)
Macrogroup	Northern Hardwood & Conifer Forest (MG014)
Group	Northern Hardwood - Hemlock - White Pine Forest (G163)
Association (Common name)	Maple - Yellow Birch Northern Hardwoods Forest
Ecological System(s):	Laurentian-Acadian Northern Hardwoods Forest (CES201.564)

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

Pictured Rocks National Lakeshore Environment: This common sugar maple - birch forest was sampled at 16 locations in the park. Sites range from flat to moderately sloping south-, southwest-, west- and northwest-facing low to midslope glaciated uplands, ground moraines, and kame terraces, often with pit-and-mound topography. Soils are somewhat poorly drained to well-drained sand, loamy sand, sandy loam, silt loam, and loam. Surficial geology is end moraine of medium-textured till (Farrand and Bell 1982). The unvegetated surface is dominated by leaf litter (52-100% cover) with some wood (0-48%), water (0-1%), bare soil (0-1%), and dead snags (0-1%). Evidence of disturbance includes wind damage, past logging, insect infestation, and tree pathogens (cankers), jack pine mortality and replacement, and the presence of exotic species.
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

Pictured Rocks National Lakeshore Vegetation: The moderate to very dense (20-80% cover) highly variable tree canopy, 15-50 m tall, is dominated by *Acer saccharum* (sugar maple) and may include lesser amounts of *Acer rubrum* (red maple), *Betula papyrifera* (paper birch), *Fagus grandifolia* (American beech), *Populus balsamifera* (balsam poplar), *Populus grandidentata* (bigtooth aspen), *Prunus serotina* (black cherry), and *Tilia americana* (American basswood). The very sparse to moderately dense (5-80%) subcanopy (5-35 m) includes *Abies balsamea* (balsam fir), *Betula alleghaniensis* (yellow birch), and *Thuja occidentalis* (northern white-cedar). The very sparse to moderate (5-50%) tall-shrub layer (2-5 m) includes *Sambucus racemosa* (red elderberry). The very sparse to moderately dense (10-80%) short-shrub layer (0.5-1 m) is made up of species from the upper layers along with *Ribes* (currant) sp. The variable herbaceous layer (5-70%) includes *Dryopteris intermedia* (intermediate woodfern), *Lycopodium annotinum* (stiff clubmoss), *Maianthemum canadense* (Canada mayflower), *Maianthemum racemosum* (feathery false lily of the valley), *Matteuccia struthiopteris* (ostrich fern), *Streptopus lanceolatus* var. *roseus* (twistedstalk), *Tiarella cordifolia* (heartleaf foamflower), *Trillium cernuum* (whip-

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poor-will flower), and *Viola canadensis* (Canadian white violet), among many others; a total of 63 taxa were recorded from 15 plots. Nonvascular species (mosses) cover 0-20% of the ground surface.

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

Pictured Rocks National Lakeshore

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Acer rubrum* (red maple), *Acer saccharum* (sugar maple), *Betula papyrifera* (paper birch), *Fagus grandifolia* (American beech), *Tilia americana* (American basswood)
Tree subcanopy	Needle-leaved tree	*Abies balsamea* (balsam fir), *Thuja occidentalis* (northern white-cedar)
Tree subcanopy	Broad-leaved deciduous tree	*Betula alleghaniensis* (yellow birch)
Tall shrub/sapling	Broad-leaved deciduous shrub	*Sambucus racemosa* (red elderberry)
Short shrub/sapling	Needle-leaved shrub	*Taxus canadensis* (Canada yew)
Short shrub/sapling	Broad-leaved deciduous shrub	*Acer saccharum* (sugar maple), *Acer spicatum* (mountain maple)
Herb (field)	Fern or fern ally	*Dryopteris intermedia* (intermediate woodfern)

Global

Stratum	Lifeform	Species

CHARACTERISTIC SPECIES

Pictured Rocks National Lakeshore: *Acer saccharum* (sugar maple), *Dryopteris intermedia* (intermediate woodfern)
Global:

OTHER NOTEWORTHY SPECIES

Pictured Rocks National Lakeshore: Exotic/Invasive: *Epipactis helleborine* (broadleaf helleborine, exotic, Medium/Low), *Streptopus amplexifolius* (claspleaf twistedstalk, exotic), *Taraxacum officinale* (common dandelion, exotic), *Veronica officinalis* (common gypsyweed, exotic)
Global:

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
Pictured Rocks National Lakeshore Comments:
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:

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

OTHER COMMENTS

Other Comments:

ELEMENT DISTRIBUTION

Pictured Rocks National Lakeshore Range: This common sugar maple - yellow birch - American basswood forest occurs throughout the park.
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. Range extent is about 300,000 square km.
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

Pictured Rocks National Lakeshore Inventory Notes:
Pictured Rocks National Lakeshore Plots: PIRO.001, PIRO.012, PIRO.019, PIRO.020, PIRO.029, PIRO.038, PIRO.043, PIRO.056, PIRO.059, PIRO.060, PIRO.069, PIRO.071, PIRO.079, PIRO.118, PIRO.133, PIRO.503.
Pictured Rocks National Lakeshore Map Code: FMB, FMY, FMF, FMM
Local Description Authors: M.J. Russo
Global Description Authors: J. Drake
References: Chambers et al. 1997, Chapman et al. 1989, Coffman and Willis 1977, Farrand and Bell 1982, Flaccus and Ohmann 1964, Frelich 1995, Hansen et al. 1973, Kotar and Burger 1989, MNNHP 1993, Midwestern Ecology Working Group n.d., Pregitzer and Barnes 1984, WNHIP unpubl. data

Great Lakes White Pine - Hemlock Forest

***Pinus strobus - Tsuga canadensis* Great Lakes Forest**
Eastern White Pine - Eastern Hemlock Great Lakes Forest
Identifier: CEGL002590

NVC CLASSIFICATION

Division	Eastern North American Cool Temperate Forest (1.C.2.a)
Macrogroup	Northern Hardwood & Conifer Forest (MG014)
Group	Northern Hardwood - Hemlock - White Pine Forest (G163)
Association (Common name)	Great Lakes White Pine - Hemlock Forest
Ecological System(s):	Laurentian-Acadian Pine-Hemlock-Hardwood Forest (CES201.563)

ELEMENT CONCEPT

Global Summary: This white pine - hemlock forest type is found in the Great Lakes region of the United States and Canada. Stands occur on acidic, nutrient-poor, usually moderately well-drained soils such as sandy loams. Generally, *Tsuga canadensis* (eastern hemlock) and *Pinus strobus* (eastern white pine) are codominant, but other common associates include *Fagus grandifolia* (American beech), *Acer rubrum* (red maple), *Betula lenta* (sweet birch), *Betula alleghaniensis* (yellow birch), and *Quercus rubra* (northern red oak). *Quercus rubra* (northern red oak) becomes more prevalent in the south. Typical shrubs include *Acer spicatum* (mountain maple), *Hamamelis virginiana* (American witch-hazel), and *Acer pensylvanicum* (striped maple). The herbaceous layer may be sparse and generally depauperate, including *Trientalis borealis* (starflower), *Cypripedium acaule* (moccasin flower), *Maianthemum canadense* (Canada mayflower), *Gaultheria procumbens* (eastern teaberry), *Clintonia borealis* (bluebead), and *Lycopodium* (clubmoss) spp. Diagnostic features include the dominance of both *Pinus strobus* (eastern white pine) and *Tsuga canadensis* (eastern hemlock), with a sparse, sub-boreal ground layer.

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ENVIRONMENTAL DESCRIPTION

Pictured Rocks National Lakeshore Environment: This white pine - hemlock forest was sampled only once in the park near Legion Lake. The site is a gently sloping spit/peninsula extending into the lake and only 1-2 m above the lake surface. Soil is well-drained loamy sand. The unvegetated surface is dominated by leaf litter (90% cover) with some wood (5%) and dead snags (5%). A pair of loons with two young were observed along with deer scat and a beaver warning slap was heard. Evidence of disturbance includes logging in 1880s for pine and the possible presence white pine blister rust.

Global Environment: This community is found on acidic, nutrient-poor, usually moderately well-drained soils such as sandy loams. In the north, it may occur on ridges with a fragipan, and to the south the more prevalent habitat is higher elevations and north-facing slopes (Eyre 1980). In northern Michigan and northeastern Wisconsin, this community is commonly found on beach ridges and dunes within glacial lakebeds on poorly drained lakeplains.

VEGETATION DESCRIPTION

Pictured Rocks National Lakeshore Vegetation: The moderate (40% cover) tree canopy, 15-20 m tall, is made up of nearly equal amounts of *Acer rubrum* (red maple), *Pinus strobus* (eastern white pine), and *Tsuga canadensis* (eastern hemlock). *Betula papyrifera* (paper birch) makes up a sparse (20%) subcanopy (5-10 m). The sparse (30%) tall-shrub layer (2-5 m) includes canopy species along with *Picea mariana* (black spruce). The moderate (50%) short-shrub layer (0.5-1 m) is dominated by ericaceous species, including *Gaultheria procumbens* (eastern teaberry), *Ledum groenlandicum* (bog Labrador-tea), *Vaccinium angustifolium* (lowbush blueberry), *Vaccinium membranaceum* (thinleaf huckleberry), and *Vaccinium myrtilloides* (velvetleaf huckleberry). *Epigaea repens* (trailing arbutus) forms a very sparse (5%) dwarf-shrub layer (<0.5 m). No herbaceous layer is present. Nonvascular species (mosses) cover 10% of the ground surface.

Global Vegetation: Generally, *Tsuga canadensis* (eastern hemlock) and *Pinus strobus* (eastern white pine) are codominant, but other common associates include *Fagus grandifolia* (American beech), *Acer rubrum* (red maple), *Betula lenta* (sweet birch), *Betula alleghaniensis* (yellow birch), and *Quercus rubra* (northern red oak). *Quercus rubra* (northern red oak) becomes more prevalent in the south. Typical shrubs include *Acer spicatum* (mountain maple), *Hamamelis virginiana* (American witch-hazel), and *Acer pensylvanicum* (striped maple). The herbaceous layer may be sparse and generally depauperate, including *Trientalis borealis* (starflower), *Cypripedium acaule* (moccasin flower), *Maianthemum canadense* (Canada mayflower), *Gaultheria procumbens* (eastern teaberry), *Clintonia borealis* (bluebead), and *Lycopodium* (clubmoss) spp. (Eyre 1980).

MOST ABUNDANT SPECIES

Pictured Rocks National Lakeshore

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Pinus strobus* (eastern white pine), *Tsuga canadensis* (eastern hemlock)
Short shrub/sapling	Needle-leaved shrub	*Tsuga canadensis* (eastern hemlock)

Global

Stratum	Lifeform	Species

CHARACTERISTIC SPECIES

Pictured Rocks National Lakeshore: *Acer rubrum* (red maple), *Picea mariana* (black spruce), *Pinus strobus* (eastern white pine), *Tsuga canadensis* (eastern hemlock), *Vaccinium angustifolium* (lowbush blueberry), *Vaccinium myrtilloides* (velvetleaf huckleberry)
Global:

OTHER NOTEWORTHY SPECIES

Pictured Rocks National Lakeshore:
Global:

CONSERVATION STATUS RANK

Global Rank & Reasons: G3 (24-Oct-2002). This white pine - hemlock forest type is found in the Great Lakes region of the United States and Canada, where it currently occupies limited portions of its former range. It is floristically similar to hemlock stands without extensive white pine, and this type is not always distinguished from that type. It was far more extensive as a canopy or supercanopy dominant in presettlement forests than it is today. In Wisconsin and Michigan, white pine is often a supercanopy relict only and has been logged out of most stands. As a result, old-growth stands that belong to this type are not known to be very extensive. This type may represent a long-lived transitional phase from a pine type to a hemlock type in the absence of further disturbance. It is perhaps the combination of substrate and disturbance dynamics that create a somewhat specific set of environmental factors. Further documentation of this type is needed.

CLASSIFICATION

Status: Standard
Classification Confidence: 2 - Moderate
Pictured Rocks National Lakeshore Comments:
Global Comments: This description is based on the Great Lakes portion of the SAF cover type 22 (Eyre 1980). The type is currently not recognized in recent Ontario publications of forest types (Chambers et al. 1997, Bakowsky and Lee 1996, Lee et al. 1998), which seems surprising. In Wisconsin and Michigan, white pine is often a supercanopy relict only and has been logged out of most stands (E.

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Epstein, D. Albert pers. comm. 1996). Presence of *Picea rubens* (red spruce) may be a good indicator of the separate type, *Pinus strobus - Tsuga canadensis - Picea rubens* Forest (CEGL006324), in northern New England (and Quebec).

Global Similar Associations:

- *Pinus strobus - Tsuga canadensis - Picea rubens* Forest (CEGL006324)--a northeastern version of the same type.
- *Pinus strobus - Tsuga canadensis* Lower New England / Northern Piedmont Forest (CEGL006328)

Global Related Concepts:

- Mesic Northern Forest - Hemlock-White Pine (Chapman et al. 1989) =
- White Pine - Hemlock: 22 (Eyre 1980) B

OTHER COMMENTS

Other Comments:

ELEMENT DISTRIBUTION

Pictured Rocks National Lakeshore Range: This white pine - hemlock forest is found on a narrow peninsula of land in Legion Lake and also as a narrow band around Legion Lake at the base of the uplands. Throughout the park it occurs only in select areas that were not logged at the turn of the 20th century.

Global Range: This white pine - hemlock forest type is found in the Great Lakes region of the United States and Canada, ranging from northern Wisconsin and Michigan to central Ontario.

Nations: CA, US

States/Provinces: MI:S3, ON, WI:S2

TNC Ecoregions: 47:C, 48:C, 64:C

USFS Ecoregions (1994/95): 212Ea:CCC, 212Eb:CCC, 212Ee:CCC, 212Ha:CC?, 212Hb:CC?, 212He:CCP, 212Hh:CCP, 212Hi:CCC, 212Hj:CCC, 212Hk:CC?, 212Hl:CCC, 212Hm:CCP, 212Hn:CCP, 212Ho:CCC, 212Hp:CCP, 212Hq:CCP, 212Hr:CCP, 212Hu:CC?, 212Hv:CCP, 212Hw:CCP, 212Hx:CCP, 212Hy:CCC, 212Ia:CCC, 212Ja:CCC, 212Jb:CCP, 212Jc:CCC, 212Jj:CCC, 212Jl:CCC, 212Jm:CCC, 212Jn:CCP, 212Jo:CCP, 212Js:CCC, 222Ja:???

Federal Lands: NPS (Apostle Islands, Pictured Rocks); USFS (Chequamegon-Nicolet, Chequamegon?, Hiawatha, Huron, Huron-Manistee, Manistee, Nicolet, Ottawa)

ELEMENT SOURCES

Pictured Rocks National Lakeshore Inventory Notes:

Pictured Rocks National Lakeshore Plots: PIRO.126.

Pictured Rocks National Lakeshore Map Code: FWH

Local Description Authors: M.J. Russo

Global Description Authors: J. Drake

References: Bakowsky and Lee 1996, Barnes 1991, Chambers et al. 1997, Chapman et al. 1989, Eyre 1980, Lee et al. 1998, Midwestern Ecology Working Group n.d., WNHIP unpubl. data

White-cedar - Boreal Conifer Mesic Forest

***Thuja occidentalis / Abies balsamea - Acer spicatum* Forest**

Northern White-cedar / Balsam Fir - Mountain Maple Forest

Identifier: CEGL002449

NVC CLASSIFICATION

Division	Eastern North American Cool Temperate Forest (1.C.2.a)
Macrogroup	Northern Hardwood & Conifer Forest (MG014)
Group	Northern Hardwood - Hemlock - White Pine Forest (G163)
Association (Common name)	White-cedar - Boreal Conifer Mesic Forest
Ecological System(s):	Laurentian-Acadian Northern Hardwoods Forest (CES201.564)

ELEMENT CONCEPT

Global Summary: This sub-boreal upland white-cedar forest occurs in the northern Great Lakes region of the United States and Canada, and occasionally eastward into northern New England. Stands are found on gentle wet-mesic slopes to very steep well-drained slopes, or in the eastern portion of the range on moderately well-drained flats. The predominant aspect is north to northeast. Soils are fine to moderately coarse-textured, usually calcareous, moderately deep to deep (50-100 cm), and often contain boulders at the surface. The overstory is dominated by coniferous trees, with or without a substantial deciduous component. *Thuja occidentalis* (northern white-cedar) is the most abundant tree and may occur in pure stands. Other canopy species include *Abies balsamea* (balsam fir), *Acer rubrum* (red maple), *Betula papyrifera* (paper birch), *Picea glauca* (white spruce), *Picea mariana* (black spruce), *Populus tremuloides* (quaking aspen), and *Pinus strobus* (eastern white pine). There is usually an abundant shrub/sapling layer with saplings of *Thuja occidentalis* (northern white-cedar) and *Abies balsamea* (balsam fir) along with *Acer pensylvanicum* (striped maple) and the shrubs *Acer spicatum* (mountain maple), *Corylus cornuta* (beaked hazelnut), *Linnaea borealis* (twinflower), *Lonicera canadensis* (American fly honeysuckle), *Rubus pubescens* (dwarf red blackberry), and *Sorbus decora* (northern mountain-ash). *Vaccinium angustifolium* (lowbush blueberry) and *Viburnum nudum* var. *cassinoides* (withe-rod) may be present on more acidic sites. The ground layer is typically diverse on mesic to wet-mesic stands and less so on drier stands. Wet-mesic stands can contain a hummock-and-

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hollow topography, with a seasonally saturated hydrology. Typical species include *Aralia nudicaulis* (wild sarsaparilla), *Eurybia macrophylla* (bigleaf aster), *Clintonia borealis* (bluebead), *Coptis trifolia* (threeleaf goldthread), *Cornus canadensis* (bunchberry dogwood), *Dryopteris carthusiana* (spinulose woodfern), *Galium triflorum* (fragrant bedstraw), *Maianthemum canadense* (Canada mayflower), *Mitella nuda* (naked miterwort), *Trillium undulatum* (painted trillium), and *Trientalis borealis* (starflower). Mosses include *Sanionia uncinata* (sanionia moss), *Hylocomium splendens* (splendid feather moss), *Plagiomnium cuspidatum* (toothed plagiomnium moss), *Pleurozium schreberi* (Schreber's big red stem moss), *Ptilium crista-castrensis* (knights plume moss), and *Rhytidiadelphus triquetrus* (rough goose neck moss) and, in wetter phases of the type, *Sphagnum* (sphagnum) spp.

ENVIRONMENTAL DESCRIPTION

Pictured Rocks National Lakeshore Environment: This white-cedar - birch forest was sampled once in the park. This site is located two-thirds of the way down a somewhat steep, northwest-facing exposed inland sandstone cliff. Soil is saturated (seep), poorly drained loam. The unvegetated surface is made up of leaf litter (75% cover), wood (21%) and bare soil (4%). There is very little evidence of disturbance.

Global Environment: This community is found on gentle wet-mesic slopes to very steep well-drained slopes (MNNHP 1993). The predominant aspect is north to northeast. Soils are moderately deep to deep (50-100 cm), calcareous, coarse- to fine-textured, and often contain boulders at the surface (Ohmann and Ream 1971, Sims et al. 1989).

VEGETATION DESCRIPTION

Pictured Rocks National Lakeshore Vegetation: The moderate (50% cover) tree canopy, 15-20 m tall, is dominated by *Thuja occidentalis* (northern white-cedar) and *Betula alleghaniensis* (yellow birch) with lesser amounts of *Populus balsamifera* (balsam poplar) and *Betula papyrifera* (paper birch). The sparse (30%) subcanopy (10-15 m) is made up of equal amounts of *Abies balsamea* (balsam fir), *Acer spicatum* (mountain maple), and *Picea glauca* (white spruce). The moderate (40%) tall-shrub (2-5 m) (no species recorded) and short-shrub (0.5-2 m) layers are dominated by *Acer spicatum* (mountain maple). The herbaceous layer (30%) includes *Carex pedunculata* (longstalk sedge), *Circaea alpina* (small enchanter's nightshade), *Dryopteris intermedia* (intermediate woodfern), and *Geum rivale* (purple avens), among others. Nonvascular species (mosses) cover 10% of the ground surface.

Global Vegetation: The overstory is dominated by coniferous trees, with or without a substantial deciduous component. *Thuja occidentalis* (northern white-cedar) is the most abundant tree and may occur in pure stands. Usually there are other canopy species, especially *Abies balsamea* (balsam fir), *Betula papyrifera* (paper birch), *Picea glauca* (white spruce), *Picea mariana* (black spruce), *Populus tremuloides* (quaking aspen), and *Pinus strobus* (eastern white pine). There is usually an abundant shrub/sapling layer with saplings of *Thuja occidentalis* (northern white-cedar) and *Abies balsamea* (balsam fir) along with the shrubs *Acer spicatum* (mountain maple), *Corylus cornuta* (beaked hazelnut), *Linnaea borealis* (twinflower), *Lonicera canadensis* (American fly honeysuckle), *Rubus pubescens* (dwarf red blackberry), and *Sorbus decora* (northern mountain-ash). The ground layer is typically diverse on mesic to wet-mesic stands and less so on steep drier stands. Wet-mesic stands can contain a hummock-and-hollow topography, with a seasonally saturated hydrology. Typical species include *Aralia nudicaulis* (wild sarsaparilla), *Eurybia macrophylla* (bigleaf aster), *Clintonia borealis* (bluebead), *Coptis trifolia* (threeleaf goldthread), *Cornus canadensis* (bunchberry dogwood), *Dryopteris carthusiana* (spinulose woodfern), *Galium triflorum* (fragrant bedstraw), *Maianthemum canadense* (Canada mayflower), *Mitella nuda* (naked miterwort), and *Trientalis borealis* (starflower). Mosses include *Sanionia uncinata* (sanionia moss), *Hylocomium splendens* (splendid feather moss), *Plagiomnium cuspidatum* (toothed plagiomnium moss), *Pleurozium schreberi* (Schreber's big red stem moss), *Ptilium crista-castrensis* (knights plume moss), and *Rhytidiadelphus triquetrus* (rough goose neck moss) and, in wetter phases of the type, *Sphagnum* (sphagnum) spp. (Ohmann and Ream 1971, Sims et al. 1989, MNNHP 1993, Chambers et al. 1997).

MOST ABUNDANT SPECIES

Pictured Rocks National Lakeshore

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Thuja occidentalis* (northern white-cedar)
Tree canopy	Broad-leaved deciduous tree	*Betula alleghaniensis* (yellow birch)
Tall shrub/sapling	Broad-leaved deciduous shrub	*Acer spicatum* (mountain maple)
Herb (field)	Graminoid	*Carex pedunculata* (longstalk sedge)
Herb (field)	Fern or fern ally	*Dryopteris intermedia* (intermediate woodfern)

Global

Stratum	Lifeform	Species

CHARACTERISTIC SPECIES

Pictured Rocks National Lakeshore: *Acer spicatum* (mountain maple), *Betula alleghaniensis* (yellow birch), *Betula papyrifera* (paper birch), *Populus balsamifera* (balsam poplar), *Thuja occidentalis* (northern white-cedar)

Global:

OTHER NOTEWORTHY SPECIES

Pictured Rocks National Lakeshore:

Global:

CONSERVATION STATUS RANK

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

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CLASSIFICATION

Status: Standard
Classification Confidence: 1 - Strong
Pictured Rocks National Lakeshore Comments:
Global Comments: This type has a wet-mesic phase that can be difficult to distinguish from cedar swamps, such as *Thuja occidentalis - (Picea mariana, Abies balsamea) / Alnus incana* Forest (CEGL002456). [See also Harris et al. (1996) who consider W32, a white-cedar swamp, to be equivalent to V21, a white-cedar upland type, of Sims et al. (1989).] Type is equivalent in concept to V21 of Sims et al. (1989) and V21 Chambers et al. (1997). In Wisconsin, stands of this type are best developed near the Great Lakes shore, but the type concept is still not clear. Those stands may still best go with either *Thuja occidentalis - Betula alleghaniensis* Forest (CEGL002450) or *Thuja occidentalis - (Betula alleghaniensis, Tsuga canadensis)* Forest (CEGL002595).
Global Similar Associations:
- *Thuja occidentalis - (Betula alleghaniensis, Tsuga canadensis)* Forest (CEGL002595)
- *Thuja occidentalis - (Picea mariana, Abies balsamea) / Alnus incana* Forest (CEGL002456)
- *Thuja occidentalis - Betula alleghaniensis* Forest (CEGL002450)--This is the mixed conifer-hardwood equivalent

Global Related Concepts:
- Boreal Forest (Chapman et al. 1989) B
- Cedar (inc. Mixedwood) / Mountain Maple Forest (V21) (Sims et al. 1989) =
- Lowland lakeshore northern white cedar forest (NAP pers. comm. 1998) ?
- White Cedar Type (Grigal and Ohmann 1975) =
- White Cedar-Trembling Aspen-White Spruce-Twinflower (V21) (Chambers et al. 1997) =

OTHER COMMENTS

Other Comments:

ELEMENT DISTRIBUTION

Pictured Rocks National Lakeshore Range: This white-cedar - birch forest was sampled once in the park. It is located in poorly drained depressions at higher elevations than other saturated white-cedar communities.
Global Range: This sub-boreal upland white-cedar forest type occurs in the northern Great Lakes region of the United States and Canada, east to upstate New York and northern New England.
Nations: CA, US
States/Provinces: MI, MN, NH:S1, NY, ON, QC?, WI
TNC Ecoregions: 35:C, 47:C, 48:C, 63:C, 64:C
USFS Ecoregions (1994/95): 212He:CCC, 212Hi:CCC, 212Hj:CCP, 212Hl:CCC, 212Ho:CCC, 212Hr:CCP, 212Hw:CCC, 212Ia:CCC, 212Ib:CCC, 212Ja:CPP, 212Jb:CPP, 212Jc:CPP, 212Jl:CPP, 212Jn:CPP, 212Jo:CPP, 212La:CCC, 212Lb:CCC, 212Lc:CCC, 212Ld:CC?, 212Mb:CCC, 212Na:CCC, 212Nb:CCP, 212Nc:CC?, 212Oa:CCC, 212Ob:CCC, 212Pa:CCC, 222Na:CCC, M212Ae:CCC
Federal Lands: NPS (Apostle Islands, Grand Portage, Isle Royale, Pictured Rocks, Sleeping Bear Dunes, Voyageurs); USFS (Chippewa, Huron, Huron-Manistee, Manistee?, Ottawa, Superior)

ELEMENT SOURCES

Pictured Rocks National Lakeshore Inventory Notes:
Pictured Rocks National Lakeshore Plots: PIRO.139.
Pictured Rocks National Lakeshore Map Code: FCC, FCM
Local Description Authors: M.J. Russo
Global Description Authors: J. Drake
References: Chambers et al. 1997, Chapman et al. 1989, Edinger et al. 2002, Grigal and Ohmann 1975, MNNHP 1993, Midwestern Ecology Working Group n.d., NAP pers. comm. 1998, Ohmann and Ream 1971, Sims et al. 1989, Sperduto 2000a, WNHIP unpubl. data

Hemlock Mesic Forest

***Tsuga canadensis - (Betula alleghaniensis)* Forest**
Eastern Hemlock - (Yellow Birch) Forest
Identifier: CEGL002598

NVC CLASSIFICATION

Division	Eastern North American Cool Temperate Forest (1.C.2.a)
Macrogroup	Northern Hardwood & Conifer Forest (MG014)
Group	Northern Hardwood - Hemlock - White Pine Forest (G163)
Association (Common name)	Hemlock Mesic Forest
Ecological System(s):	Laurentian-Acadian Pine-Hemlock-Hardwood Forest (CES201.563)

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ELEMENT CONCEPT

Global Summary: This mesic hemlock evergreen forest is found in the Great Lakes region of the United States and Canada. Stands occur on deep, acidic soils that may be poorly drained. The overstory of this community is strongly dominated by *Tsuga canadensis* (eastern hemlock), typically around 25 m tall. *Betula alleghaniensis* (yellow birch) is often present in the canopy and subcanopy, but at less than 25% cover. Other species that are a minor component of the canopy include *Abies balsamea* (balsam fir), *Acer rubrum* (red maple), *Acer saccharum* (sugar maple), *Pinus strobus* (eastern white pine), *Tilia americana* (American basswood), and *Thuja occidentalis* (northern white-cedar). The sapling layer may also contain *Abies balsamea* (balsam fir) and *Thuja occidentalis* (northern white-cedar), especially in canopy gaps. Shrubs are rare and herbaceous species only moderately abundant under the dense evergreen canopy; however, where gaps occur, *Acer pensylvanicum* (striped maple), *Acer spicatum* (mountain maple), *Amelanchier* (serviceberry) spp., *Gaultheria procumbens* (eastern teaberry), *Lonicera canadensis* (American fly honeysuckle), and *Rubus idaeus* (American red raspberry) may be moderately abundant. The herbaceous layer is poor under drier, more evergreen stands, and richer under more moist and somewhat deciduous stands. Herbaceous species found in this community include *Aralia nudicaulis* (wild sarsaparilla), *Clintonia borealis* (bluebead), *Coptis trifolia* (threeleaf goldthread), *Cornus canadensis* (bunchberry dogwood), *Dryopteris carthusiana* (spinulose woodfern), *Huperzia lucidula* (shining clubmoss), *Maianthemum canadense* (Canada mayflower), *Oxalis montana* (mountain woodsorrel), *Pteridium aquilinum* (western brackenfern), *Streptopus lanceolatus* var. *longipes* (twistedstalk), and *Trientalis borealis* (starflower). A sparse to dense moss layer includes *Brachythecium reflexum* (brachythecium moss), *Callicladium haldanianum* (callicladium moss), *Dicranum flagellare* (dicranum moss), *Dicranum montanum* (Montane Dicranum Moss), *Mnium marginatum* (olivegreen calcareous moss), *Plagiothecium laetum* (plagiothecium moss), *Polytrichum commune* (polytrichum moss), *Ptilidium pulcherrimum*, and *Tetraphis pellucida* (tetraphis moss).

ENVIRONMENTAL DESCRIPTION

Pictured Rocks National Lakeshore Environment: This mesic hemlock forest was sampled at five locations in the park. Sites include gentle to moderate north-, northeast-, southeast- and southwest-facing midslope moraines, glaciated uplands, and kettle outwash plains. Sites exhibit various degrees of pit-and-mound topography depending on maturity of the stand and management history. Soils are moderately well-drained loam, loamy sand, and sand. The unvegetated surface is dominated by leaf litter (70-99% cover) with some wood (1-28%) and dead snags (0-2%). Evidence of disturbance includes past logging (stumps and old logging roads) and fire.

Global Environment: This community is found on acidic soils that may be poorly drained. Coffman and Willis (1977) found this community on sandy loam and loams that averaged 115 cm deep and had a fragipan at 45-70 cm. This community may be found on shallow soils in the Huron Mountains of upper Michigan (P. Comer pers. comm. 1996).

VEGETATION DESCRIPTION

Pictured Rocks National Lakeshore Vegetation: The moderate to total (50-100% cover) tree canopy, 15-35 m tall, is dominated by *Tsuga canadensis* (eastern hemlock) and *Acer rubrum* (red maple) and may also include lesser amounts of *Betula alleghaniensis* (yellow birch) and *Betula papyrifera* (paper birch). The sparse to moderate (20-40%) subcanopy (5-15 m) is made up of canopy species and *Abies balsamea* (balsam fir). The very sparse to moderate (5-60%) tall-shrub layer (2-5 m) is dominated by *Abies balsamea* (balsam fir) and *Fagus grandifolia* (American beech). The sparse to moderate (10-40%) short-shrub layer (0.5-2 m) is more diverse and includes species from the upper layers as well as *Acer saccharum* (sugar maple), *Acer spicatum* (mountain maple), *Amelanchier* (serviceberry) sp., *Gaultheria procumbens* (eastern teaberry), *Lonicera canadensis* (American fly honeysuckle), *Picea glauca* (white spruce), *Sorbus decora* (northern mountain-ash), and *Vaccinium ovalifolium* (oval-leaf blueberry). *Mitchella repens* (partridgeberry) forms a sparse (0-5%) dwarf-shrub layer (<0.5 m). The variable herbaceous layer (30-70%) includes *Aralia nudicaulis* (wild sarsaparilla), *Clintonia borealis* (bluebead), *Coptis trifolia* (threeleaf goldthread), *Cornus canadensis* (bunchberry dogwood), *Cypripedium acaule* (moccasin flower), *Dryopteris intermedia* (intermediate woodfern), *Huperzia lucidula* (shining clubmoss), *Maianthemum canadense* (Canada mayflower), *Oxalis montana* (mountain woodsorrel), and *Trientalis borealis* (starflower), among others. Nonvascular species (mosses) cover 0-20% of the ground surface.

Global Vegetation: The overstory of this community is strongly dominated by *Tsuga canadensis* (eastern hemlock), typically around 25 m tall (Martin 1959a). *Betula alleghaniensis* (yellow birch) is often present in the canopy and subcanopy, but at less than 25% cover. Other species that are a minor component of the canopy include *Abies balsamea* (balsam fir), *Acer rubrum* (red maple), *Acer saccharum* (sugar maple), *Pinus strobus* (eastern white pine), *Tilia americana* (American basswood), and *Thuja occidentalis* (northern white-cedar). The sapling layer may also contain *Abies balsamea* (balsam fir) and *Thuja occidentalis* (northern white-cedar), especially in canopy gaps (Martin 1959a). Shrubs are rare and herbaceous species only moderately abundant under the dense evergreen canopy; however, where gaps occur, *Acer pensylvanicum* (striped maple), *Acer spicatum* (mountain maple), *Amelanchier* (serviceberry) spp., *Gaultheria procumbens* (eastern teaberry), *Lonicera canadensis* (American fly honeysuckle), and *Rubus idaeus* (American red raspberry) may be moderately abundant. The herbaceous layer is poor under drier, more evergreen stands, and richer under more moist and somewhat deciduous stands. Herbaceous species found in this community include *Aralia nudicaulis* (wild sarsaparilla), *Clintonia borealis* (bluebead), *Coptis trifolia* (threeleaf goldthread), *Cornus canadensis* (bunchberry dogwood), *Dryopteris carthusiana* (spinulose woodfern), *Huperzia lucidula* (shining clubmoss), *Maianthemum canadense* (Canada mayflower), *Oxalis montana* (mountain woodsorrel), *Pteridium aquilinum* (western brackenfern), *Streptopus lanceolatus* (twistedstalk), and *Trientalis borealis* (starflower). A sparse to dense moss layer includes *Brachythecium reflexum* (brachythecium moss), *Callicladium haldanianum* (callicladium moss), *Dicranum flagellare* (dicranum moss), *Dicranum montanum* (Montane Dicranum Moss), *Mnium marginatum* (olivegreen calcareous moss), *Plagiothecium laetum* (plagiothecium moss), *Polytrichum commune* (polytrichum moss),

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Ptilidium pulcherrimum, and *Tetraphis pellucida* (tetraphis moss). Liverworts may include *Bazzania trilobata* and *Jamesoniella autumnalis* (Chambers et al. 1997).

MOST ABUNDANT SPECIES

Pictured Rocks National Lakeshore

Stratum	Lifeform	Species
Tree (canopy & subcanopy)	Needle-leaved tree	*Tsuga canadensis* (eastern hemlock)
Tree canopy	Broad-leaved deciduous tree	*Betula alleghaniensis* (yellow birch)
Tree subcanopy	Needle-leaved tree	*Abies balsamea* (balsam fir)
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Fagus grandifolia* (American beech)
Tall shrub/sapling	Needle-leaved tree	*Abies balsamea* (balsam fir)
Short shrub/sapling	Needle-leaved shrub	*Tsuga canadensis* (eastern hemlock)
Short shrub/sapling	Broad-leaved deciduous shrub	*Acer pensylvanicum* (striped maple), *Acer rubrum* (red maple), *Betula alleghaniensis* (yellow birch), *Sorbus decora* (northern mountain-ash)
Herb (field)	Forb	*Aralia nudicaulis* (wild sarsaparilla), *Clintonia borealis* (bluebead), *Coptis trifolia* (threeleaf goldthread), *Cornus canadensis* (bunchberry dogwood), *Cypripedium acaule* (moccasin flower), *Maianthemum canadense* (Canada mayflower), *Mitchella repens* (partridgeberry), *Oxalis montana* (mountain woodsorrel), *Trientalis borealis* (starflower)
Herb (field)	Fern or fern ally	*Dryopteris intermedia* (intermediate woodfern), *Huperzia lucidula* (shining clubmoss)

Global

Stratum	Lifeform	Species

CHARACTERISTIC SPECIES

Pictured Rocks National Lakeshore: *Abies balsamea* (balsam fir), *Acer rubrum* (red maple), *Aralia nudicaulis* (wild sarsaparilla), *Dryopteris intermedia* (intermediate woodfern), *Huperzia lucidula* (shining clubmoss), *Oxalis montana* (mountain woodsorrel), *Sorbus decora* (northern mountain-ash), *Tsuga canadensis* (eastern hemlock)
Global:

OTHER NOTEWORTHY SPECIES

Pictured Rocks National Lakeshore:
Global:

CONSERVATION STATUS RANK

Global Rank & Reasons: G3G4 (24-Oct-2002). This mesic hemlock evergreen forest has a moderately wide range, being found fairly commonly in the Great Lakes region of the United States and Canada. It does not require particularly specific environmental factors, and there may be a large number of Element Occurrences. Under natural conditions many stands would be expected to be in a variety of old-growth conditions, but, at this time, the area occupied by such stands is a relatively small percentage of their former area (Frelich 1995).

CLASSIFICATION

Status: Standard
Classification Confidence: 1 - Strong
Pictured Rocks National Lakeshore Comments:
Global Comments: This type varies from almost pure *Tsuga canadensis* (eastern hemlock) to more of a mix with *Betula alleghaniensis* (yellow birch), but the deciduous component is generally less than 25% cover (see e.g., Chambers et al. 1997, Ecosite 30.1 and 30.2). If hardwoods exceed 25%, the type is placed in *Tsuga canadensis* - *Acer saccharum* - *Betula alleghaniensis* Forest (CEGL005044), but logged stands, or remnants that occur in a matrix of secondary growth hardwoods, can be difficult to assign. Chambers et al. (1997) recognize a moist and a dry type in central Ontario. Those are treated as variants of the one type here. In Michigan this type is on the clay lakeplain in the western Upper Peninsula and in the Saginaw Bay Lakeplain. The data by Rogers (1980), who examined pure hemlock stands (many of them less than 2 ha in size) from Wisconsin to Nova Scotia, make clear that there are few species strictly associated with a pure hemlock versus a mixed hemlock-hardwood type, and also indicate that some distinction between a Great Lakes versus northeastern United States/eastern Canada has some merit, as done for the mixed hemlock-hardwood type (CEGL005044 versus *Tsuga canadensis* - *(Betula alleghaniensis)* - *Picea rubens / Cornus canadensis* Forest (CEGL006129)). No pure evergreen hemlock type is currently recognized in the northeast because of its small patch size.
Global Similar Associations:
- *Tsuga canadensis* - *Acer saccharum* - *Betula alleghaniensis* Forest (CEGL005044)

Global Related Concepts:
- *Tsuga-Coptis* Association (Coffman and Willis 1977) =
- *Tsuga* Forest, Stands He1 and He2 (Martin 1959a) =

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- CNE mesic conifer [transition] forest on acidic bedrock/till (Rawinski 1984) B
- Eastern Hemlock: 23 (Eyre 1980) B
- Hemlock - Yellow Birch: 24 (Eyre 1980) B
- Hemlock Forest (Thompson 1996) B
- Hemlock-Spinulose Wood Fern-Herb Poor (V19) (Chambers et al. 1997) F
- Hemlock-Yellow Birch-Goldthread-Wood Sorrel (V18) (Chambers et al. 1997) F
- Mesic Northern Forest - Hemlock-Yellow Birch (Chapman et al. 1989) =

OTHER COMMENTS

Other Comments:

ELEMENT DISTRIBUTION

Pictured Rocks National Lakeshore Range: This mesic hemlock forest is found throughout the park in seeps over organic or clay soils. Overall, it is a relatively uncommon community at Pictured Rocks.
Global Range: This mesic hemlock evergreen forest is found in the Great Lakes region of the United States and Canada, ranging from Wisconsin and Michigan to Ontario. Range extent is about 300,000 square km.
Nations: CA, US
States/Provinces: MI:S3, ON, WI:S3S4
TNC Ecoregions: 46:C, 47:C, 48:C
USFS Ecoregions (1994/95): 212Hb:CC?, 212Hh:CCP, 212Hi:CCC, 212Hl:CCC, 212Ho:CCC, 212Hw:CCC, 212Ia:CCC, 212Ja:CCC, 212Jb:CCC, 212Jc:CCC, 212Je:CCC, 212Jf:CCC, 212Jj:CCC, 212Jl:CCC, 212Jm:CCC, 212Jn:CCP, 212Jo:CCP, 212Js:CCC, 222Ja:CCC, 222Je:CCC, 222Ld:CCC
Federal Lands: NPS (Apostle Islands, Pictured Rocks, Sleeping Bear Dunes); USFS (Chequamegon-Nicolet, Chequamegon?, Hiawatha?, Nicolet, Ottawa)

ELEMENT SOURCES

Pictured Rocks National Lakeshore Inventory Notes:
Pictured Rocks National Lakeshore Plots: PIRO.015, PIRO.028, PIRO.041, PIRO.070, PIRO.077.
Pictured Rocks National Lakeshore Map Code: FHC
Local Description Authors: M.J. Russo
Global Description Authors: J. Drake
References: Chambers et al. 1997, Chapman et al. 1989, Coffman and Willis 1977, Comer pers. comm., Eyre 1980, Frelich 1995, Frelich and Lorimer 1991a, Martin 1959a, Midwestern Ecology Working Group n.d., Rawinski 1984, Rogers 1980, Thompson 1996, Thompson and Sorenson 2000, Tyrrell and Crow 1994, WNHIP unpubl. data

North-Central Hemlock - Hardwood Forest

***Tsuga canadensis* - *Acer saccharum* - *Betula alleghaniensis* Forest**
Eastern Hemlock - Sugar Maple - Yellow Birch Forest
Identifier: CEGL005044

NVC CLASSIFICATION

Division	Eastern North American Cool Temperate Forest (1.C.2.a)
Macrogroup	Northern Hardwood & Conifer Forest (MG014)
Group	Northern Hardwood - Hemlock - White Pine Forest (G163)
Association (Common name)	North-Central Hemlock - Hardwood Forest
Ecological System(s):	Laurentian-Acadian Pine-Hemlock-Hardwood Forest (CES201.563)

ELEMENT CONCEPT

Global Summary: This hemlock - hardwoods forest is found in the northern Great Lakes region of the United States and Canada. Sites are dry-mesic, typically coarse- to medium-textured ground and end moraines, but also silty/clayey lakeplains, thin glacial till over bedrock, and sand dunes. Soils are loamy sand to sandy loam, with moderately acidic soils. The tree canopy is dominated by a mix of evergreen and deciduous species. *Acer saccharum* (sugar maple), *Betula alleghaniensis* (yellow birch), and *Tsuga canadensis* (eastern hemlock) dominate the canopy. Canopy associates include *Acer rubrum* (red maple). Shrub cover is moderate to sparse, including species such as *Acer pensylvanicum* (striped maple) (eastward), *Acer spicatum* (mountain maple), *Corylus cornuta* (beaked hazelnut), *Sambucus racemosa* var. *racemosa* (red elderberry), and *Viburnum lantanoides* (hobblebush) (eastward). Typical herbs include *Actaea pachypoda* (white baneberry), *Aralia nudicaulis* (wild sarsaparilla), *Eurybia macrophylla* (bigleaf aster), *Carex arctata* (drooping woodland sedge), *Clintonia borealis* (bluebead), *Dryopteris carthusiana* (spinulose woodfern), *Galium triflorum* (fragrant bedstraw), *Lycopodium dendroideum* (tree groundpine), *Maianthemum canadense* (Canada mayflower), *Medeola virginiana* (Indian cucumber), *Mitella nuda* (naked miterwort), *Osmorhiza claytonii* (Clayton's sweetroot), *Polygonatum pubescens* (hairy Solomon's seal), *Streptopus lanceolatus* var. *longipes* (twistedstalk), *Trientalis borealis* (starflower), *Trillium erectum* (red trillium), and *Trillium grandiflorum* (snow trillium). Mosses include *Brachythecium reflexum* (brachythecium moss), *Callicladium haldanianum* (callicladium moss), *Dicranum montanum* (Montane Dicranum Moss), and *Plagiothecium laetum* (plagiothecium moss).

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ENVIRONMENTAL DESCRIPTION

Pictured Rocks National Lakeshore Environment: This hemlock - sugar maple forest was sampled at three locations in the park. One site is a flat glaciated upland with pit-and-mound topography, another is a gentle northwest-facing midslope moraine, and the third is a gentle southwest-facing lower slope ground moraine. Soils are somewhat poorly drained silty clay, moderately well-drained clay loam, and somewhat poorly drained peat, respectively. The unvegetated surface is dominated by leaf litter (93-99% cover) with some wood (1-7%). Evidence of disturbance includes past logging (1940s), often multiple times for white pine and hemlock removal, and the presence of exotic species.

Global Environment: Sites are dry-mesic, typically coarse- to medium-textured ground and end moraines, but also silty/clayey lakeplains, thin glacial till over bedrock, and sand dunes. Soils are loamy sand to sandy loam, with moderately acidic soils.

VEGETATION DESCRIPTION

Pictured Rocks National Lakeshore Vegetation: The dense (80-90% cover) tree canopy, 15-35 m tall, is dominated by *Tsuga canadensis* (eastern hemlock), *Acer rubrum* (red maple), and *Betula alleghaniensis* (yellow birch) along with lesser amounts of *Pinus strobus* (eastern white pine). The moderate (30-40%) subcanopy (5-15 m) may include *Acer pensylvanicum* (striped maple), *Acer rubrum* (red maple), *Thuja occidentalis* (northern white-cedar), and *Tsuga canadensis* (eastern hemlock). The tall-shrub layer (2-5 m) is absent in one plot and sparse (20%) in the other two; species include *Abies balsamea* (balsam fir), *Acer pensylvanicum* (striped maple), *Fagus grandifolia* (American beech), and *Picea mariana* (black spruce). The sparse (5-20%) short-shrub layer (0.5-1 m) includes saplings of tree species from the upper layers along with *Acer spicatum* (mountain maple), *Amelanchier* (serviceberry) sp., *Corylus cornuta* (beaked hazelnut), *Lonicera oblongifolia* (swamp fly honeysuckle), *Picea glauca* (white spruce), *Sorbus decora* (northern mountain-ash), *Vaccinium angustifolium* (lowbush blueberry), and *Vaccinium ovalifolium* (oval-leaf blueberry). The very sparse to dense (5-80%) herbaceous layer includes *Aralia nudicaulis* (wild sarsaparilla), *Athyrium filix-femina* (common ladyfern), *Clintonia borealis* (bluebead), *Dryopteris intermedia* (intermediate woodfern), *Huperzia lucidula* (shining clubmoss), *Maianthemum canadense* (Canada mayflower), *Oxalis montana* (mountain woodsorrel), *Polygonatum pubescens* (hairy Solomon's seal), *Streptopus lanceolatus* var. *roseus* (twistedstalk), and *Trientalis borealis* (starflower). Nonvascular species (mosses) cover 0-10% of the ground surface.

Global Vegetation: The tree canopy is dominated by a mix of evergreen and deciduous species. *Acer saccharum* (sugar maple), *Betula alleghaniensis* (yellow birch), and *Tsuga canadensis* (eastern hemlock) dominate the canopy. Canopy associates include *Acer rubrum* (red maple). Shrub cover is moderate to sparse, including species such as *Acer pensylvanicum* (striped maple) (eastward), *Acer spicatum* (mountain maple), *Corylus cornuta* (beaked hazelnut), *Sambucus racemosa* var. *racemosa* (red elderberry), and *Viburnum lantanoides* (hobblebush) (eastward). Typical herbs include *Actaea pachypoda* (white baneberry), *Aralia nudicaulis* (wild sarsaparilla), *Eurybia macrophylla* (bigleaf aster), *Carex arctata* (drooping woodland sedge), *Clintonia borealis* (bluebead), *Dryopteris carthusiana* (spinulose woodfern), *Galium triflorum* (fragrant bedstraw), *Lycopodium dendroideum* (tree groundpine), *Maianthemum canadense* (Canada mayflower), *Medeola virginiana* (Indian cucumber), *Mitella nuda* (naked miterwort), *Osmorhiza claytonii* (Clayton's sweetroot), *Polygonatum pubescens* (hairy Solomon's seal), *Streptopus lanceolatus* (twistedstalk), *Trientalis borealis* (starflower), *Trillium erectum* (red trillium), and *Trillium grandiflorum* (snow trillium). Mosses include *Brachythecium reflexum* (brachythecium moss), *Callicladium haldanianum* (callicladium moss), *Dicranum montanum* (Montane Dicranum Moss), and *Plagiothecium laetum* (plagiothecium moss) (Curtis 1959, Chapman et al. 1989, Chambers et al. 1997).

MOST ABUNDANT SPECIES

Pictured Rocks National Lakeshore

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Tsuga canadensis* (eastern hemlock)
Tree canopy	Broad-leaved deciduous tree	*Betula alleghaniensis* (yellow birch)
Short shrub/sapling	Needle-leaved shrub	*Abies balsamea* (balsam fir), *Picea glauca* (white spruce)
Short shrub/sapling	Broad-leaved deciduous shrub	*Acer rubrum* (red maple), *Acer spicatum* (mountain maple), *Betula alleghaniensis* (yellow birch)
Herb (field)	Forb	*Aralia nudicaulis* (wild sarsaparilla), *Clintonia borealis* (bluebead), *Maianthemum canadense* (Canada mayflower), *Polygonatum pubescens* (hairy Solomon's seal), *Streptopus lanceolatus* var. *roseus* (twistedstalk), *Trientalis borealis* (starflower)
Herb (field)	Fern or fern ally	*Huperzia lucidula* (shining clubmoss)

Global

Stratum	Lifeform	Species

CHARACTERISTIC SPECIES

Pictured Rocks National Lakeshore: *Acer rubrum* (red maple), *Athyrium filix-femina* (common ladyfern), *Huperzia lucidula* (shining clubmoss), *Oxalis montana* (mountain woodsorrel), *Tsuga canadensis* (eastern hemlock)

Global:

OTHER NOTEWORTHY SPECIES

Pictured Rocks National Lakeshore: Exotic/Invasive: *Veronica serpyllifolia* (thymeleaf speedwell, exotic)

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Global:

CONSERVATION STATUS RANK

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

CLASSIFICATION

Status: Standard
Classification Confidence: 2 - Moderate
Pictured Rocks National Lakeshore Comments:
Global Comments: This type is either west of the range of *Fagus grandifolia* (American beech), or within the range of *Fagus* (beech) may occupy drier, and perhaps somewhat less acidic, sites (Chambers et al. 1997). In Michigan this type is found mostly on till/bedrock in western Upper Peninsula. Going eastward in the United States and Canada, the presence of *Picea rubens* (red spruce) may be a good indicator as to when *Tsuga canadensis - (Betula alleghaniensis) - Picea rubens / Cornus canadensis* Forest (CEGL006129) occurs. Other more eastern species include *Acer pensylvanicum* (striped maple), *Viburnum lantanoides* (hobblebush), and *Trillium undulatum* (painted trillium) (Rogers 1980). The data by Rogers (1980), who examined pure hemlock stands (many of them less than 2 ha in size) from Wisconsin to Nova Scotia, make clear that there are few species strictly associated with a pure hemlock versus a mixed hemlock-hardwood type, and also indicate that some distinction between a Great Lakes versus northeastern United States/eastern Canada has some merit.
Global Similar Associations:
- *Acer saccharum - Tilia americana / Ostrya virginiana / Lonicera canadensis* Forest (CEGL002458)
- *Tsuga canadensis - (Betula alleghaniensis) - Picea rubens / Cornus canadensis* Forest (CEGL006129)--is found in the northeastern United States and contains *Picea rubens*.
- *Tsuga canadensis - (Betula alleghaniensis)* Forest (CEGL002598)
- *Tsuga canadensis - Acer saccharum / (Hepatica nobilis* var. *acuta)* Driftless Forest (CEGL002597)
- *Tsuga canadensis - Fagus grandifolia - (Acer saccharum)* Great Lakes Forest (CEGL005042)--appears to be more mesic, is more eastward and contains beech.

Global Related Concepts:
- Acer-Tsuga/Dryopteris (Kotar et al. 1988) F
- Acer-Tsuga/Maianthemum (Kotar et al. 1988) F
- Mesic Northern Forest - Hemlock-Beech (Chapman et al. 1989) =
- Sugar Maple-Hemlock-Yellow Birch-Striped Maple (V16) (Chambers et al. 1997) =

OTHER COMMENTS

Other Comments:

ELEMENT DISTRIBUTION

Pictured Rocks National Lakeshore Range: This hemlock - hardwood community occurs on mesic to dry-mesic, flat, glaciated uplands and coarse- to medium-textured ground and end moraines. Overall, this is not a common community at Pictured Rocks.
Global Range: This hemlock-hardwoods community type is found in the northern Great Lakes region of the United States and Canada, ranging from Michigan and Wisconsin to Ontario.
Nations: CA, US
States/Provinces: MI:S4, ON, WI:S3S4
TNC Ecoregions: 46:C, 47:C, 48:C
USFS Ecoregions (1994/95): 212Ha:CCC, 212Hb:CCC, 212He:CC?, 212Hi:CCC, 212Hm:CCP, 212Hp:CCP, 212Hq:CCP, 212Hs:CCP, 212Ht:CCP, 212Hw:CCP, 212Ia:CCC, 212Ja:CCP, 212Jb:CCC, 212Jc:CCC, 212Je:CC?, 212Jf:CCP, 212Jj:CCP, 212Jl:CCC, 212Jm:CCC, 212Jn:CCC, 212Jo:CCP, 212Jr:CCC, 212Js:CCC, 212Oa:CCC, 222Ja:CCC, 222Je:CCC, 222Jj:CCC, 222Ka:CCC
Federal Lands: NPS (Apostle Islands, Pictured Rocks); USFS (Chequamegon, Chequamegon-Nicolet, Hiawatha, Nicolet, Ottawa)

ELEMENT SOURCES

Pictured Rocks National Lakeshore Inventory Notes:
Pictured Rocks National Lakeshore Plots: PIRO.013, PIRO.055, PIRO.085.
Pictured Rocks National Lakeshore Map Code: FHM
Local Description Authors: M.J. Russo
Global Description Authors: D. Faber-Langendoen
References: Chambers et al. 1997, Chapman et al. 1989, Curtis 1959, Frelich and Lorimer 1991a, Frelich and Lorimer 1991b, Frelich et al. 1993, Kotar et al. 1988, Midwestern Ecology Working Group n.d., Rogers 1980, Tyrrell and Crow 1994, WNHIP unpubl. data

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Great Lakes Hemlock - Beech - Hardwood Forest

***Tsuga canadensis - Fagus grandifolia - (Acer saccharum)* Great Lakes Forest**
Eastern Hemlock - American Beech - (Sugar Maple) Great Lakes Forest
Identifier: CEGL005042

NVC CLASSIFICATION

Division	Eastern North American Cool Temperate Forest (1.C.2.a)
Macrogroup	Northern Hardwood & Conifer Forest (MG014)
Group	Northern Hardwood - Hemlock - White Pine Forest (G163)
Association (Common name)	Great Lakes Hemlock - Beech - Hardwood Forest
Ecological System(s):	Laurentian-Acadian Pine-Hemlock-Hardwood Forest (CES201.563)

ELEMENT CONCEPT

Global Summary: This hemlock - beech hardwood forest is found in the central Great Lakes region of the United States and Canada. Stands may be found on flat to moderately steep slopes of any aspect. Soils are primarily dry-mesic to mesic loams and sands and sometimes loamy silt. The overstory is typically a closed canopy dominated by *Tsuga canadensis* (eastern hemlock) and either *Acer saccharum* (sugar maple) or *Fagus grandifolia* (American beech). *Acer rubrum* (red maple), *Betula alleghaniensis* (yellow birch), *Fraxinus americana* (white ash), *Pinus strobus* (eastern white pine), *Quercus rubra* (northern red oak), and *Ulmus americana* (American elm) also can be found in the canopy. Along with smaller individuals of the canopy species, *Abies balsamea* (balsam fir), *Ostrya virginiana* (hophornbeam), and *Picea glauca* (white spruce) can often be found in the undergrowth in Upper Michigan. The shrub layer is usually not well-developed and includes such species as *Corylus cornuta* (beaked hazelnut), *Diervilla lonicera* (northern bush honeysuckle), *Hamamelis virginiana* (American witch-hazel), and *Lonicera canadensis* (American fly honeysuckle). The herbaceous layer may contain few to many species. Herbaceous species, such as *Anemone quinquefolia* (nightcaps), *Cornus canadensis* (bunchberry dogwood), *Dryopteris carthusiana* (spinulose woodfern), *Maianthemum canadense* (Canada mayflower), *Maianthemum racemosum* (feathery false lily of the valley), *Medeola virginiana* (Indian cucumber), *Trientalis borealis* (starflower), *Trillium grandiflorum* (snow trillium), and *Viola* (violet) spp., can be moderately abundant.

ENVIRONMENTAL DESCRIPTION

Pictured Rocks National Lakeshore Environment: This hemlock - beech forest was sampled twice in the park. One site is a gently sloping south-facing moraine, the other is part of a dune-and-swale complex on a moderately sloping dune. Surficial geology of the first site is an end moraine of medium-textured till (Farrand and Bell 1982). Soils are well-drained loamy sand and sand, respectively. The unvegetated surface is dominated by leaf litter (73-99% cover) with some wood (1-25%) and dead snags (0-2%). Evidence of disturbance includes hiking trails, numerous snags and broken tops due to strong winds, and tree pathogens.
Global Environment: This community is found primarily on dry-mesic to mesic loams and sands and sometimes on loamy silts (Kotar et al. 1988). Stands may be found on flat to moderately steep slopes of any aspect.

VEGETATION DESCRIPTION

Pictured Rocks National Lakeshore Vegetation: The highly variable (30-90% cover) tree canopy, 15-35 m tall, is dominated by *Fagus grandifolia* (American beech) (80%) in one plot and by nearly equal amounts of *Pinus strobus* (eastern white pine), *Tsuga canadensis* (eastern hemlock), and *Acer rubrum* (red maple) in the other. The sparse (20-30%) subcanopy (5-15 m) includes *Tsuga canadensis* (eastern hemlock), *Thuja occidentalis* (northern white-cedar), and *Abies balsamea* (balsam fir). The sparse to moderate (20-40%) tall-shrub layer (2-5 m) is dominated by *Fagus grandifolia* (American beech) (60%) in one plot and by *Abies balsamea* (balsam fir) in the other. The sparse to moderate (20-50%) short-shrub layer (0.5-1 m) includes saplings of upper layer species as well as *Acer saccharum* (sugar maple), *Amelanchier arborea* (common serviceberry), *Gaultheria hispidula* (creeping snowberry), *Nemopanthus mucronatus* (catberry), *Sorbus decora* (northern mountain-ash), *Vaccinium membranaceum* (thinleaf huckleberry), and *Vaccinium ovalifolium* (oval-leaf blueberry), among others. *Epigaea repens* (trailing arbutus) and *Mitchella repens* (partridgeberry) form a very sparse (0-5%) dwarf-shrub layer. The sparse (10-30%) herbaceous layer includes *Aralia nudicaulis* (wild sarsaparilla), *Clintonia borealis* (bluebead), *Dryopteris intermedia* (intermediate woodfern), and *Maianthemum canadense* (Canada mayflower). Nonvascular species (mosses) cover 5% of the ground surface.
Global Vegetation: The overstory is typically a closed canopy dominated by *Tsuga canadensis* (eastern hemlock) and either *Acer saccharum* (sugar maple) or *Fagus grandifolia* (American beech). *Betula alleghaniensis* (yellow birch), *Fraxinus americana* (white ash), and *Ulmus americana* (American elm) are common associates, and occasionally *Acer rubrum* (red maple), *Pinus strobus* (eastern white pine), and *Quercus rubra* (northern red oak) can be found in the canopy. Along with smaller individuals of the canopy species, *Abies balsamea* (balsam fir), *Ostrya virginiana* (hophornbeam), and *Picea glauca* (white spruce) can often be found in the undergrowth in Upper Michigan (Braun 1950). The shrub layer is usually not well-developed. *Corylus cornuta* (beaked hazelnut), *Diervilla lonicera* (northern bush honeysuckle), *Hamamelis virginiana* (American witch-hazel), and *Lonicera canadensis* (American fly honeysuckle) can be found scattered in this community. The herbaceous layer may contain few to many species. In some stands, the shade from the overstory and a carpet of *Acer saccharum* (sugar maple) seedlings do not allow other species to flourish (Braun 1950). In other places, herbaceous species such as *Anemone quinquefolia* (nightcaps), *Cornus canadensis* (bunchberry dogwood), *Dryopteris carthusiana* (spinulose woodfern), *Maianthemum canadense* (Canada mayflower), *Medeola virginiana* (Indian cucumber), *Maianthemum racemosum* (feathery false lily of the valley), *Trientalis borealis* (starflower), *Trillium grandiflorum* (snow trillium), and *Viola* (violet) spp. can be moderately abundant.

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MOST ABUNDANT SPECIES

Pictured Rocks National Lakeshore

Stratum	Lifeform	Species
Short shrub/sapling	Broad-leaved deciduous shrub	*Acer rubrum* (red maple), *Sorbus decora* (northern mountain-ash)
Herb (field)	Forb	*Aralia nudicaulis* (wild sarsaparilla), *Clintonia borealis* (bluebead), *Maianthemum canadense* (Canada mayflower)

Global

Stratum	Lifeform	Species

CHARACTERISTIC SPECIES

Pictured Rocks National Lakeshore: *Fagus grandifolia* (American beech), *Maianthemum canadense* (Canada mayflower), *Pinus strobus* (eastern white pine), *Tsuga canadensis* (eastern hemlock)
Global:

OTHER NOTEWORTHY SPECIES

Pictured Rocks National Lakeshore:
Global:

CONSERVATION STATUS RANK

Global Rank & Reasons: G4G5 (22-Jun-1998).

CLASSIFICATION

Status: Standard
Classification Confidence: 2 - Moderate
Pictured Rocks National Lakeshore Comments:
Global Comments: The type may be limited eastward by the main range of *Picea rubens* (red spruce), whose presence may indicate a transition to *Tsuga canadensis - (Betula alleghaniensis) - Picea rubens / Cornus canadensis* Forest (CEGL006129) in the region of the Ontario/Quebec border. Other more eastern species include *Acer pensylvanicum* (striped maple), *Viburnum lantanoides* (hobblebush), and *Trillium undulatum* (painted trillium) (Rogers 1980). The data by Rogers (1980), who examined pure hemlock stands (many of them less than 2 ha in size) from Wisconsin to Nova Scotia, make clear that there are few species strictly associated with a pure hemlock versus a mixed hemlock-hardwood type, and also indicate that some distinction between a Great Lakes versus northeastern United States/eastern Canada has some merit. Southward this type probably does not extend below Lake Erie or Lake Ontario, though stands in western New York need to be reviewed. Presence of some boreal species, such as *Clintonia borealis* (bluebead), *Coptis trifolia* (threeleaf goldthread), and *Cornus canadensis* (bunchberry dogwood) separate this type from *Tsuga canadensis - Fagus grandifolia - Acer saccharum / (Hamamelis virginiana, Kalmia latifolia)* Forest (CEGL005043) (Black and Mack 1976), but this needs further study. In Michigan this type is mostly on the lakeplain/outwash throughout the Michigan range of beech. Compare with *Tsuga canadensis - Acer saccharum - Betula alleghaniensis* Forest (CEGL005044).
Global Similar Associations:
- *Tsuga canadensis - (Betula alleghaniensis) - Picea rubens / Cornus canadensis* Forest (CEGL006129)
- *Tsuga canadensis - Acer saccharum - Betula alleghaniensis* Forest (CEGL005044)
- *Tsuga canadensis - Fagus grandifolia - Acer saccharum / (Hamamelis virginiana, Kalmia latifolia)* Forest (CEGL005043)
- *Tsuga canadensis - Fagus grandifolia - Quercus rubra* Forest (CEGL006088)

Global Related Concepts:
- *Acer - Fagus / Dryopteris* (Kotar et al. 1988) F
- *Acer - Tsuga / Dryopteris spinulosa* (Kotar et al. 1988) I
- Hardwood and Hemlock-Hardwood Forests (Braun 1950) B
- Mesic Northern Forest - Hemlock-Sugar Maple (Chapman et al. 1989) B

OTHER COMMENTS

Other Comments:

ELEMENT DISTRIBUTION

Pictured Rocks National Lakeshore Range: This hemlock - beech hardwoods community is rare at Pictured Rocks, most likely as a result of the logging history of the park. The community is located on a south-facing moraine and within a dune-and-swale complex on a moderately sloping dune.
Global Range: This hemlock - beech hardwoods forest type is found in the central Great Lakes region of the United States and Canada, ranging from northeastern Wisconsin east to Michigan and southern Ontario.
Nations: CA, US
States/Provinces: MI, ON, WI:S4
TNC Ecoregions: 45:C, 47:C, 48:C, 64:C
USFS Ecoregions (1994/95): 212Hb:CCC, 212Hd:CCC, 212He:CCC, 212Hi:CCC, 212Hj:CCC, 212Hl:CCC, 212Hm:CCP, 212Ho:CCC, 212Hp:CCP, 212Hq:CCP, 212Hs:CCC, 212Ht:CCP, 212Hv:CCC, 212Hw:CCC, 212Hx:CCC, 212Ia:CCC, 212Jj:CCC, 212Jk:CC?, 212Jl:CCC, 212Oc:CCC, 212Pa:CCC, 222Hb:CCC, 222Ia:CCC, 222Ja:CCC, 222Jj:CCC

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Federal Lands: NPS (Pictured Rocks, Sleeping Bear Dunes); USFS (Chequamegon-Nicolet, Hiawatha, Huron, Huron-Manistee, Manistee?, Nicolet, Ottawa?)

ELEMENT SOURCES

Pictured Rocks National Lakeshore Inventory Notes:
Pictured Rocks National Lakeshore Plots: PIRO.016, PIRO.074.
Pictured Rocks National Lakeshore Map Code: FHB
Local Description Authors: M.J. Russo
Global Description Authors: J. Drake
References: Black and Mack 1976, Braun 1950, Chapman et al. 1989, Farrand and Bell 1982, Kotar et al. 1988, Midwestern Ecology Working Group n.d., Rogers 1980, WNHIP unpubl. data

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

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.a)
Macrogroup	Northern Hardwood & Conifer Forest (MG014)
Group	White Pine - Red Pine - Jack Pine - Oak Forest & Woodland (G025)
Association (Common name)	Red Pine - Aspen - Birch Forest
Ecological System(s):	Laurentian-Acadian Northern Pine-(Oak) Forest (CES201.719)

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

Pictured Rocks National Lakeshore Environment: This red pine - aspen forest was only sampled once in the park. The site is a summit of a kame terrace that slopes gently to the north. It is on a rapidly rising ridge from Lake Superior with surrounding dry channels and deep-pocket openings (>15 m deep) with minimal pit-and-mound topography. Soil is well-drained sand. The unvegetated surface is dominated by leaf litter (95% cover) with some wood (5%). Evidence of disturbance includes past fire and logging.
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

Pictured Rocks National Lakeshore Vegetation: The dense (80% cover) tree canopy, 20-35 m tall, is dominated by *Pinus resinosa* (red pine) with lesser amounts of *Populus grandidentata* (bigtooth aspen) and *Quercus rubra* (northern red oak). The sparse (20%) subcanopy (10-15 m) includes *Acer rubrum* (red maple), *Betula papyrifera* (paper birch), and *Pinus strobus* (eastern white pine). *Acer rubrum* (red maple) makes up the sparse (20%) tall-shrub layer (2-5 m). The moderate (50%) short-shrub layer (0.5-2 m) is dominated by ericaceous species, including *Vaccinium angustifolium* (lowbush blueberry), *Vaccinium myrtilloides* (velvetleaf huckleberry), and *Gaultheria procumbens* (eastern teaberry) and includes saplings of species from upper layers. *Epigaea repens* (trailing arbutus) forms a sparse (5%) dwarf-shrub layer (<0.5 m). The herbaceous layer (60%) is dominated by *Pteridium aquilinum* (western brackenfern); other taxa include *Chimaphila umbellata* (pipsissewa), *Cornus canadensis* (bunchberry dogwood), *Goodyera oblongifolia* (western rattlesnake plantain), *Maianthemum canadense* (Canada mayflower), *Melampyrum lineare* (narrowleaf cowwheat), and *Trientalis borealis* (starflower). Nonvascular species (mosses) cover is negligible.
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),

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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 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

Pictured Rocks National Lakeshore

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Populus grandidentata* (bigtooth aspen), *Quercus rubra* (northern red oak)
Tree subcanopy	Needle-leaved tree	*Pinus strobus* (eastern white pine)
Tree subcanopy	Broad-leaved deciduous tree	*Acer rubrum* (red maple), *Betula papyrifera* (paper birch)
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Acer rubrum* (red maple)
Short shrub/sapling	Broad-leaved deciduous shrub	*Vaccinium angustifolium* (lowbush blueberry), *Vaccinium myrtilloides* (velvetleaf huckleberry)
Herb (field)	Fern or fern ally	*Pteridium aquilinum* (western brackenfern)

Global

Stratum	Lifeform	Species

CHARACTERISTIC SPECIES

Pictured Rocks National Lakeshore: *Pinus resinosa* (red pine), *Pteridium aquilinum* (western brackenfern)
Global:

OTHER NOTEWORTHY SPECIES

Pictured Rocks National Lakeshore:
Global:

CONSERVATION STATUS RANK

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

CLASSIFICATION

Status: Standard
Classification Confidence: 2 - Moderate
Pictured Rocks National Lakeshore Comments:
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:
- Red Pine Mixedwood (V13) (Sims et al. 1989) =
- Red Pine Mixedwood (V5) (McCarthy et al. 1994) =

OTHER COMMENTS

Other Comments:

ELEMENT DISTRIBUTION

Pictured Rocks National Lakeshore Range: This red pine - hardwood mixed forest is relatively uncommon within Pictured Rocks, although the closely related *Pinus resinosa / Vaccinium* spp. Forest (CEGL002443) can be found along the Lake Superior shoreline throughout the park.
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

Pictured Rocks National Lakeshore Inventory Notes:

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Pictured Rocks National Lakeshore Plots: PIRO.078.
Pictured Rocks National Lakeshore Map Code: FRA
Local Description Authors: M.J. Russo
Global Description Authors: D. Faber-Langendoen
References: Greenall 1996, McCarthy et al. 1994, Midwestern Ecology Working Group n.d., Sims et al. 1989

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.a)
Macrogroup	Northern Hardwood & Conifer Forest (MG014)
Group	White Pine - Red Pine - Jack Pine - Oak Forest & Woodland (G025)
Association (Common name)	Red Pine / Blueberry Dry Forest
Ecological System(s):	Laurentian-Acadian Northern Pine-(Oak) Forest (CES201.719)

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

Pictured Rocks National Lakeshore Environment: This red pine forest was sampled at four locations in the park. Sites are flat to gently sloping and include a kame terrace, an interdune flat, and outwash plains with some pit-and-mound topography. Soils are rapidly to well-drained sand. According to Farrand and Bell (1982), surficial geology is lacustrine sand and gravel. The unvegetated surface is dominated by leaf litter (94-100% cover) with some wood (1-3%) and dead snags (0-3%). This habitat is used by woodpecker, white-throated sparrow, deer and hare. Evidence of disturbance includes trails, heavy recreational impacts, old logging stumps, past fire, and more recently fire suppression.
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

Pictured Rocks National Lakeshore Vegetation: The moderate (50-60% cover) tree canopy is of variable height, 10-35 m tall, and is dominated by *Pinus resinosa* (red pine); it may also include lesser amounts of *Pinus banksiana* (jack pine) or *Pinus strobus* (eastern white pine). The very sparse to moderate (5-40%) subcanopy (5-15 m) and sparse (5-20%) tall-shrub layer (2-5 m) include *Abies balsamea* (balsam fir), *Betula papyrifera* (paper birch), *Picea mariana* (black spruce), *Pinus resinosa* (red pine), and *Pinus strobus* (eastern white pine). The sparse to very dense (10-90%) short-shrub layer (1-2 m) is dominated by the ericaceous species *Gaultheria procumbens* (eastern teaberry), *Gaylussacia baccata* (black huckleberry), *Vaccinium angustifolium* (lowbush blueberry), and *Vaccinium myrtilloides* (velvetleaf huckleberry) and includes saplings of species from upper layers. *Epigaea repens* (trailing arbutus) forms a sparse (5%) dwarf-shrub layer (<0.5 m). The moderate (60-70%) herbaceous layer is dominated by *Pteridium aquilinum* (western brackenfern); other herbs include *Cypripedium acaule* (moccasin flower) and *Melampyrum lineare* (narrowleaf cowwheat). Nonvascular species, mostly mosses and lichens, cover 5-50% of the ground surface and include *Cladina rangiferina* (greygreen reindeer lichen).
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*

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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 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

Pictured Rocks National Lakeshore

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Pinus banksiana* (jack pine), *Pinus resinosa* (red pine)
Short shrub/sapling	Broad-leaved deciduous shrub	*Vaccinium angustifolium* (lowbush blueberry), *Vaccinium myrtilloides* (velvetleaf huckleberry)
Short shrub/sapling	Broad-leaved evergreen shrub	*Gaultheria procumbens* (eastern teaberry)
Herb (field)	Dwarf-shrub	*Epigaea repens* (trailing arbutus)
Herb (field)	Fern or fern ally	*Pteridium aquilinum* (western brackenfern)

Global

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

CHARACTERISTIC SPECIES

Pictured Rocks National Lakeshore: *Betula papyrifera* (paper birch), *Pinus resinosa* (red pine), *Pteridium aquilinum* (western brackenfern), *Vaccinium angustifolium* (lowbush blueberry)
Global: *Corylus cornuta* (beaked hazelnut), *Pinus resinosa* (red pine), *Vaccinium angustifolium* (lowbush blueberry), *Vaccinium myrtilloides* (velvetleaf huckleberry)

OTHER NOTEWORTHY SPECIES

Pictured Rocks National Lakeshore:
Global:

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
Pictured Rocks National Lakeshore Comments:
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

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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.

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) B
- Red Pine (Ohmann and Ream 1971) =
- Red Pine Conifer (V27) (Sims et al. 1989) ?
- Red Pine-White Pine-Jack Pine-Blueberry-Feathermoss (V30) (Chambers et al. 1997) F
- Red Pine-White Pine-Jack Pine-Largetooth Aspen-White Pine Shrub-Wintergreen (V31) (Chambers et al. 1997) F

OTHER COMMENTS

Other Comments:

ELEMENT DISTRIBUTION

Pictured Rocks National Lakeshore Range: This upland red pine forest is associated with sandy outwash and dune systems in close proximity to the Lake Superior shoreline throughout the park, from Grand Marais to Munising. It is most widespread in the Kingston Lake area, Miners Beach, and Sable Point lighthouse.

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

Pictured Rocks National Lakeshore Inventory Notes:

Pictured Rocks National Lakeshore Plots: PIRO.007, PIRO.026, PIRO.030, PIRO.095.

Pictured Rocks National Lakeshore Map Code: FRP

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, Farrand and Bell 1982, Frelich 1992, Greenall 1996, Grigal and Ohmann 1975, Hazlett 1986, Heinselman 1973, MNNHP 1993, Midwestern Ecology Working Group n.d., Ohmann and Ream 1971, Sims et al. 1989, WNHIP unpubl. data

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.a)
Macrogroup	Northern Hardwood & Conifer Forest (MG014)
Group	White Pine - Red Pine - Jack Pine - Oak Forest & Woodland (G025)

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Association (Common name) White Pine - Red Oak Forest
Ecological System(s): Laurentian-Acadian Pine-Hemlock-Hardwood Forest (CES201.563)
Laurentian-Acadian Northern Pine-(Oak) Forest (CES201.719)

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

Pictured Rocks National Lakeshore Environment: This white pine - red oak forest was sampled at three locations in the park. The sites include a flat dune field, a gentle northwest-facing midslope glaciated upland, and a moderate south-facing beach ridge. Soils are well-drained sand. Surficial geology is lacustrine sand and gravel (Farrand and Bell 1982). The unvegetated surface is made up almost entirely of leaf litter (98-100% cover) with some wood (1-2%). Evidence of disturbance includes past logging and fire.
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

Pictured Rocks National Lakeshore Vegetation: The sparse to moderate (10-60% cover) tree canopy, 15-20 m tall, is dominated by *Quercus rubra* (northern red oak), *Pinus strobus* (eastern white pine), and *Betula papyrifera* (paper birch). The sparse to dense (30-80%) subcanopy (5-15 m) includes canopy species as well as *Acer rubrum* (red maple), *Fagus grandifolia* (American beech), and *Picea mariana* (black spruce), as is the sparse to moderate (20-50%) tall-shrub layer (2-5 m). The moderate to dense (60-80%) short-shrub layer (0.5-1 m) is dominated by ericaceous species, including *Gaultheria procumbens* (eastern teaberry), *Vaccinium angustifolium* (lowbush blueberry), and *Vaccinium myrtilloides* (velvetleaf huckleberry) along with saplings of tree species. *Epigaea repens* (trailing arbutus) forms a sparse (0-10%) dwarf-shrub layer (<0.5 m). The herbaceous layer (60-80%) is dominated by *Pteridium aquilinum* (western brackenfern); also present are traces of *Carex pensylvanica* (Pennsylvania sedge), *Cypripedium acaule* (moccasin flower), *Maianthemum canadense* (Canada mayflower), *Melampyrum lineare* (narrowleaf cowwheat), and *Trientalis borealis* (starflower). Nonvascular species (mosses and lichens) cover 10-20% of the ground surface.
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* (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

Pictured Rocks National Lakeshore

Stratum	Lifeform	Species
Tree (canopy & subcanopy)	Needle-leaved tree	*Pinus strobus* (eastern white pine)
Tree (canopy & subcanopy)	Broad-leaved deciduous tree	*Quercus rubra* (northern red oak)
Tree canopy	Broad-leaved deciduous tree	*Betula papyrifera* (paper birch)

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Tree subcanopy	Broad-leaved deciduous tree	*Acer rubrum* (red maple)
Tall shrub/sapling	Needle-leaved shrub	*Pinus strobus* (eastern white pine)
Tall shrub/sapling	Broad-leaved deciduous shrub	*Betula papyrifera* (paper birch)
Short shrub/sapling	Broad-leaved deciduous shrub	*Quercus rubra* (northern red oak), *Vaccinium angustifolium* (lowbush blueberry), *Vaccinium myrtilloides* (velvetleaf huckleberry)
Short shrub/sapling	Broad-leaved evergreen shrub	*Gaultheria procumbens* (eastern teaberry)
Short shrub/sapling	Dwarf-shrub	*Epigaea repens* (trailing arbutus)
Herb (field)	Fern or fern ally	*Pteridium aquilinum* (western brackenfern)

Global Stratum	**Lifeform**	**Species**

CHARACTERISTIC SPECIES

Pictured Rocks National Lakeshore: *Acer rubrum* (red maple), *Betula papyrifera* (paper birch), *Gaultheria procumbens* (eastern teaberry), *Pinus strobus* (eastern white pine), *Pteridium aquilinum* (western brackenfern), *Quercus rubra* (northern red oak), *Vaccinium angustifolium* (lowbush blueberry), *Vaccinium myrtilloides* (velvetleaf huckleberry)
Global:

OTHER NOTEWORTHY SPECIES

Pictured Rocks National Lakeshore:
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
Pictured Rocks National Lakeshore Comments:
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)

Global Related Concepts:
- Dry-Mesic Northern Forest - White Pine (Red Pine)-Oak (Chapman et al. 1989) =
- White Pine - Northern Red Oak - Red Maple: 20 (Eyre 1980) =
- White Pine-White Birch-Red Oak-Largetooth Aspen-Bracken Fern (Chambers et al. 1997) =

OTHER COMMENTS

Other Comments:

ELEMENT DISTRIBUTION

Pictured Rocks National Lakeshore Range: This white pine - oak forest is found in a small locale by Beaver Lake on slopes of rolling topography.
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. Range extent is about 300,000 square km.

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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

Pictured Rocks National Lakeshore Inventory Notes:
Pictured Rocks National Lakeshore Plots: PIRO.033, PIRO.040, PIRO.128.
Pictured Rocks National Lakeshore Map Code: FWO
Local Description Authors: M.J. Russo
Global Description Authors: D. Faber-Langendoen
References: Chambers et al. 1997, Chapman et al. 1989, Eyre 1980, Farrand and Bell 1982, MNNHP 1993, Midwestern Ecology Working Group n.d., WNHIP unpubl. Data

White Pine - Mixed Deciduous / Bracken Barren Forest and Scrub

***Pinus strobus - Populus tremuloides - (Acer rubrum) / Pteridium aquilinum* Forest**
Eastern White Pine - Quaking Aspen - (Red Maple) / Bracken Fern Forest
Identifier: CEGL005563

NVC CLASSIFICATION

Division	Eastern North American Cool Temperate Forest (1.C.2.a)
Macrogroup	Northern Hardwood & Conifer Forest (MG014)
Group	White Pine - Red Pine - Jack Pine - Oak Forest & Woodland (G025)
Association (Common name)	White Pine - Mixed Deciduous / Bracken Barren Forest and Scrub
Ecological System(s):	Laurentian-Acadian Northern Pine-(Oak) Forest (CES201.719)

ELEMENT CONCEPT

Global Summary: This mixed conifer - hardwood semi-natural forest is found in the Great Lakes region of the United States. Stands occur on a variety of slope positions from flat to moderately sloped kettled outwash plains to steep ridges on well-drained loamy sand to sandy soils. The canopy is mixed evergreen-deciduous and can range from moderately open (10%) to moderately closed (>60%) and just 1.5 to 10.6 m (5-35 feet) tall. Species in the canopy are highly variable and can be present in the canopy, subcanopy, and tall-shrub layers. *Pinus strobus* (eastern white pine), *Pinus resinosa* (red pine), *Acer rubrum* (red maple), *Betula papyrifera* (paper birch), and *Populus tremuloides* (quaking aspen) are the most common species. Other possible species include *Abies balsamea* (balsam fir), *Picea glauca* (white spruce), and *Pinus banksiana* (jack pine). Short shrubs such as *Vaccinium angustifolium* (lowbush blueberry) and *Vaccinium myrtilloides* (velvetleaf huckleberry) can occur. The herbaceous layer is dominated by *Pteridium aquilinum* (western brackenfern) which can form an almost continuous layer in some examples. Nonvascular species can cover up to 90% of the ground surface. This forest type resulted from extensive logging and burning of the slash during the early 1900s. The severity of this disturbance has prevented original forest types in the area from reestablishing.

ENVIRONMENTAL DESCRIPTION

Pictured Rocks National Lakeshore Environment: This pine - mixed deciduous / bracken barren forest was sampled at 34 locations in the park. Sites range from flat to moderately sloped kettled outwash plains to steep ridges of any aspect. Substrates are generally well-drained loamy sand and sand soils. The unvegetated surface is made up of leaf litter (5-65% cover), wood (0-40%), bare soil/sand (0-90%), and mosses and lichens (0-90%). Evidence of disturbance includes old logging stumps and slash, windthrow, and past fire.
Global Environment: Sites range from flat to moderately sloped kettled outwash plains to steep ridges of any aspect. Substrates are generally well-drained loamy sand and sand soils. The unvegetated surface is made up of leaf litter (0-80% cover), wood (0-50%), bare soil/sand (0-95%), and mosses and lichens (5-95%).

VEGETATION DESCRIPTION

Pictured Rocks National Lakeshore Vegetation: The highly variable (5-70% cover) tree canopy, 5-35+ m tall, and sparse to dense (10-80%) subcanopy (5-20 m) are dominated by *Acer rubrum* (red maple), *Betula papyrifera* (paper birch), *Pinus resinosa* (red pine), *Pinus strobus* (eastern white pine), and/or *Populus tremuloides* (quaking aspen); additional taxa may include *Abies balsamea* (balsam fir), *Picea glauca* (white spruce), *Populus grandidentata* (bigtooth aspen), and *Pinus banksiana* (jack pine). The sparse to moderate (5-40%) tall-shrub (1-5 m) and short-shrub layer (0.5-2 m) are made up of sapling canopy species. *Vaccinium angustifolium* (lowbush blueberry) and *Vaccinium myrtilloides* (velvetleaf huckleberry) form a sparse to dense (10-80%) dwarf-shrub layer (<0.5 m). The

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highly variable herbaceous layer (5-90%) is dominated by *Pteridium aquilinum* (western brackenfern). Nonvascular species (mosses and lichens) cover up to 90% of the ground surface.

Global Vegetation: The highly variable tree canopy and moderate to dense subcanopy are dominated by *Pinus strobus* (eastern white pine), *Acer rubrum* (red maple), *Betula papyrifera* (paper birch), *Pinus resinosa* (red pine), and/or *Populus tremuloides* (quaking aspen). These species may form a more scrubby, open canopy in some examples. Additional taxa may include *Abies balsamea* (balsam fir), *Picea glauca* (white spruce), *Populus grandidentata* (bigtooth aspen), and *Pinus banksiana* (jack pine). The tall-shrub (1-5 m) and short-shrub layer (0.5-2 m) are made up of sapling or scrubby canopy species. *Vaccinium angustifolium* (lowbush blueberry) and *Vaccinium myrtilloides* (velvetleaf huckleberry) form a sparse to somewhat dense dwarf-shrub layer (<0.5 m). The herbaceous layer is dominated by *Pteridium aquilinum* (western brackenfern) with nonvascular species (mosses and lichens) covering up to 90% of the ground surface.

MOST ABUNDANT SPECIES

Pictured Rocks National Lakeshore

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Pinus resinosa* (red pine)
Tree canopy	Broad-leaved deciduous tree	*Betula papyrifera* (paper birch), *Populus tremuloides* (quaking aspen)
Tree subcanopy	Needle-leaved tree	*Pinus resinosa* (red pine)
Tree subcanopy	Broad-leaved deciduous tree	*Acer rubrum* (red maple), *Populus tremuloides* (quaking aspen)
Herb (field)	Dwarf-shrub	*Vaccinium angustifolium* (lowbush blueberry), *Vaccinium myrtilloides* (velvetleaf huckleberry)
Herb (field)	Fern or fern ally	*Pteridium aquilinum* (western brackenfern)

Global

Stratum	Lifeform	Species
Tree (canopy & subcanopy)	Needle-leaved tree	*Pinus strobus* (eastern white pine)
Shrub/sapling (tall & short)	Needle-leaved tree	*Pinus strobus* (eastern white pine)
Shrub/sapling (tall & short)	Broad-leaved deciduous tree	*Populus tremuloides* (quaking aspen)
Herb (field)	Fern or fern ally	*Pteridium aquilinum* (western brackenfern)

CHARACTERISTIC SPECIES

Pictured Rocks National Lakeshore: *Pinus resinosa* (red pine), *Populus tremuloides* (quaking aspen), *Pteridium aquilinum* (western brackenfern), *Vaccinium angustifolium* (lowbush blueberry), *Vaccinium myrtilloides* (velvetleaf huckleberry)
Global: *Acer rubrum* (red maple), *Betula papyrifera* (paper birch), *Pinus resinosa* (red pine), *Pinus strobus* (eastern white pine), *Populus tremuloides* (quaking aspen), *Pteridium aquilinum* (western brackenfern)

OTHER NOTEWORTHY SPECIES

Pictured Rocks National Lakeshore: Exotic/Invasive: *Rumex acetosella* (common sheep sorrel, exotic, Medium/Low)
Global: Information not available.

CONSERVATION STATUS RANK

Global Rank & Reasons: GNA (ruderal) (19-Aug-2009).

CLASSIFICATION

Status: Nonstandard
Classification Confidence: 2 - Moderate
Pictured Rocks National Lakeshore Comments: Information not available.
Global Comments: This description is based on sites sampled at Pictured Rocks National Lakeshore and areas across the Kingston Plains of the Upper Peninsula of Michigan. Further evidence is needed to see if other areas within the Great Lakes states suffered similar, severe disturbances that resulted in this type of forest.
Global Related Concepts: Information not available.

OTHER COMMENTS

Other Comments: Information not available.

ELEMENT DISTRIBUTION

Pictured Rocks National Lakeshore Range: This community is found at Kingston Plains, Kingston Lake, Au Sable Campground, and along Fox River Trail.
Global Range: Information not available.
Nations: US
States/Provinces: MI, WI?
USFS Ecoregions (1994/95): 212Hi:CCC
Federal Lands: NPS (Pictured Rocks)
Federal Lands: Information not available.

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ELEMENT SOURCES

Pictured Rocks National Lakeshore Inventory Notes: Information not available.
Pictured Rocks National Lakeshore Plots: PIRO.022, PIRO.089, PIRO.109, PIRO.137, PIRO.138, PIRO.151, PIRO.153, PIRO.215, PIRO.218, PIRO.229, PIRO.275, PIRO.280, PIRO.330, PIRO.358, PIRO.376, PIRO.418, PIRO.432, PIRO.471, PIRO.473, PIRO.536, PIRO.544, PIRO.583, PIRO.589, PIRO.614, PIRO.624, PIRO.656, PIRO.664, PIRO.666, PIRO.757, PIRO.839.
Pictured Rocks National Lakeshore Map Code: FPB, SSS
Local Description Authors:
Global Description Authors: S.E. Menard
References: Midwestern Ecology Working Group n.d.

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.a)
Macrogroup	Northern Hardwood & Conifer Forest (MG014)
Group	White Pine - Red Pine - Jack Pine - Oak Forest & Woodland (G025)
Association (Common name)	White Pine - Aspen - Birch Forest
Ecological System(s):	Laurentian-Acadian Northern Pine-(Oak) Forest (CES201.719)

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

Pictured Rocks National Lakeshore Environment: This white pine - aspen - birch forest was sampled at five locations in the park. Sites include flat to gently sloping north- and southeast-facing kame terraces. One site is located on a somewhat steep west-facing kettle. Soils are rapidly to well-drained sand and loamy sand. The unvegetated surface is made up almost entirely of leaf litter (95-99% cover) with some wood (1-5%) and dead snags (0-1%). Evidence of disturbance includes trails, old logging stumps, past fire, insect damage, more recently fire suppression, and the presence of exotic species.
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

Pictured Rocks National Lakeshore Vegetation: The sparse to moderate (10-60% cover) highly variable tree canopy, 10-35 m tall, is dominated by *Betula papyrifera* (paper birch) and may also include lesser amounts of *Acer rubrum* (red maple), *Picea mariana* (black spruce), *Pinus resinosa* (red pine), *Pinus strobus* (eastern white pine), and *Populus grandidentata* (bigtooth aspen) (which can codominate). The sparse to moderate (10-50%) subcanopy (5-15 m) includes *Populus tremuloides* (quaking aspen) and *Pinus strobus* (eastern white pine). The sparse to moderately dense (20-70%) tall-shrub layer (2-5 m) includes *Acer pensylvanicum* (striped maple), *Acer saccharum* (sugar maple), *Amelanchier arborea* (common serviceberry), and *Betula papyrifera* (paper birch), along with canopy species. The sparse to total (10-100%) short-shrub layer (0.5-2 m) is dominated by ericaceous species, including *Vaccinium angustifolium* (lowbush blueberry) (up to 90% cover in one plot), *Gaultheria procumbens* (eastern teaberry), and *Vaccinium myrtilloides* (velvetleaf huckleberry); other taxa include *Amelanchier* (serviceberry) sp., *Diervilla lonicera* (northern bush honeysuckle), *Lonicera canadensis* (American fly honeysuckle), and *Sorbus decora* (northern mountain-ash), along with saplings of tree species. *Epigaea repens* (trailing arbutus) forms a sparse (0-10%) dwarf-shrub layer (<0.5 m). The herbaceous layer (50-80%) is

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dominated by *Pteridium aquilinum* (western brackenfern) and may include moderate cover (up to 40%) of *Deschampsia flexuosa* (wavy hairgrass); other common species include *Chimaphila umbellata* (pipsissewa), *Danthonia spicata* (poverty oatgrass), *Maianthemum canadense* (Canada mayflower), *Melampyrum lineare* (narrowleaf cowwheat), and *Trientalis borealis* (starflower). Nonvascular species (mosses and lichens) cover 0-40% of the ground surface.

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).

MOST ABUNDANT SPECIES

Pictured Rocks National Lakeshore

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Betula papyrifera* (paper birch)
Tree subcanopy	Needle-leaved tree	*Pinus strobus* (eastern white pine)
Tree subcanopy	Broad-leaved deciduous tree	*Populus tremuloides* (quaking aspen)
Tall shrub/sapling	Needle-leaved shrub	*Abies balsamea* (balsam fir), *Pinus strobus* (eastern white pine)
Tall shrub/sapling	Broad-leaved deciduous shrub	*Acer rubrum* (red maple)
Short shrub/sapling	Broad-leaved deciduous shrub	*Diervilla lonicera* (northern bush honeysuckle), *Vaccinium angustifolium* (lowbush blueberry), *Vaccinium myrtilloides* (velvetleaf huckleberry)
Short shrub/sapling	Broad-leaved evergreen shrub	*Gaultheria procumbens* (eastern teaberry)
Herb (field)	Forb	*Trientalis borealis* (starflower)
Herb (field)	Graminoid	*Danthonia spicata* (poverty oatgrass), *Deschampsia flexuosa* (wavy hairgrass)
Herb (field)	Fern or fern ally	*Pteridium aquilinum* (western brackenfern)

Global

Stratum	Lifeform	Species

CHARACTERISTIC SPECIES

Pictured Rocks National Lakeshore: *Acer pensylvanicum* (striped maple), *Acer rubrum* (red maple), *Betula papyrifera* (paper birch), *Deschampsia flexuosa* (wavy hairgrass), *Gaultheria procumbens* (eastern teaberry), *Melampyrum lineare* (narrowleaf cowwheat), *Pinus strobus* (eastern white pine), *Populus grandidentata* (bigtooth aspen), *Populus tremuloides* (quaking aspen), *Pteridium aquilinum* (western brackenfern), *Vaccinium angustifolium* (lowbush blueberry)

Global:

OTHER NOTEWORTHY SPECIES

Pictured Rocks National Lakeshore: Exotic/Invasive: *Hypericum perforatum* (common St. Johnswort, exotic, High/Medium), *Rumex acetosella* (common sheep sorrel, exotic, Medium/Low)

Global:

CONSERVATION STATUS RANK

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

CLASSIFICATION

Status: Standard

Classification Confidence: 2 - Moderate

Pictured Rocks National Lakeshore Comments:

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:

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- *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) B
- White Birch-White Pine-Trembling Aspen-Beaked Hazel-Mountain Maple (V23) (Chambers et al. 1997) =
- White Pine Mixedwood (Sims et al. 1989) =

OTHER COMMENTS

Other Comments:

ELEMENT DISTRIBUTION

Pictured Rocks National Lakeshore Range: This white pine - hardwood forest can be found throughout the park and the IBZ. Sampled plots are thought to be the result of management or stochastic wind events.
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, Grand Portage, Isle Royale, Pictured Rocks, Saint Croix, Sleeping Bear Dunes, Voyageurs); USFS (Chippewa, Huron, Huron-Manistee, Manistee?, Ottawa, Superior?)

ELEMENT SOURCES

Pictured Rocks National Lakeshore Inventory Notes:
Pictured Rocks National Lakeshore Plots: PIRO.009, PIRO.096, PIRO.100, PIRO.135, PIRO.136.
Pictured Rocks National Lakeshore Map Code: FWA
Local Description Authors: M.J. Russo
Global Description Authors: D. Faber-Langendoen
References: Chambers et al. 1997, Chapman et al. 1989, Grigal and Ohmann 1975, Heinselman 1996, MNNHP 1993, Midwestern Ecology Working Group n.d., Sims et al. 1989, WNHIP unpubl. data

White Pine / Blueberry Dry-Mesic Forest

***Pinus strobus / Vaccinium* spp. Forest**
Eastern White Pine / Blueberry species Forest
Identifier: CEGL002444

NVC CLASSIFICATION

Division	Eastern North American Cool Temperate Forest (1.C.2.a)
Macrogroup	Northern Hardwood & Conifer Forest (MG014)
Group	White Pine - Red Pine - Jack Pine - Oak Forest & Woodland (G025)
Association (Common name)	White Pine / Blueberry Dry-Mesic Forest
Ecological System(s):	Laurentian-Acadian Northern Pine-(Oak) Forest (CES201.719)

ELEMENT CONCEPT

Global Summary: This dry white pine forest community is found near the western Great Lakes region of the United States and Canada and eastward into the northeastern United States and eastern Canada. Stands occur on sandy soils within glaciated landscapes, such as moraines and till. It may be on flat to moderately sloping topography. Conifers dominate the overstory. *Pinus strobus* (eastern white pine) is the most abundant mature tree species, often found with small to substantial amounts of *Pinus resinosa* (red pine). Scattered *Acer rubrum* (red maple), *Betula papyrifera* (paper birch), and *Populus tremuloides* (quaking aspen) can be found as subcanopy or small canopy trees. The understory contains species such as *Aralia nudicaulis* (wild sarsaparilla), *Eurybia macrophylla* (bigleaf aster), *Maianthemum canadense* (Canada mayflower), *Pteridium aquilinum* (western brackenfern), *Vaccinium angustifolium* (lowbush blueberry), and *Vaccinium myrtilloides* (velvetleaf huckleberry). An inland dune ridge variant occurs in Michigan; the overstory contains *Pinus strobus* (eastern white pine) and *Pinus resinosa* (red pine), the shrub layers contain *Vaccinium angustifolium* (lowbush blueberry) and *Arctostaphylos uva-ursi* (kinnikinnick), and *Pteridium aquilinum* (western brackenfern) is common in the understory.

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ENVIRONMENTAL DESCRIPTION

Pictured Rocks National Lakeshore Environment: This white pine forest was sampled at three locations in the park. The sites range from flat to moderately sloping northwest- and west-facing outwash plains and interdune flats. Soils are well-drained sand. The unvegetated surface is made up almost entirely of leaf litter (97-100% cover) with some wood (0-3%). The site is used by white-throated sparrow, flicker, deer and red squirrel. Evidence of disturbance includes trails, old logging stumps, and past fire.
Global Environment: This community is found on sandy soils. It occurs most often on glaciated landscapes, such as moraines and till, where sandy pockets occur, and may be on flat to moderately sloping topography (MNNHP 1993). It is also found on somewhat poorly drained sand and clay lakeplains. The inland dune variant occurs on dune ridges.

VEGETATION DESCRIPTION

Pictured Rocks National Lakeshore Vegetation: The sparse to moderate (10-50% cover) tree canopy, 15-35 m tall, is dominated by *Pinus strobus* (eastern white pine) with lesser amounts of *Betula papyrifera* (paper birch), *Picea mariana* (black spruce) and *Pinus resinosa* (red pine). The moderate (30-40%) subcanopy (10-20 m) and very sparse (5-10%) tall-shrub layer (2-5 m) are dominated by *Acer rubrum* (red maple) and may include *Abies balsamea* (balsam fir), *Betula papyrifera* (paper birch), *Picea mariana* (black spruce), and *Amelanchier arborea* (common serviceberry). The moderate to dense (50-90%) short-shrub layer (0.5-2 m) is dominated by ericaceous species, including *Gaultheria procumbens* (eastern teaberry), *Vaccinium angustifolium* (lowbush blueberry), and *Vaccinium myrtilloides* (velvetleaf huckleberry); additional species include *Nemopanthus mucronatus* (catberry), *Sorbus decora* (northern mountain-ash), *Linnaea borealis* (twinflower), and saplings of species from upper layers. *Epigaea repens* (trailing arbutus) and *Mitchella repens* (partridgeberry) form a very sparse (5%) dwarf-shrub layer (<0.5 m). The moderately dense (70-80%) herbaceous layer is dominated by *Pteridium aquilinum* (western brackenfern) (70%); other species include *Clintonia borealis* (bluebead), *Cornus canadensis* (bunchberry dogwood), *Cypripedium acaule* (moccasin flower), *Deschampsia flexuosa* (wavy hairgrass), *Huperzia lucidula* (shining clubmoss), *Maianthemum canadense* (Canada mayflower), *Maianthemum canadense* (Canada mayflower), *Melampyrum lineare* (narrowleaf cowwheat), *Melampyrum lineare* (narrowleaf cowwheat), and *Trientalis borealis* (starflower). Nonvascular species (mosses and lichens) cover 0-30% of the ground surface and include *Cladina* (reindeer lichen) sp. and *Leucobryum glaucum* (leucobryum moss).
Global Vegetation: Conifers dominate the overstory. *Pinus strobus* (eastern white pine) is the most abundant mature tree species, often found with small to substantial amounts of *Pinus resinosa* (red pine). Scattered *Acer rubrum* (red maple), *Betula papyrifera* (paper birch), and *Populus tremuloides* (quaking aspen) can be found as subcanopy or small canopy trees. The understory contains species such as *Aralia nudicaulis* (wild sarsaparilla), *Eurybia macrophylla* (bigleaf aster), *Maianthemum canadense* (Canada mayflower), *Pteridium aquilinum* (western brackenfern), and *Vaccinium* (blueberry) spp. (MNNHP 1993). An inland dune ridge variant occurs in Michigan; the overstory contains *Pinus strobus* (eastern white pine) and *Pinus resinosa* (red pine), the shrub layers contain *Vaccinium angustifolium* (lowbush blueberry) and *Arctostaphylos uva-ursi* (kinnikinnick), and *Pteridium aquilinum* (western brackenfern) is common in the understory (P. Comer pers. comm. 1996, D. Albert pers. comm. 1996).

MOST ABUNDANT SPECIES

Pictured Rocks National Lakeshore

Stratum	Lifeform	Species
Tree (canopy & subcanopy)	Needle-leaved tree	*Pinus strobus* (eastern white pine)
Short shrub/sapling	Broad-leaved deciduous shrub	*Vaccinium angustifolium* (lowbush blueberry), *Vaccinium myrtilloides* (velvetleaf huckleberry)
Short shrub/sapling	Dwarf-shrub	*Epigaea repens* (trailing arbutus)
Herb (field)	Forb	*Maianthemum canadense* (Canada mayflower), *Melampyrum lineare* (narrowleaf cowwheat)
Herb (field)	Fern or fern ally	*Pteridium aquilinum* (western brackenfern)

Global

Stratum	Lifeform	Species

CHARACTERISTIC SPECIES

Pictured Rocks National Lakeshore: *Acer rubrum* (red maple), *Pinus strobus* (eastern white pine), *Pteridium aquilinum* (western brackenfern), *Vaccinium angustifolium* (lowbush blueberry), *Vaccinium myrtilloides* (velvetleaf huckleberry)
Global:

OTHER NOTEWORTHY SPECIES

Pictured Rocks National Lakeshore:
Global:

CONSERVATION STATUS RANK

Global Rank & Reasons: G3G4 (22-Jun-1998). There are well over 100 occurrences rangewide, but the occurrences tend to be fairly small stands (under 100 acres) because of the somewhat restricted environmental requirements. Few old-growth remnants remain, but several are protected. This community may be dependent on occasional catastrophic fires (with a very long fire-return interval) to allow regeneration of pines instead of gradual succession to other forest types. Fire suppression, grazing, and logging in the last 100 years have substantially reduced the acreage of this forest type.

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CLASSIFICATION

Status: Standard
Classification Confidence: 1 - Strong
Pictured Rocks National Lakeshore Comments:
Global Comments: This type is similar to *Pinus resinosa / Vaccinium* spp. Forest (CEGL002443). It occurs on droughty soils, influenced by adjacent moraines. The inland dune variant, found in Saginaw Bay and in Luce County (Two-hearted River), Upper Peninsula, could also be treated as a variant of the Great Lakes Dune Pine Forest, *Pinus banksiana - Pinus resinosa - Pinus strobus* Dune Forest (CEGL002589).
Global Similar Associations:
- *Pinus banksiana - (Quercus ellipsoidalis) / Schizachyrium scoparium* - Prairie Forbs Wooded Herbaceous Vegetation (CEGL002490)
- *Pinus banksiana - Pinus resinosa - Pinus strobus* Dune Forest (CEGL002589)--This is a pine forest on Great Lakes dunes.
- *Pinus resinosa / Vaccinium* spp. Forest (CEGL002443)
- *Pinus strobus / Acer spicatum - Corylus cornuta* Forest (CEGL002445)

Global Related Concepts:
- Dry-Mesic Northern Forest - Red Pine-White Pine (Chapman et al. 1989) B
- Northern Dry Forest (Curtis 1959) B
- SNE Dry oak/pine forest on sandy / gravelly soils (Rawinski 1984) B

OTHER COMMENTS

Other Comments:

ELEMENT DISTRIBUTION

Pictured Rocks National Lakeshore Range: This dry white pine forest occurs only in very small pockets in close proximity to Lake Superior. It is found only in areas that were not previously logged at the turn of the 20th century. It is typically surrounded by and associated with other mixed pine forest. Overall this community is very infrequent throughout the park.
Global Range: This dry white pine forest community is found in the western Great Lakes region of the United States and Canada. It ranges from northern Minnesota and northwestern Ontario east possibly into Quebec. Its range extent is close to 200,000 square km.
Nations: CA, US
States/Provinces: MI, MN:S2, ON, QC, WI:S3
TNC Ecoregions: 46:C, 47:C, 48:C
USFS Ecoregions (1994/95): 212Hb:CCP, 212He:CCP, 212Hh:CCC, 212Hi:CCC, 212Hj:CCC, 212Hl:CCC, 212Hm:CCC, 212Ho:CCC, 212Hp:CCC, 212Hq:CCP, 212Hr:CCC, 212Hs:CCP, 212Ht:CCP, 212Hu:CCP, 212Hv:CCP, 212Hw:CCP, 212Hy:CCP, 212Ia:CCC, 212Ja:CCP, 212Jb:CCP, 212Jc:CCP, 212Jl:CCP, 212Jm:CCP, 212Jn:CCP, 212Jr:CCC, 212Ka:CCP, 212Kb:CCC, 212Na:CCC, 212Nb:CCP, 212Nc:CCC, 222Ma:CCC, 222Mc:CCC, M212:P
Federal Lands: NPS (Apostle Islands, Pictured Rocks, Sleeping Bear Dunes); USFS (Chequamegon, Chequamegon-Nicolet, Chippewa, Huron, Huron-Manistee, Manistee?, Nicolet, Ottawa)

ELEMENT SOURCES

Pictured Rocks National Lakeshore Inventory Notes:
Pictured Rocks National Lakeshore Plots: PIRO.027, PIRO.031, PIRO.093.
Pictured Rocks National Lakeshore Map Code: FWP
Local Description Authors: M.J. Russo
Global Description Authors: J. Drake
References: Albert pers. comm., Chapman et al. 1989, Comer pers. comm., Curtis 1959, MNNHP 1993, Midwestern Ecology Working Group n.d., Rawinski 1984, WNHIP unpubl. data

MG159. Northern Pine - Oak Woodland & Barrens

G160. Great Lakes Pine Barrens

Great Lakes Dune Pine Forest

***Pinus banksiana - Pinus resinosa - Pinus strobus* Dune Forest**
Jack Pine - Red Pine - Eastern White Pine Dune Forest
Identifier: CEGL002589

NVC CLASSIFICATION

Division	Eastern North American Cool Temperate Forest (1.C.2.a)
Macrogroup	Northern Pine - Oak Woodland & Barrens (MG159)
Group	Great Lakes Pine Barrens (G160)
Association (Common name)	Great Lakes Dune Pine Forest
Ecological System(s):	Great Lakes Dune (CES201.026)
	Great Lakes Wooded Dune and Swale (CES201.726)

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ELEMENT CONCEPT

Global Summary: This pine dune forest is found on dune systems on Lake Superior, Lake Michigan and Lake Huron in the United States and Canada. The canopy is more-or-less closed and is dominated by *Pinus banksiana* (jack pine), *Pinus resinosa* (red pine), and *Pinus strobus* (eastern white pine). This type has not been well-described, and further characterization is needed.

ENVIRONMENTAL DESCRIPTION

Pictured Rocks National Lakeshore Environment: This mixed-pine dune forest was sampled at two locations in the park: once on a flat lower dune and once on a moderately sloping, west-facing upper dune. Stands are located away from the lake in the lowest swales and wind-protected hollows surrounded by ridges and steep slopes. Soils are rapidly to moderately well-drained very fine silty sand. Surficial geology is coarse-textured glacial till (Farrand and Bell 1982). The unvegetated surface is dominated by leaf litter (74-99% cover) with some wood (1-2%) and bare sand (2-25%). These sites are used for foraging by deer, goldfinch, black-capped chickadee, flicker, and nuthatch. Evidence of disturbance includes wind damage and past fire; stand dbh and height indicate a single age class likely resulting from a past fire.
Global Environment: Stands are found on dune systems along Lake Superior, Lake Michigan and Lake Huron.

VEGETATION DESCRIPTION

Pictured Rocks National Lakeshore Vegetation: The very sparse to moderately dense (5-70% cover) tree canopy, 15-35 m tall, is dominated by *Pinus banksiana* (jack pine). *Abies balsamea* (balsam fir) makes up the very sparse to very dense (5-70%) subcanopy (10-15 m) and moderately sparse to total (40-100%) tall-shrub layer (1-5 m). The moderate (60%) short-shrub layer (0.5-1 m) may include saplings of *Abies balsamea* (balsam fir), *Acer pensylvanicum* (striped maple), *Acer saccharum* (sugar maple), *Betula papyrifera* (paper birch), *Fagus grandifolia* (American beech), *Juniperus communis* (common juniper), and *Picea glauca* (white spruce), as well as shrubs *Cornus rugosa* (roundleaf dogwood), *Corylus cornuta* (beaked hazelnut), *Linnaea borealis* (twinflower), *Lonicera canadensis* (American fly honeysuckle), *Prunus virginiana* (chokecherry), and *Sorbus decora* (northern mountain-ash). The very sparse to moderate (5-40%) herbaceous layer may include *Aralia nudicaulis* (wild sarsaparilla), *Chimaphila umbellata* (pipsissewa), *Clintonia borealis* (bluebead), *Cornus canadensis* (bunchberry dogwood), *Cypripedium acaule* (moccasin flower), *Cypripedium arietinum* (ram's head lady's slipper), *Goodyera oblongifolia* (western rattlesnake plantain), *Linnaea borealis* (twinflower), *Maianthemum canadense* (Canada mayflower), *Maianthemum stellatum* (starry false lily of the valley), *Pyrola asarifolia* (liverleaf wintergreen), and *Trientalis borealis* (starflower). Nonvascular species (5-40%), mostly mosses and lichens, include *Hylocomium splendens* (splendid feather moss), *Plagiomnium ciliare* (plagiomnium moss), and *Ptilium crista-castrensis* (knights plume moss). This community supports globally and state-vulnerable *Cypripedium arietinum* (ram's head lady's slipper) (including one very large population) and state-vulnerable *Cynoglossum virginianum* var. *boreale* (wild comfrey).
Global Vegetation: The canopy is more-or-less closed and is dominated by *Pinus banksiana* (jack pine), *Pinus resinosa* (red pine), and *Pinus strobus* (eastern white pine). This type has not been well-described, and further characterization is needed.

MOST ABUNDANT SPECIES

Pictured Rocks National Lakeshore

Stratum	Lifeform	Species
Tree (canopy & subcanopy)	Needle-leaved tree	*Pinus banksiana* (jack pine)
Tree canopy	Needle-leaved tree	*Pinus strobus* (eastern white pine)
Tree canopy	Broad-leaved deciduous tree	*Betula papyrifera* (paper birch)
Tree subcanopy	Broad-leaved deciduous tree	*Populus balsamifera* (balsam poplar)
Short shrub/sapling	Needle-leaved shrub	*Juniperus communis* (common juniper)
Herb (field)	Dwarf-shrub	*Arctostaphylos uva-ursi* (kinnikinnick)
Herb (field)	Forb	*Chimaphila umbellata* (pipsissewa)

Global

Stratum	Lifeform	Species

CHARACTERISTIC SPECIES

Pictured Rocks National Lakeshore: *Arctostaphylos uva-ursi* (kinnikinnick), *Juniperus communis* (common juniper), *Maianthemum stellatum* (starry false lily of the valley), *Pinus banksiana* (jack pine)
Global:

OTHER NOTEWORTHY SPECIES

Pictured Rocks National Lakeshore: Vulnerable: *Tanacetum bipinnatum* ssp. *huronense* (Lake Huron tansy, state-vulnerable, G5T4T5); **Exotic/Invasive**: *Poa compressa* (Canada bluegrass, exotic, High/Low), *Taraxacum officinale* (common dandelion, exotic)
Global:

CONSERVATION STATUS RANK

Global Rank & Reasons: G3Q (24-Oct-2002). This type is found within the coastal areas of Lake Superior, Lake Michigan and Lake Huron where it is a component of a complex dune-and-swale system found along the lakeplains. It is primarily restricted to drier, sandy soils on dune tops or ridges. It is listed for the United States, but currently not attributed to Canada. More information on the status of this type is needed.

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CLASSIFICATION

Status: Standard
Classification Confidence: 3 - Weak
Pictured Rocks National Lakeshore Comments:
Global Comments: Type is not described in Ontario by Lee et al. (1998). Its extent in the United States may be limited, and a review of its concept is needed. Perhaps this type can be combined with Great Lakes Pine Barrens, *Pinus banksiana - (Pinus resinosa) - Pinus strobus / Juniperus horizontalis* Wooded Herbaceous Vegetation (CEGL005125), or can be dissolved into the respective *Pinus banksiana* (jack pine), *Pinus resinosa* (red pine) or *Pinus strobus* (eastern white pine) inland forests on sand. Type (whether as forest or barrens) has been eliminated in Illinois.
Global Similar Associations:
- *Pinus banksiana - (Pinus resinosa) - Pinus strobus / Juniperus horizontalis* Wooded Herbaceous Vegetation (CEGL005125)--This is the open Great Lakes pine barrens type.
- *Pinus resinosa / Vaccinium* spp. Forest (CEGL002443)
- *Pinus strobus / Vaccinium* spp. Forest (CEGL002444)

Global Related Concepts:
- Great Lakes Barren (Chapman et al. 1989) B

OTHER COMMENTS

Other Comments:

ELEMENT DISTRIBUTION

Pictured Rocks National Lakeshore Range: This pine dune forest is located along Lake Superior on dune ridges. It was sampled twice at Grand Sable Dunes.
Global Range: This pine dune forest type is found on dune systems on Lake Superior, Lake Michigan and Lake Huron in the United States and possibly in Canada, ranging from Wisconsin and Michigan to Ontario, and, at least historically, in Indiana and Illinois.
Nations: CA, US
States/Provinces: IL, IN, MI, ON, QC:S3?, WI
TNC Ecoregions: 48:C
USFS Ecoregions (1994/95): 212Ha:CC?, 212Hb:CC?, 212He:CCC, 212Hh:CC?, 212Hi:CCC, 212Hj:CCC, 212Hk:CC?, 212Hl:CCC, 212Ho:CCC, 212Hr:CCP, 212Hw:CCC, 212Hx:CCC, 212Ia:CCC, 212Ja:CC?, 212Jn:CC?, 212Jr:CCC, 212Oa:CCC, 222Jj:CCC
Federal Lands: NPS (Apostle Islands, Indiana Dunes, Pictured Rocks, Sleeping Bear Dunes); USFS (Hiawatha, Huron-Manistee, Huron?, Manistee)

ELEMENT SOURCES

Pictured Rocks National Lakeshore Inventory Notes:
Pictured Rocks National Lakeshore Plots: PIRO.112, PIRO.115.
Pictured Rocks National Lakeshore Map Code: FPD
Local Description Authors: M.J. Russo
Global Description Authors: D. Faber-Langendoen
References: Bakowsky and Lee 1996, Chapman et al. 1989, Farrand and Bell 1982, Lee et al. 1998, Midwestern Ecology Working Group n.d.

1.C.3. Temperate Flooded & Swamp Forest

1.C.3.a. Northeastern & Central North American Flooded & Swamp Forest

MG030. Northern & Central Swamp Forest

G046. Northern & Central Alkaline Conifer & Hardwood Swamp

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	Northeastern & Central North American Flooded & Swamp Forest (1.C.3.a)
Macrogroup	Northern & Central Swamp Forest (MG030)
Group	Northern & Central Alkaline Conifer & Hardwood Swamp (G046)
Association (Common name)	Black Ash - Mixed Hardwood Swamp
Ecological System(s):	Laurentian-Acadian Alkaline Conifer-Hardwood Swamp (CES201.575) Eastern Boreal Floodplain (CES103.588)

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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

Pictured Rocks National Lakeshore Environment: This black ash - hardwood swamp forest was observed twice in the park near Sable Falls. Sites are low-lying areas likely subject to seasonal flooding. The unvegetated surface is dominated by leaf litter (80% cover) with some wood (15%) and bare soil (5%). The hydrology of the sites have been altered by road construction and extended drought.

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

Pictured Rocks National Lakeshore Vegetation: The moderate to very dense (50-90% cover) tree canopy, 10-20 m tall, is dominated by *Fraxinus nigra* (black ash) and may include *Betula alleghaniensis* (yellow birch), *Betula papyrifera* (paper birch), *Picea glauca* (white spruce), and *Ulmus americana* (American elm). The very dense (80-90%) subcanopy (5-15 m) is also dominated by *Fraxinus nigra* (black ash) (up to 90%) and may include *Acer saccharum* (sugar maple) and *Thuja occidentalis* (northern white-cedar). The moderate to dense (50-80%) tall-shrub layer (2-5 m) includes large amounts of sapling *Fraxinus nigra* (black ash) along with saplings of other canopy and subcanopy species. The sparse (30%) short-shrub layer (0.5-1 m) is dominated by *Ribes triste* (red currant) and *Lonicera canadensis* (American fly honeysuckle). *Rubus pubescens* (dwarf red blackberry) forms a moderate (50%) dwarf-shrub layer. The dense to total (80-100%) herbaceous layer is dominated by *Dryopteris carthusiana* (spinulose woodfern) and *Matteuccia struthiopteris* (ostrich fern) and may include *Arisaema triphyllum* (Jack in the pulpit), *Carex intumescens* (greater bladder sedge), *Equisetum pratense* (meadow horsetail), and *Glyceria striata* (fowl mannagrass).

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).

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MOST ABUNDANT SPECIES

Pictured Rocks National Lakeshore

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Picea glauca* (white spruce)
Tree canopy	Broad-leaved deciduous tree	*Betula alleghaniensis* (yellow birch), *Fraxinus nigra* (black ash)
Tree subcanopy	Broad-leaved deciduous tree	*Acer saccharum* (sugar maple), *Fraxinus nigra* (black ash)
Tall shrub/sapling	Broad-leaved deciduous shrub	*Acer spicatum* (mountain maple), *Fraxinus nigra* (black ash)
Short shrub/sapling	Broad-leaved deciduous shrub	*Ribes triste* (red currant)
Herb (field)	Forb	*Matteuccia struthiopteris* (ostrich fern), *Rubus pubescens* (dwarf red blackberry)
Herb (field)	Fern or fern ally	*Dryopteris carthusiana* (spinulose woodfern), *Equisetum pratense* (meadow horsetail)

Global

Stratum	Lifeform	Species

CHARACTERISTIC SPECIES

Pictured Rocks National Lakeshore: *Acer saccharum* (sugar maple), *Acer spicatum* (mountain maple), *Dryopteris carthusiana* (spinulose woodfern), *Equisetum pratense* (meadow horsetail), *Fraxinus nigra* (black ash), *Rubus pubescens* (dwarf red blackberry)
Global:

OTHER NOTEWORTHY SPECIES

Pictured Rocks National Lakeshore:
Global:

CONSERVATION STATUS RANK

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

CLASSIFICATION

Status: Standard
Classification Confidence: 2 - Moderate
Pictured Rocks National Lakeshore Comments:
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 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-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) F
- Hardwood swamp: black ash (other hardwood): upland transition (W33) (Harris et al. 1996) F
- Northern Swamp (Chapman et al. 1989) B

OTHER COMMENTS

Other Comments:

ELEMENT DISTRIBUTION

Pictured Rocks National Lakeshore Range:
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

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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

Pictured Rocks National Lakeshore Inventory Notes:
Pictured Rocks National Lakeshore Plots: PIRO.300, PIRO.301.
Pictured Rocks National Lakeshore Map Code: FBA. FLD
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, Greenall 1996, Harris et al. 1996, MNNHP 1993, Midwestern Ecology Working Group n.d., NDNHI unpubl. data, Sims et al. 1989, WNHIP unpubl. data, Wovcha et al. 1995

White Pine - Red Maple Swamp

***Pinus strobus* - *(Acer rubrum)* / *Osmunda* spp. Forest**
Eastern White Pine - (Red Maple) / Royal Fern species Forest
Identifier: CEGL002482

NVC CLASSIFICATION

Division	Northeastern & Central North American Flooded & Swamp Forest (1.C.3.a)
Macrogroup	Northern & Central Swamp Forest (MG030)
Group	Northern & Central Alkaline Conifer & Hardwood Swamp (G046)
Association (Common name)	White Pine - Red Maple Swamp

Ecological System(s):

ELEMENT CONCEPT

Global Summary: This white pine - red maple swamp forest is found in the southern Great Lakes region of the United States and Canada, ranging east in scattered locations. Stands occur on sites with at least a thin layer of organic material on the surface. Glacially deposited sand usually lies beneath the organic layer. The overstory is dominated by *Pinus strobus* (eastern white pine) and may contain *Acer rubrum* (red maple), *Betula alleghaniensis* (yellow birch), *Tsuga canadensis* (eastern hemlock), and *Ulmus americana* (American elm). Shrubs can be sparse but include *Alnus incana* (gray alder) and *Ilex verticillata* (common winterberry). Understory species include *Carex* (sedge) spp., *Osmunda cinnamomea* (cinnamon fern), *Osmunda regalis* (royal fern), and *Symplocarpus foetidus* (skunk-cabbage). *Sphagnum* (sphagnum) spp. may occur as a ground cover. In Wisconsin, common species include *Carex folliculata* (northern long sedge) and *Thelypteris simulata* (bog fern), which are more common in the eastern United States.

ENVIRONMENTAL DESCRIPTION

Pictured Rocks National Lakeshore Environment: This white pine forest was sampled twice in the park. Both sites are part of dune-and-swale complexes that are either flat or gently sloping. soils are either seasonally flooded, somewhat poorly drained sandy loam over pure medium-fine-textured sand or well-drained sand. The unvegetated surface is almost entirely leaf litter (97-99% cover) with some wood (1%) and bare sand (0-2%). Evidence of disturbance includes hiking trails, wind and weather stress that has damaged the tops of the white pines, and fire suppression.
Global Environment: This community is flooded or saturated for at least part of the year. The soils have at least a thin layer of organic material on the surface, which may be thick enough to qualify as a soil layer itself. Glacially deposited sand usually lies beneath the organic layer, and these, in turn, are underlain, or interrupted by, impermeable silts and clays (E. Epstein pers. comm. 1999).

VEGETATION DESCRIPTION

Pictured Rocks National Lakeshore Vegetation: The moderate (50% cover) tree canopy, 10-20 m tall, is dominated by *Pinus resinosa* (red pine) and *Pinus strobus* (eastern white pine), as is the sparse (10-20%) subcanopy (10-15 m) which may also include *Acer rubrum* (red maple) and *Picea mariana* (black spruce). These species also form the very sparse to moderate (5-30%) tall-shrub layer (2-5 m). The dense (80%) short-shrub layer (0.5-1 m) is dominated by *Chamaedaphne calyculata* (leatherleaf), *Vaccinium angustifolium* (lowbush blueberry), and *Vaccinium myrtilloides* (velvetleaf huckleberry); additional species include *Kalmia polifolia* (bog laurel), *Ledum groenlandicum* (bog Labrador-tea), *Nemopanthus mucronatus* (catberry), and *Photinia floribunda* (purple chokeberry). *Epigaea repens* (trailing arbutus) may form a very sparse (0-5%) dwarf-shrub layer. The very sparse (5-20%) herbaceous layer includes *Deschampsia flexuosa* (wavy hairgrass), *Maianthemum canadense* (Canada mayflower), and *Melampyrum lineare* (narrowleaf cowwheat). Nonvascular species (mosses and lichens) cover 10-80% of the ground surface.

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Global Vegetation: The overstory is dominated by *Pinus strobus* (eastern white pine) and may contain *Acer rubrum* (red maple), *Betula alleghaniensis* (yellow birch), *Tsuga canadensis* (eastern hemlock), and *Ulmus americana* (American elm). Shrubs can be sparse, but include *Alnus incana* (gray alder) and *Ilex verticillata* (common winterberry). Understory species include *Carex* (sedge) spp., *Osmunda cinnamomea* (cinnamon fern), *Osmunda regalis* (royal fern) and *Symplocarpus foetidus* (skunk-cabbage). *Sphagnum* (sphagnum) spp. may occur as a ground cover. In Wisconsin, common species include *Carex folliculata* (northern long sedge) and *Thelypteris simulata* (bog fern), which are more common in the eastern United States (E. Epstein pers. comm. 1999).

MOST ABUNDANT SPECIES

Pictured Rocks National Lakeshore

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

Global

Stratum	Lifeform	Species

CHARACTERISTIC SPECIES

Pictured Rocks National Lakeshore: *Chamaedaphne calyculata* (leatherleaf), *Deschampsia flexuosa* (wavy hairgrass), *Picea mariana* (black spruce), *Pinus resinosa* (red pine), *Pinus strobus* (eastern white pine), *Vaccinium angustifolium* (lowbush blueberry), *Vaccinium myrtilloides* (velvetleaf huckleberry)
Global:

OTHER NOTEWORTHY SPECIES

Pictured Rocks National Lakeshore:
Global:

CONSERVATION STATUS RANK

Global Rank & Reasons: G3G4 (22-Jun-1998). The total number of occurrences is unknown. One has been documented in Ohio (where the community is ranked S1), and 7 in Wisconsin (S2), where its distribution is very local on central Wisconsin glacial lake beds, with few good occurrences. Although no other occurrences have been documented, the community is also reported in Vermont (S?), Massachusetts (S?), Connecticut (S?), New York (S?), Ontario (S2), and possibly Minnesota (SP). It is usually found on a layer of organic soil over glacially deposited sand which is flooded or saturated for at least part of the year.

CLASSIFICATION

Status: Standard
Classification Confidence: 2 - Moderate
Pictured Rocks National Lakeshore Comments:
Global Comments: See Golet et al. (1993 [p. 51]) for a description of this type in the northeastern United States. In Wisconsin, *Ilex verticillata* (common winterberry) and *Osmunda cinnamomea* (cinnamon fern) are typical. Elsewhere, *Osmunda regalis* (royal fern) may be more typical. In Michigan this type may be in Montcalm County. Status in Indiana is not clear.
Global Related Concepts:

- Hardwood-Conifer Swamp (Chapman et al. 1989) B
- Palustrine Broad-leaved Deciduous Forested Wetlands (PFO1) (Cowardin et al. 1979) ?
- Successional mixed forest (NAP pers. comm. 1998) ?

OTHER COMMENTS

Other Comments:

ELEMENT DISTRIBUTION

Pictured Rocks National Lakeshore Range: This white pine - red maple swamp forest is common throughout the park, often created and maintained by anthropogenic disturbance.
Global Range: This white pine - red maple swamp forest type is found in the southern Great Lakes region of the United States and Canada, ranging locally from central Wisconsin east to Ohio. It also occurs in scattered locations in the Northeast; it has been reported from two locations in Rhode Island and one potential occurrence in Pennsylvania. More data are needed to determine whether this type occurs more broadly in the Northeast.
Nations: CA, US
States/Provinces: MI, MN, OH:S1, ON, PA?, QC:S3?, RI, WI:S2
TNC Ecoregions: 46:C, 47:C, 48:C, 61:P, 64:C
USFS Ecoregions (1994/95): 212Ec:CCC, 212Ha:CCP, 212Hb:CCP, 212He:CCP, 212Hh:CCP, 212Hi:CCC, 212Hj:CCP, 212Hk:CCP, 212Hl:CCP, 212Hm:CCP, 212Hp:CCP, 212Hq:CCP, 212Hr:CCP, 212Hs:CCP, 212Ht:CCP, 212Hv:CCP, 212Hx:CCP, 212Ja:CCP, 212Jb:CCP, 212Jc:CCP, 212Jh:CCC, 212Jk:CCP, 212Jl:CCP, 212Jn:CCP, 212Jo:CCP, 212Jr:CCP, 221Ae:CPP, 221Da:CPP, 221Fa:CCC, 222Ka:CCC, 222Lb:CCC, M212D:CP, M212F:CP
Federal Lands: NPS (Pictured Rocks, Sleeping Bear Dunes); USFS (Huron, Huron-Manistee, Manistee, Ottawa)

ELEMENT SOURCES

Pictured Rocks National Lakeshore Inventory Notes:

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Pictured Rocks National Lakeshore Plots: PIRO.051, PIRO.102.
Pictured Rocks National Lakeshore Map Code: FWM, FWW
Local Description Authors: M.J. Russo
Global Description Authors: J. Drake
References: Chapman et al. 1989, Cowardin et al. 1979, Epstein pers. comm., Golet et al. 1993, Midwestern Ecology Working Group n.d., NAP pers. comm. 1998, ONHD unpubl. data, WNHIP unpubl. data

White-cedar Seepage Swamp

***Thuja occidentalis* - *(Larix laricina)* Seepage Forest**
Northern White-cedar - (Tamarack) Seepage Forest
Identifier: CEGL002455

NVC CLASSIFICATION

Division	Northeastern & Central North American Flooded & Swamp Forest (1.C.3.a)
Macrogroup	Northern & Central Swamp Forest (MG030)
Group	Northern & Central Alkaline Conifer & Hardwood Swamp (G046)
Association (Common name)	White-cedar Seepage Swamp
Ecological System(s):	Laurentian-Acadian Alkaline Conifer-Hardwood Swamp (CES201.575)

ELEMENT CONCEPT

Global Summary: This lowland white-cedar swamp forest is found in the central and upper midwestern United States and Canada (Great Lakes region). Stands occur where water seeps from the ground. The water is moderately to highly mineralized with circumneutral pH. Soils are usually organic but may be mineral. The canopy is heavily dominated by *Thuja occidentalis* (northern white-cedar), sometimes to the exclusion of other trees. Other tree species that may be present include *Acer rubrum* (red maple), *Betula alleghaniensis* (yellow birch), and *Larix laricina* (tamarack). The understory contains *Cornus sericea* (red-osier dogwood), *Cystopteris bulbifera* (bulblet bladderfern), *Drosera rotundifolia* (roundleaf sundew), *Maianthemum canadense* (Canada mayflower), *Mitchella repens* (partridgeberry), *Mitella nuda* (naked miterwort), and *Rubus pubescens* (dwarf red blackberry). The ground layer may be dominated by mosses.

ENVIRONMENTAL DESCRIPTION

Pictured Rocks National Lakeshore Environment: Information not available.
Global Environment: This community is found where water seeps from the ground. The water is moderately to highly mineralized with circumneutral pH (Wilcox et al. 1986). Soils are usually organic but may be mineral (MNNHP 1993).

VEGETATION DESCRIPTION

Pictured Rocks National Lakeshore Vegetation:
Global Vegetation: The canopy is heavily dominated by *Thuja occidentalis* (northern white-cedar), sometimes to the exclusion of other trees. Other tree species that may be present are *Acer rubrum* (red maple), *Betula alleghaniensis* (yellow birch), and *Larix laricina* (tamarack). The understory contains *Cornus sericea* (red-osier dogwood), *Cystopteris bulbifera* (bulblet bladderfern), *Drosera rotundifolia* (roundleaf sundew), *Maianthemum canadense* (Canada mayflower), *Mitchella repens* (partridgeberry), *Mitella nuda* (naked miterwort), and *Rubus pubescens* (dwarf red blackberry). The ground layer may be dominated by mosses (MNNHP 1993).

MOST ABUNDANT SPECIES

Pictured Rocks National Lakeshore

Stratum	Lifeform	Species

Global

Stratum	Lifeform	Species

CHARACTERISTIC SPECIES

Pictured Rocks National Lakeshore:
Global:

OTHER NOTEWORTHY SPECIES

Pictured Rocks National Lakeshore:
Global:

CONSERVATION STATUS RANK

Global Rank & Reasons: G3G4 (22-Jun-1998). The total number of occurrences is unknown. Four have been documented: 2 in Wisconsin (where the community is ranked S2), 1 in Indiana (S1), and 1 in Illinois (S1S2). Although no other occurrences have been documented, the community is also reported in Michigan (S4), Minnesota (S2?), Ohio (S2), and Ontario (S?). It is usually found on organic soils where moderately to highly mineralized water seeps from the ground.

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CLASSIFICATION

Status: Standard
Classification Confidence: 3 - Weak
Pictured Rocks National Lakeshore Comments:
Global Comments: This type was based initially on the Minnesota NHP state type - white cedar swamp, seepage subtype. Globally the type is conceptually restricted to the southern-central parts of Wisconsin, Michigan, Minnesota and Ontario, with scattered occurrences in northern parts of Illinois, Indiana, and Ohio. There is only one site in Indiana. However, the demarcation between this type and *Thuja occidentalis - (Picea mariana, Abies balsamea) / Alnus incana* Forest (CEGL002456) or other more northern white-cedar swamps is not entirely clear.
Global Similar Associations:
- *Thuja occidentalis - (Picea mariana, Abies balsamea) / Alnus incana* Forest (CEGL002456)
- *Thuja occidentalis - (Picea rubens) / Tiarella cordifolia* Forest (CEGL006175)

Global Related Concepts:
- *Thuja occidentalis* swamp (Wilcox et al. 1986) =
- Arbor Vitae Association (Frederick 1974) =
- Rich Conifer Swamp (cedar) (Chapman et al. 1989) B
- Rich conifer swamp: cedar-(tamarack) (W32) (Harris et al. 1996) =

OTHER COMMENTS

Other Comments:

ELEMENT DISTRIBUTION

Pictured Rocks National Lakeshore Range:
Global Range: This lowland conifer forest is found in the upper and central midwestern United States and Canada (Great Lakes region), ranging from southern Minnesota east to Ohio and southern Ontario.
Nations: CA, US
States/Provinces: IL, IN, MI, MN:S2?, OH:S2, ON, WI
TNC Ecoregions: 45:C, 46:C, 47:C, 48:C
USFS Ecoregions (1994/95): 212Ha:CCP, 212Hb:CCP, 212He:CCP, 212Hh:CCP, 212Hi:CCC, 212Hj:CCP, 212Hk:CCP, 212Hm:CCP, 212Hn:CCP, 212Ho:CCP, 212Hp:CCP, 212Hq:CCP, 212Hr:CCP, 212Hs:CCP, 212Ht:CCP, 212Hu:CCP, 212Hv:CCP, 212Hw:CCP, 212Ja:CPP, 212Jb:CPP, 212Jc:CPP, 212Jk:CPP, 212Jl:CPP, 212Jn:CPP, 212Jo:CPP, 212Jr:CPP, 212Nb:CP?, 212Nc:CPP, 222Hd:CCC, 222Jj:CCC, 222Kf:CCC
Federal Lands: NPS (Pictured Rocks); USFS (Chippewa, Ottawa)

ELEMENT SOURCES

Pictured Rocks National Lakeshore Inventory Notes:
Pictured Rocks National Lakeshore Plots: N/A
Pictured Rocks National Lakeshore Map Code: N/A
Local Description Authors:
Global Description Authors: J. Drake
References: Chapman et al. 1989, Frederick 1974, Harris et al. 1996, MNNHP 1993, Midwestern Ecology Working Group n.d., ONHD unpubl. data, WNHIP unpubl. data, Wilcox et al. 1986

White-cedar - Black Ash Swamp

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

NVC CLASSIFICATION

Division	Northeastern & Central North American Flooded & Swamp Forest (1.C.3.a)
Macrogroup	Northern & Central Swamp Forest (MG030)
Group	Northern & Central Alkaline Conifer & Hardwood Swamp (G046)
Association (Common name)	White-cedar - Black Ash Swamp
Ecological System(s):	Laurentian-Acadian Alkaline Conifer-Hardwood Swamp (CES201.575)
	Great Lakes Wooded Dune and Swale (CES201.726)

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*

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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

Pictured Rocks National Lakeshore Environment: This white-cedar - black ash forest was sampled at four locations in the park. Sites are generally flat to gently sloping basin floors and depressions. Soils are seasonally flooded to saturated, poorly drained to very poorly drained muck and sandy loam. The unvegetated surface is dominated by leaf litter (80-99% cover) with some wood (1-20%). Evidence of disturbance includes past logging (1940s) (multiple harvesting) and wind damage.

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

Pictured Rocks National Lakeshore Vegetation: The sparse to moderate (30-70% cover) tree canopy, 5-20 m tall, is dominated by *Thuja occidentalis* (northern white-cedar), *Betula alleghaniensis* (yellow birch), and *Fraxinus nigra* (black ash) and may include lesser amounts of *Acer rubrum* (red maple), *Betula papyrifera* (paper birch), *Picea glauca* , and *Tilia americana* (American basswood). The sparse to moderate (20-50%) subcanopy (2-15 m) includes *Abies balsamea* (balsam fir), *Alnus incana* ssp. *rugosa* (speckled alder), and *Ulmus americana* (American elm). The sparse to moderate (20-60%) tall-shrub (2-5 m) and short-shrub (0.5-1 m) layers include saplings of tree species from the upper layers, as well as *Acer spicatum* (mountain maple), *Amelanchier* (serviceberry) sp., *Corylus cornuta* (beaked hazelnut), *Lonicera canadensis* (American fly honeysuckle), *Ribes* (currant) sp., *Rubus* (blackberry) sp., Sorbus decora, and *Tsuga canadensis* (eastern hemlock). The moderate to dense (60-90%) herbaceous layer is relatively diverse; a total of 44 taxa were recorded in four plots. Common herbs include *Aralia nudicaulis* (wild sarsaparilla), *Arisaema triphyllum* (Jack in the pulpit), *Caltha palustris* (yellow marsh-marigold), *Carex* (sedge) spp., *Circaea alpina* (small enchanter's nightshade), *Clintonia borealis* (bluebead), *Galium triflorum* (fragrant bedstraw), *Maianthemum* (mayflower) spp., *Mitella nuda* (naked miterwort), *Oxalis montana* (mountain woodsorrel), *Trientalis borealis* (starflower), and *Trillium cernuum* (whip-poor-will flower). Common ferns include *Athyrium filix-femina* (common ladyfern), *Dryopteris carthusiana* (spinulose woodfern), *Gymnocarpium dryopteris* (western oakfern), *Onoclea sensibilis* (sensitive fern), and *Osmunda cinnamomea* (cinnamon fern). Nonvascular species (mosses) cover 10-50% of the ground surface.

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), *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

Pictured Rocks National Lakeshore

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Thuja occidentalis* (northern white-cedar)
Tree canopy	Broad-leaved deciduous tree	*Acer rubrum* (red maple), *Betula alleghaniensis* (yellow birch), *Fraxinus nigra* (black ash)
Tree subcanopy	Needle-leaved tree	*Abies balsamea* (balsam fir)
Tall shrub/sapling	Broad-leaved deciduous shrub	*Betula alleghaniensis* (yellow birch)
Short shrub/sapling	Needle-leaved shrub	*Abies balsamea* (balsam fir), *Picea glauca* (white spruce)
Short shrub/sapling	Broad-leaved deciduous shrub	*Acer spicatum* (mountain maple), *Lonicera canadensis* (American fly honeysuckle)
Herb (field)	Forb	*Aralia nudicaulis* (wild sarsaparilla), *Arisaema triphyllum* (Jack in the pulpit), *Caltha palustris* (yellow marsh-marigold), *Circaea alpina* (small enchanter's nightshade), *Clintonia borealis* (bluebead), *Galium triflorum* (fragrant bedstraw), *Mitella nuda* (naked miterwort), *Oxalis montana* (mountain woodsorrel), *Trientalis borealis* (starflower), *Trillium cernuum* (whip-poor-will flower)
Herb (field)	Graminoid	*Carex intumescens* (greater bladder sedge), *Carex leptalea* (bristlystalked sedge), *Carex leptonervia* (nerveless woodland sedge), *Carex trisperma* (threeseeded sedge)

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Herb (field)	Fern or fern ally	*Athyrium filix-femina* (common ladyfern), *Dryopteris carthusiana* (spinulose woodfern), *Gymnocarpium dryopteris* (western oakfern), *Onoclea sensibilis* (sensitive fern)

Global Stratum	**Lifeform**	**Species**

CHARACTERISTIC SPECIES

Pictured Rocks National Lakeshore: *Acer rubrum* (red maple), *Acer spicatum* (mountain maple), *Alnus incana* ssp. *rugosa* (speckled alder), *Betula alleghaniensis* (yellow birch), *Fraxinus nigra* (black ash), *Onoclea sensibilis* (sensitive fern), *Thuja occidentalis* (northern white-cedar)
Global:

OTHER NOTEWORTHY SPECIES

Pictured Rocks National Lakeshore:
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
Pictured Rocks National Lakeshore Comments:
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) B
- White Cedar-Hardwoods-Fragrant Bedstraw-Herb Rich (V8) (Chambers et al. 1997) =

OTHER COMMENTS

Other Comments:

ELEMENT DISTRIBUTION

Pictured Rocks National Lakeshore Range: This white-cedar - black ash swamp community is located away from the direct influence of Lake Superior, concentrated in the eastern half of the park.
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?)

ELEMENT SOURCES

Pictured Rocks National Lakeshore Inventory Notes:
Pictured Rocks National Lakeshore Plots: PIRO.014, PIRO.057, PIRO.062, PIRO.068.
Pictured Rocks National Lakeshore Map Code: FCA
Local Description Authors: M.J. Russo
Global Description Authors: D. Faber-Langendoen
References: Chambers et al. 1997, Chapman et al. 1989, Midwestern Ecology Working Group n.d.

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Hemlock - Yellow Birch Swamp Wet-Mesic Forest

***Tsuga canadensis* - *Betula alleghaniensis* Saturated Forest**

Eastern Hemlock - Yellow Birch Saturated Forest

Identifier: CEGL005003

NVC CLASSIFICATION

Division	Northeastern & Central North American Flooded & Swamp Forest (1.C.3.a)
Macrogroup	Northern & Central Swamp Forest (MG030)
Group	Northern & Central Alkaline Conifer & Hardwood Swamp (G046)
Association (Common name)	Hemlock - Yellow Birch Swamp Wet-Mesic Forest
Ecological System(s):	Laurentian-Acadian Alkaline Conifer-Hardwood Swamp (CES201.575)

ELEMENT CONCEPT

Global Summary: This community is found in the central Great Lakes region of the United States and adjacent Canada. Stands occur on wet-mesic areas with imperfectly drained sandy loam/loam or silty clay soils that are often saturated. These areas occur on gentle slopes, drainageways, and bordering lakes and wetlands. The nutrient status is generally poor to medium. The overstory of this community is composed of conifers with a moderate amount of deciduous trees. *Tsuga canadensis* (eastern hemlock) is usually the most abundant species with *Acer rubrum* (red maple), *Acer saccharum* (sugar maple), *Betula alleghaniensis* (yellow birch), *Pinus strobus* (eastern white pine), and *Thuja occidentalis* (northern white-cedar) less common. *Abies balsamea* (balsam fir) in northern Wisconsin and Michigan. The shrub layer is not well-developed in mature stands with dense canopies, but shrubs are often abundant in disturbed or young stands. Shrubs that may be present include *Amelanchier* (serviceberry) spp., *Corylus cornuta* (beaked hazelnut), *Lonicera canadensis* (American fly honeysuckle), *Prunus pensylvanica* (pin cherry), and *Vaccinium* (blueberry) spp. Common herbaceous species include *Clintonia borealis* (bluebead), *Coptis trifolia* (threeleaf goldthread), *Cornus canadensis* (bunchberry dogwood), *Dryopteris carthusiana* (spinulose woodfern), *Maianthemum canadense* (Canada mayflower), *Trientalis borealis* (starflower), *Viola* (violet) spp., and others.

ENVIRONMENTAL DESCRIPTION

Pictured Rocks National Lakeshore Environment: This hemlock - birch forest was sampled once in the park. The site is a flat, seasonally flooded floodplain about 1.5 m (5 feet) above Beaver Creek with somewhat poorly drained sand soil. The unvegetated surface is made up almost entirely of leaf litter (99% cover) with some wood (1%). Evidence of disturbance includes past logging, including white pine removal.

Global Environment: This community is typically found on wet-mesic areas with imperfectly drained loamy sand, sandy loam, and loam soils that are often saturated. These areas occur on gentle slopes, drainageways, and bordering lakes and wetlands. The nutrient status is generally poor to medium (Kotar et al. 1988).

VEGETATION DESCRIPTION

Pictured Rocks National Lakeshore Vegetation: The dense (80% cover) tree canopy, 20-35 m tall, is dominated by *Tsuga canadensis* (eastern hemlock), as is the moderate (40%) subcanopy (15-20 m) which may also include *Acer rubrum* (red maple) and *Betula papyrifera* (paper birch). The sparse (10%) tall-shrub layer (2-5 m) and sparse (10%) short-shrub layer (0.5-2 m) are made up of saplings of canopy and subcanopy species. Additional short shrubs include ericaceous species *Gaultheria procumbens* (eastern teaberry), *Ledum groenlandicum* (bog Labrador-tea), *Vaccinium angustifolium* (lowbush blueberry), and *Vaccinium membranaceum* (thinleaf huckleberry). The very spare (5%) herbaceous layer includes *Clintonia borealis* (bluebead), *Coptis trifolia* (threeleaf goldthread), *Linnaea borealis* (twinflower), *Monotropa uniflora* (Indianpipe), and *Pteridium aquilinum* (western brackenfern). Nonvascular species (mosses) cover 30% of the ground surface.

Global Vegetation: The overstory of this community is composed of conifers with a moderate amount of deciduous trees. *Tsuga canadensis* (eastern hemlock) is usually the most abundant species with *Abies balsamea* (balsam fir), *Acer rubrum* (red maple), *Acer saccharum* (sugar maple), *Betula alleghaniensis* (yellow birch), *Picea glauca* (white spruce), *Pinus strobus* (eastern white pine), and *Thuja occidentalis* (northern white-cedar) less common. The shrub layer is not well-developed in mature stands with dense canopies, but shrubs are often abundant in disturbed or young stands. Shrubs that may be present include *Amelanchier* (serviceberry) spp., *Corylus cornuta* (beaked hazelnut), *Lonicera canadensis* (American fly honeysuckle), *Prunus pensylvanica* (pin cherry), and *Vaccinium* (blueberry) spp. Common herbaceous species include *Clintonia borealis* (bluebead), *Coptis trifolia* (threeleaf goldthread), *Cornus canadensis* (bunchberry dogwood), *Dryopteris carthusiana* (spinulose woodfern), *Maianthemum canadense* (Canada mayflower), *Oxalis montana* (mountain woodsorrel), *Trientalis borealis* (starflower), *Viola* (violet) spp., and others.

MOST ABUNDANT SPECIES

Pictured Rocks National Lakeshore

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Tsuga canadensis* (eastern hemlock)
Tree subcanopy	Broad-leaved deciduous tree	*Acer rubrum* (red maple)
Short shrub/sapling	Broad-leaved deciduous shrub	*Vaccinium angustifolium* (lowbush blueberry), *Vaccinium membranaceum* (thinleaf huckleberry)
Herb (field)	Forb	*Clintonia borealis* (bluebead), *Coptis trifolia* (threeleaf goldthread)

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Global
Stratum **Lifeform** **Species**

CHARACTERISTIC SPECIES

Pictured Rocks National Lakeshore: *Acer rubrum* (red maple), *Tsuga canadensis* (eastern hemlock)
Global:

OTHER NOTEWORTHY SPECIES

Pictured Rocks National Lakeshore:
Global:

CONSERVATION STATUS RANK

Global Rank & Reasons: G3 (22-Jun-1998). This type is fairly widespread in, e.g., Wisconsin, but few good occurrences have been recorded (E. Epstein pers. comm. 1999).

CLASSIFICATION

Status: Standard
Classification Confidence: 3 - Weak
Pictured Rocks National Lakeshore Comments:
Global Comments: Type probably varies from mixed evergreen-deciduous to evergreen, with at least 25% *Tsuga canadensis* (eastern hemlock) present (cover or basal area), and the rest either hardwoods or some conifers. If *Thuja occidentalis* (northern white-cedar) is prominent (>50% cover (or basal area?) of the conifer component?), place with *Thuja occidentalis* (northern white-cedar) white-cedar types, such as *Thuja occidentalis - (Picea mariana, Abies balsamea) / Alnus incana* Forest (CEGL002456). Mixed stands of *Thuja* (red cedar) and *Tsuga* (hemlock) have been identified on the Chequamegon National Forest in Wisconsin, and are currently placed with this *Tsuga* (hemlock) type until field verification can be conducted (M. Brzeskiewicz pers. comm. 1997). Type may equal *Tsuga canadensis - Betula alleghaniensis / Ilex verticillata / Sphagnum* spp. Forest (CEGL006226) in the Northeast, but would make a broad type. Stands in northeastern Ohio are placed with CEGL006226, found in New York and the northeastern United States. Ohio stands have no *Rhododendron* (rhododendron) spp. (at least, not currently), and appear to resemble CEGL006226 more than CEGL006279. In Michigan this type is found in Gogebic and Iron counties in the western Upper Peninsula.
Global Similar Associations:
- *Thuja occidentalis - (Picea mariana, Abies balsamea) / Alnus incana* Forest (CEGL002456)
- *Tsuga canadensis - Betula alleghaniensis / Ilex verticillata / Sphagnum* spp. Forest (CEGL006226)
- *Tsuga canadensis / Rhododendron maximum / Sphagnum* spp. Forest (CEGL006279)

Global Related Concepts:
- *Tsuga / Maianthemum - Coptis* (Kotar et al. 1988) =
- Rich Conifer Swamp (Chapman et al. 1989) ?

OTHER COMMENTS

Other Comments:

ELEMENT DISTRIBUTION

Pictured Rocks National Lakeshore Range: This community is located in seeps over organic or clay soils. Overall it is an uncommon association at Pictured Rocks.
Global Range: This community is found in the central Great Lakes region of the United States and adjacent Canada, ranging from northern Wisconsin to southern Ontario.
Nations: CA, US
States/Provinces: MI, OH, ON:S3S4, WI:S2S4
TNC Ecoregions: 47:C, 48:C
USFS Ecoregions (1994/95): 212Ha:CCC, 212Hb:CCP, 212Hh:CCP, 212Hi:CCC, 212Hl:CCP, 212Hm:CCP, 212Ho:CCC, 212Hr:CCP, 212Ht:CCP, 212Hu:CCP, 212Hv:CC?, 212Hw:CCC, 212Ia:CCC, 212Ja:CPP, 212Jb:CPP, 212Jc:CPP, 212Jf:CPP, 212Jl:CPP, 212Jm:CPP, 212Jn:CPP, 212Jo:CPP, 222Ia:CCC, 222Ja:CCC
Federal Lands: NPS (Apostle Islands, Pictured Rocks, Sleeping Bear Dunes); USFS (Chequamegon, Chequamegon-Nicolet, Hiawatha?, Huron-Manistee, Huron?, Manistee, Nicolet, Ottawa)

ELEMENT SOURCES

Pictured Rocks National Lakeshore Inventory Notes:
Pictured Rocks National Lakeshore Plots: PIRO.034.
Pictured Rocks National Lakeshore Map Code: FHS
Local Description Authors: M.J. Russo
Global Description Authors: J. Drake
References: Chapman et al. 1989, Epstein pers. comm., Kotar et al. 1988, Midwestern Ecology Working Group n.d., WNHIP unpubl. data

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MG160. 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	Northeastern & Central North American Flooded & Swamp Forest (1.C.3.a)
Macrogroup	Northern & Central Tall Shrub Wetland (MG160)
Group	Northern & Central Shrub Swamp (G167)
Association (Common name)	Gray Alder Swamp
Ecological System(s):	Western Great Plains Open Freshwater Depression Wetland (CES303.675)
	Laurentian-Acadian Wet Meadow-Shrub Swamp (CES201.582)
	High Allegheny Wetland (CES202.069)

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* (threeseeded 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

Pictured Rocks National Lakeshore Environment: This alder swamp was sampled twice in the park. One site is located along the edge of a stream, the other at the outlet of and along the shoreline of Miners Lake. Soils are seasonally to semipermanently flooded, very poorly drained muck. The unvegetated surface is dominated by leaf litter (93-99% cover) with some wood (0-1%) and standing water (0-5%). Evidence of disturbance includes a wooden plank trail, past beaver activity (nothing recent), past logging, nominal use by recreationists, and 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

Pictured Rocks National Lakeshore Vegetation: The dense (80-90% cover) tall-shrub layer (2-10 m tall) is dominated exclusively by *Alnus incana* ssp. *rugosa* (speckled alder). The moderate (40-50%) short-shrub layer (0.5-2 m) includes *Abies balsamea* (balsam fir), *Ilex verticillata* (common winterberry), *Ribes* (currant) sp., *Rubus* (blackberry) sp., and *Sambucus canadensis* (common elderberry). The dense (80-90%) herbaceous layer is dominated by *Caltha palustris* (yellow marsh-marigold) (80%) and *Onoclea sensibilis* (sensitive fern) (60%); other species include *Carex stipata* (owlfruit sedge), *Lycopus uniflorus* (northern bugleweed),

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Osmunda regalis (royal fern), and *Thalictrum dasycarpum* (purple meadowrue). Nonvascular species (mosses) cover 0-5% of the ground surface.

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* (threeseeded 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

Pictured Rocks National Lakeshore

Stratum	Lifeform	Species
Tall shrub/sapling	Broad-leaved deciduous shrub	*Alnus incana* ssp. *rugosa* (speckled alder)
Herb (field)	Forb	*Thalictrum dasycarpum* (purple meadowrue)
Herb (field)	Fern or fern ally	*Onoclea sensibilis* (sensitive fern), *Osmunda regalis* (royal fern)

Global

Stratum	Lifeform	Species
Tall shrub/sapling	Broad-leaved deciduous shrub	*Alnus incana* (gray alder)

CHARACTERISTIC SPECIES

Pictured Rocks National Lakeshore: *Alnus incana* ssp. *rugosa* (speckled alder), *Caltha palustris* (yellow marsh-marigold), *Onoclea sensibilis* (sensitive fern), *Osmunda regalis* (royal fern)
Global: *Alnus incana* (gray alder)

OTHER NOTEWORTHY SPECIES

Pictured Rocks National Lakeshore: Exotic/Invasive: *Veronica beccabunga* (european speedwell, 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
Pictured Rocks National Lakeshore Comments:
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.
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) F
- *Alnus incana - Viburnum cassinoides* shrub community (Darlington 1943) F
- *Alnus incana* ssp. *rugosa* tall shrub thicket (Fortney et al. 2005) =
- *Alnus incana* ssp. *rugosa* shrubland (Byers et al. 2007) =
- *Alnus rugosa* shrub (Walbridge and Lang 1982) =

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- *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 Thicket (Curtis 1959) =
- Thicket Swamp: Speckled Alder / Bluejoint Grass type , W35 (Harris et al. 1996) =

OTHER COMMENTS

Other Comments:

ELEMENT DISTRIBUTION

Pictured Rocks National Lakeshore Range: This alder swamp community is found throughout the park along inland lakes and low-flow areas of rivers and streams.
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, 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

Pictured Rocks National Lakeshore Inventory Notes:
Pictured Rocks National Lakeshore Plots: PIRO.039, PIRO.082.
Pictured Rocks National Lakeshore Map Code: SAS
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, Fortney 1975, Fortney et al. 2005, Gawler 2002, Greenall 1996, Harris et al. 1996, INAI unpubl. data, MNNHP 1993, Midwestern Ecology Working Group n.d., NDNHI unpubl. data, NRCS 2004, Ohmann and Ream 1971, Rentch unpubl. data 2003, Robinette 1966, Sperduto 2000b, Swain and Kearsley 2001, Thompson and Sorenson 2000, WNHIP unpubl. data, Walbridge 1982, Walbridge and Lang 1982

1.D.1. Lowland & Montane Boreal Forest

1.D.1.a. North American Lowland Boreal Forest

MG037. Eastern & Central North American Boreal Conifer & Hardwood Forest

G047. Jack Pine - Black Spruce Forest

Black Spruce / Feathermoss Forest

***Picea mariana / Pleurozium schreberi* Forest**
Black Spruce / Feathermoss Forest
Identifier: CEGL002447

NVC CLASSIFICATION

Division	North American Lowland Boreal Forest (1.D.1.a)
Macrogroup	Eastern & Central North American Boreal Conifer & Hardwood Forest (MG037)
Group	Jack Pine - Black Spruce Forest (G047)
Association (Common name)	Black Spruce / Feathermoss Forest
Ecological System(s):	Boreal Jack Pine-Black Spruce Forest (CES103.022)

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ELEMENT CONCEPT

Global Summary: This black spruce / feathermoss forest is found widely throughout the boreal regions of Canada and into adjacent areas of the midwestern United States. Stands occur on level to gently sloping ground. Soils are typically moderately well-drained, coarse loams, sands, and silts. The canopy of this community is closed and heavily dominated by *Picea mariana* (black spruce) with small amounts of *Abies balsamea* (balsam fir), *Betula papyrifera* (paper birch), *Picea glauca* (white spruce), *Pinus banksiana* (jack pine), and *Populus tremuloides* (quaking aspen). The shrub and herb layers are poorly developed. Species that are most abundant in these layers include the shrubs *Corylus cornuta* (beaked hazelnut), *Gaultheria procumbens* (eastern teaberry), *Ledum groenlandicum* (bog Labrador-tea), *Rosa acicularis* (prickly rose), *Vaccinium angustifolium* (lowbush blueberry), and *Vaccinium myrtilloides* (velvetleaf huckleberry) and the herbs *Eurybia macrophylla* (bigleaf aster), *Cornus canadensis* (bunchberry dogwood), *Equisetum arvense* (field horsetail), and *Maianthemum canadense* (Canada mayflower). Feathermosses, particularly *Pleurozium schreberi* (Schreber's big red stem moss), are very abundant.

ENVIRONMENTAL DESCRIPTION

Pictured Rocks National Lakeshore Environment: This black spruce / feathermoss forest was sampled at one location in the park. The site is a coarsely rolling outwash fan located above an old river channel of Miners River. Soil is well-drained sand. The unvegetated surface is dominated by leaf litter (95% cover) with some wood (5%). Miners River has changed course/channels over the centuries, creating dry riverbeds, old riverbanks 5 m high, and various topographic features, slopes, and aspects. The site contains old and very large white pine stumps with residual snags with charcoal, suggesting that the area was probably logged and then burned, initiating the current stand.

Global Environment: This community is found on level to gently sloping ground. Soils are typically moderately well-drained, coarse loams, sands, and silts (Sims et al. 1989).

VEGETATION DESCRIPTION

Pictured Rocks National Lakeshore Vegetation: The moderate (60% cover) tree canopy, 15-20 m tall, is dominated by *Picea mariana* (black spruce) along with lesser amounts of *Pinus resinosa* (red pine) and *Pinus strobus* (eastern white pine). The very sparse (10%) subcanopy (10-15 m) and very sparse (5%) tall-shrub layer (2-5 m) include canopy species along with *Acer rubrum* (red maple). The sparse (30%) short-shrub layer (0.5-1 m) is dominated by *Vaccinium myrtilloides* (velvetleaf huckleberry) and includes tree saplings as well as *Galium hispidulum* (coastal bedstraw), *Nemopanthus mucronatus* (catberry), *Sorbus decora* (northern mountain-ash), and *Vaccinium angustifolium* (lowbush blueberry). *Epigaea repens* (trailing arbutus) forms a very sparse (5%) dwarf-shrub layer. The sparse (30%) herbaceous layer is dominated by *Pteridium aquilinum* (western brackenfern) and includes *Clintonia borealis* (bluebead), *Coptis trifolia* (threeleaf goldthread), *Cornus canadensis* (bunchberry dogwood), *Maianthemum canadense* (Canada mayflower), *Melampyrum lineare* (narrowleaf cowwheat), and *Trientalis borealis* (starflower). Nonvascular species (mostly sphagnum mosses) cover 90% of the ground surface.

Global Vegetation: The canopy of this community is closed and strongly dominated by *Picea mariana* (black spruce) with small amounts of *Abies balsamea* (balsam fir), *Betula papyrifera* (paper birch), *Picea glauca* (white spruce), *Pinus banksiana* (jack pine), and *Populus tremuloides* (quaking aspen). The shrub and herb layers are poorly developed (Grigal and Ohmann 1975). Species that are most abundant in these layers include the shrubs *Corylus cornuta* (beaked hazelnut), *Gaultheria procumbens* (eastern teaberry), *Ledum groenlandicum* (bog Labrador-tea), *Rosa acicularis* (prickly rose), *Vaccinium angustifolium* (lowbush blueberry), and *Vaccinium myrtilloides* (velvetleaf huckleberry), and the herbs *Eurybia macrophylla* (bigleaf aster), *Cornus canadensis* (bunchberry dogwood), *Equisetum arvense* (field horsetail), and *Maianthemum canadense* (Canada mayflower). Feathermosses, particularly *Pleurozium schreberi* (Schreber's big red stem moss), are very abundant. Mosses may cover from 23% (Grigal and Ohmann 1975) to over 85% (Sims et al. 1989) of the forest floor.

MOST ABUNDANT SPECIES

Pictured Rocks National Lakeshore

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Picea mariana* (black spruce)
Short shrub/sapling	Broad-leaved deciduous shrub	*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)

Global

Stratum	Lifeform	Species

CHARACTERISTIC SPECIES

Pictured Rocks National Lakeshore: *Picea mariana* (black spruce)

Global:

OTHER NOTEWORTHY SPECIES

Pictured Rocks National Lakeshore:

Global: Other: *Regulus satrapa* (golden-crowned kinglet, G5)

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CONSERVATION STATUS RANK

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

CLASSIFICATION

Status: Standard
Classification Confidence: 1 - Strong
Pictured Rocks National Lakeshore Comments:
Global Comments: Portions of this type (as described by Sims et al. 1989, V34) can be somewhat poorly drained, bordering on wetland types, such as *Picea mariana - (Larix laricina) / Ledum groenlandicum / Sphagnum* spp. Forest (CEGL005271) (Sims et al. 1989, V35 or V37). There is a sparse vascular cover and few shrubs. The distribution of the type may be more fire-related in the southern part of range and less fire-dependent further north. These forests are not well understood in the northeastern United States. The abundance of black spruce and the often small stature of the canopy trees suggest that hydrological and soil conditions may be limiting for many "upland" species.
Global Similar Associations:
- *Picea mariana - (Larix laricina) / Ledum groenlandicum / Sphagnum* spp. Forest (CEGL005271)
- *Picea mariana - Picea rubens / Pleurozium schreberi* Forest (CEGL006361)
- *Picea mariana - Populus tremuloides* / Mixed Herbs Forest (CEGL002516)
- *Pinus banksiana - Picea mariana / Vaccinium* spp. / *Pleurozium schreberi* Forest (CEGL002448)

Global Related Concepts:
- Black Spruce - Feathermoss Forest (Grigal and Ohmann 1975) =
- Black Spruce / Feathermoss Forest (Zoladeski et al. 1995) =
- Black Spruce / Feathermoss Forest (V33) (Sims et al. 1989) =
- Black Spruce / Labrador Tea / Feathermoss (Sphagnum) (V34) (Sims et al. 1989) F

OTHER COMMENTS

Other Comments:

ELEMENT DISTRIBUTION

Pictured Rocks National Lakeshore Range:
Global Range: This black spruce / feathermoss forest type is found widely throughout the boreal regions of Canada, and into adjacent areas of the midwestern United States.
Nations: CA, US
States/Provinces: MB:S4, MI, MN:S4, ON, QC:S4, WI
TNC Ecoregions: 47:C, 48:C
USFS Ecoregions (1994/95): 212Hi:CCC, 212Ia:CCC, 212Ib:CCC, 212J:CC, 212La:CCC, 212M:CC
Federal Lands: NPS (Apostle Islands, Isle Royale, Pictured Rocks, Voyageurs); USFS (Superior)

ELEMENT SOURCES

Pictured Rocks National Lakeshore Inventory Notes:
Pictured Rocks National Lakeshore Plots: PIRO.061.
Pictured Rocks National Lakeshore Map Code: FBS
Local Description Authors: M.J. Russo
Global Description Authors: J. Drake, mod. D. Faber-Langendoen
References: Greenall 1996, Grigal and Ohmann 1975, MENHP 1991, MNNHP 1993, Midwestern Ecology Working Group n.d., Reschke 1990, Sims et al. 1989, Zoladeski et al. 1995

Jack Pine - Aspen / Bush-honeysuckle Forest

***Pinus banksiana - Populus tremuloides / Diervilla lonicera* Forest**
Jack Pine - Quaking Aspen / Northern Bush-honeysuckle Forest
Identifier: CEGL002518

NVC CLASSIFICATION

Division	North American Lowland Boreal Forest (1.D.1.a)
Macrogroup	Eastern & Central North American Boreal Conifer & Hardwood Forest (MG037)
Group	Jack Pine - Black Spruce Forest (G047)
Association (Common name)	Jack Pine - Aspen / Bush-honeysuckle Forest
Ecological System(s):	Boreal Jack Pine-Black Spruce Forest (CES103.022)

ELEMENT CONCEPT

Global Summary: This jack pine - aspen forest is found in the northern parts of the midwestern United States and into central Canada. Stands occur 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 fine. The canopy layer is 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*

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banksiana (jack pine) and *Populus tremuloides* (quaking aspen) with lesser amounts of *Abies balsamea* (balsam fir), *Betula papyrifera* (paper birch), *Picea glauca* (white spruce), and *Picea mariana* (black spruce). 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* (beaked hazelnut), *Diervilla lonicera* (northern bush honeysuckle), *Linnaea borealis* (twinflower), *Rosa acicularis* (prickly rose), *Rubus pubescens* (dwarf red blackberry), and *Vaccinium* (blueberry) spp. The herbaceous layer is also typically quite rich with species such as *Aralia nudicaulis* (wild sarsaparilla), *Eurybia macrophylla* (bigleaf aster), *Cornus canadensis* (bunchberry dogwood), *Clintonia borealis* (bluebead), *Streptopus lanceolatus* var. *longipes* (twistedstalk), *Trientalis borealis* (starflower), and *Viola* (violet) spp.

ENVIRONMENTAL DESCRIPTION

Pictured Rocks National Lakeshore Environment: This jack pine - aspen forest was sampled at five locations in the park. The sites are flat to moderately sloping dunes with rapidly drained to well-drained sand and loamy sand soils. The unvegetated surface is made up of leaf litter (17-93% cover), wood (1-15%) bare soil/sand (0-75%), and plant stems (5-11%). Evidence of disturbance includes some erosion on steeper slopes and the presence of exotic plants.

Global Environment: This community 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 fine (Zoladeski et al. 1995).

VEGETATION DESCRIPTION

Pictured Rocks National Lakeshore Vegetation: The moderate to very dense (40-90% cover), tree canopy, 5-20 m tall, is codominated by *Pinus banksiana* (jack pine) and *Populus balsamifera* (balsam poplar) and may include substantial amounts of *Betula papyrifera* (paper birch) along with lesser amounts of *Picea glauca* (white spruce). A subcanopy may be lacking or very dense (0-90%), 5-15 m tall, and include *Acer saccharum* (sugar maple). The moderate sparse to dense (40-80%) tall-shrub layer (2-5 m) may include saplings of canopy and subcanopy species as well as *Abies balsamea* (balsam fir), *Fagus grandifolia* (American beech), and *Prunus virginiana* (chokecherry). The sparse to dense (20-80%) short-shrub layer (0.5-2 m) is made up of tall-shrub species and may also include *Acer spicatum* (mountain maple), *Amelanchier* (serviceberry), sp., *Cornus sericea* ssp. *sericea* (red-osier dogwood), *Rosa blanda* (smooth rose), *Rubus pubescens* (dwarf red blackberry), and *Toxicodendron radicans* (eastern poison-ivy). The sparse herbaceous layer (5-30%) may include *Equisetum hyemale* (scouringrush horsetail), *Galium triflorum* (fragrant bedstraw), *Maianthemum canadense* (Canada mayflower), *Maianthemum stellatum* (starry false lily of the valley), *Osmorhiza berteroi* (sweetcicely), and *Trientalis borealis* (starflower), among others. The nonvascular layer (mosses) covers 5-30% of the ground surface and includes *Hylocomiastrum pyrenaicum* (hylocomiastrum moss), *Pleurozium schreberi* (Schreber's big red stem moss), *Polytrichum piliferum* (polytrichum moss), and *Sanionia uncinata* (sanionia moss), among others. In addition, this community supports globally and state-vulnerable *Cypripedium arietinum* (ram's head lady's slipper) and state-vulnerable *Cynoglossum virginianum* var. *boreale* (wild comfrey) and *Tanacetum bipinnatum* ssp. *huronense* (Lake Huron tansy).

Global Vegetation: The canopy layer is 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* (jack pine) and *Populus tremuloides* (quaking aspen) with lesser amounts of *Abies balsamea* (balsam fir), *Betula papyrifera* (paper birch), *Picea glauca* (white spruce), and *Picea mariana* (black spruce). 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* (beaked hazelnut), *Diervilla lonicera* (northern bush honeysuckle), *Linnaea borealis* (twinflower), *Rosa acicularis* (prickly rose), *Rubus pubescens* (dwarf red blackberry), and *Vaccinium* (blueberry) spp. The herbaceous layer is also typically quite rich with species such as *Aralia nudicaulis* (wild sarsaparilla), *Eurybia macrophylla* (bigleaf aster), *Cornus canadensis* (bunchberry dogwood), *Clintonia borealis* (bluebead), *Streptopus lanceolatus* (twistedstalk), *Trientalis borealis* (starflower), and *Viola* (violet) spp.

MOST ABUNDANT SPECIES

Pictured Rocks National Lakeshore

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Pinus banksiana* (jack pine)
Tree canopy	Broad-leaved deciduous tree	*Betula papyrifera* (paper birch), *Populus balsamifera* (balsam poplar)
Tree subcanopy	Needle-leaved tree	*Pinus banksiana* (jack pine)
Tree subcanopy	Broad-leaved deciduous tree	*Acer saccharum* (sugar maple)
Tall shrub/sapling	Needle-leaved shrub	*Abies balsamea* (balsam fir)
Tall shrub/sapling	Broad-leaved deciduous shrub	*Fagus grandifolia* (American beech)
Short shrub/sapling	Broad-leaved deciduous shrub	*Rosa blanda* (smooth rose)
Herb (field)	Forb	*Maianthemum stellatum* (starry false lily of the valley), *Pyrola asarifolia* (liverleaf wintergreen)
Nonvascular	Moss	*Sanionia uncinata* (sanionia moss)

Global

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Stratum **Lifeform** **Species**

CHARACTERISTIC SPECIES

Pictured Rocks National Lakeshore: *Abies balsamea* (balsam fir), *Acer saccharum* (sugar maple), *Betula papyrifera* (paper birch), *Fagus grandifolia* (American beech), *Pinus banksiana* (jack pine), *Populus balsamifera* (balsam poplar)
Global:

OTHER NOTEWORTHY SPECIES

Pictured Rocks National Lakeshore: Vulnerable: *Cynoglossum virginianum* var. *boreale* (wild comfrey, state-vulnerable, G5T4T5), *Cypripedium arietinum* (ram's head lady's slipper, globally and state-vulnerable, G3), *Tanacetum bipinnatum* ssp. *huronense* (Lake Huron tansy, state-vulnerable, G5T4T5); **Exotic/Invasive**: *Poa compressa* (Canada bluegrass, exotic, High/Low), *Taraxacum officinale* (common dandelion, exotic), *Trifolium pratense* (red clover, exotic, Low/Insignificant), *Veronica officinalis* (common gypsyweed, exotic)
Global: Vulnerable: *Cypripedium arietinum* (ram's head lady's slipper, G3)

CONSERVATION STATUS RANK

Global Rank & Reasons: G4G5 (1-Oct-1996).

CLASSIFICATION

Status: Standard
Classification Confidence: 3 - Weak
Pictured Rocks National Lakeshore Comments:
Global Comments: In Voyageurs National Park, this type is on thin soil, rocky substrate, but on the scale of 1-10 hectares, it tends to be a mosaic of pure *Pinus banksiana* (jack pine) and pure *Populus tremuloides* (quaking aspen) stands. Type needs rangewide review.
Global Similar Associations:
- *Pinus banksiana - (Picea mariana, Pinus strobus) / Vaccinium* spp. Rocky Woodland (CEGL002483)
- *Pinus banksiana / (Quercus rubra, Quercus ellipsoidalis)* Forest (CEGL002440)

Global Related Concepts:
- Jack Pine Mixedwood / Shrub Rich (V15) (Zoladeski et al. 1995) =
- Jack Pine Mixedwood / Shrub Rich (V17) (Sims et al. 1989) =

OTHER COMMENTS

Other Comments:

ELEMENT DISTRIBUTION

Pictured Rocks National Lakeshore Range:
Global Range: This jack pine - aspen forest community type is found in the northern parts of the midwestern United States and into central Canada, ranging from northeastern Minnesota to Manitoba and Ontario.
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, 212La:CCC
Federal Lands: NPS (Apostle Islands, Pictured Rocks, Voyageurs); USFS (Superior?)

ELEMENT SOURCES

Pictured Rocks National Lakeshore Inventory Notes:
Pictured Rocks National Lakeshore Plots: PIRO.340, PIRO.400, PIRO.500, PIRO.501, PIRO.502.
Pictured Rocks National Lakeshore Map Code: FJM
Local Description Authors: M.J. Russo
Global Description Authors: J. Drake
References: Greenall 1996, Kost et al. 2007, MNNHP 1993, Midwestern Ecology Working Group n.d., Sims et al. 1989, Zoladeski et al. 1995

Jack Pine / Balsam Fir Forest

***Pinus banksiana / Abies balsamea* Forest**
Jack Pine / Balsam Fir Forest
Identifier: CEGL002437

NVC CLASSIFICATION

Division	North American Lowland Boreal Forest (1.D.1.a)
Macrogroup	Eastern & Central North American Boreal Conifer & Hardwood Forest (MG037)
Group	Jack Pine - Black Spruce Forest (G047)
Association (Common name)	Jack Pine / Balsam Fir Forest
Ecological System(s):	Boreal Jack Pine-Black Spruce Forest (CES103.022)

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ELEMENT CONCEPT

Global Summary: This jack pine / fir forest is found in the northern parts of the midwestern United States and in central Canada. Stands occur on moderately deep (50-100 cm), usually sandy soils. The sites are often on north- to northeast-facing slopes. The tree layer of this community is dominated by *Pinus banksiana* (jack pine), often to the exclusion of other species. *Abies balsamea* (balsam fir), *Betula papyrifera* (paper birch), *Picea mariana* (black spruce), and *Populus tremuloides* (quaking aspen) dominate the sapling and seedling layers and sometimes occur in the canopy. There is a well-developed shrub layer containing species such as *Acer spicatum* (mountain maple), *Amelanchier alnifolia* (Saskatoon serviceberry), *Corylus cornuta* (beaked hazelnut), *Lonicera canadensis* (American fly honeysuckle), and *Vaccinium* (blueberry) spp. The herbaceous layer is dominated by dry-mesic forest species, including *Aralia nudicaulis* (wild sarsaparilla), *Eurybia macrophylla* (bigleaf aster), *Clintonia borealis* (bluebead), *Coptis trifolia* (threeleaf goldthread), and *Galium boreale* (northern bedstraw). Mosses and lichens are common on the forest floor.

ENVIRONMENTAL DESCRIPTION

Pictured Rocks National Lakeshore Environment: This jack pine / balsam fir forest was sampled at three locations in the park. Site are flat to gently undulating protected hollows. Soils are rapidly drained to well-drained loamy sand and sand. Surficial geology is lacustrine sand and gravel (Farrand and Bell 1982). The unvegetated surface is dominated by leaf litter (52-94% cover) with some wood (5-10%), bare sand/soil (0-2%), and jack pine snags (1-38%). The heavy duff layer at one site has minimized hiking impacts. This is active thrush habitat; also seen were two hares, nuthatches on pine boles, and numerous woodpecker cavities on pines. One area is subject to heavy fog, wind and ice. The lack of jack pine regeneration and succession to balsam fir are evidence of fire suppression. Additional evidence of disturbance includes the presence of exotic plants.
Global Environment: This community is found on moderately deep (50-100 cm), usually sandy soils (Grigal and Ohmann 1975). The sites are often on north- to northeast-facing slopes.

VEGETATION DESCRIPTION

Pictured Rocks National Lakeshore Vegetation: The very sparse to moderately dense (5-70% cover) tree canopy, 15-35 m tall, is dominated by *Pinus banksiana* (jack pine). *Abies balsamea* (balsam fir) makes up the very sparse to very dense (5-70%) subcanopy (10-15 m) and moderately sparse to total (40-100%) tall-shrub layer (1-5 m). The moderate (60%) short-shrub layer (0.5-1 m) may include saplings of *Abies balsamea* (balsam fir), *Acer pensylvanicum* (striped maple), *Acer saccharum* (sugar maple), *Betula papyrifera* (paper birch), *Fagus grandifolia* (American beech), *Juniperus communis* (common juniper), and *Picea glauca* (white spruce), as well as shrubs *Cornus rugosa* (roundleaf dogwood), *Corylus cornuta* (beaked hazelnut), *Linnaea borealis* (twinflower), *Lonicera canadensis* (American fly honeysuckle), *Prunus virginiana* (chokecherry), and *Sorbus decora* (northern mountain-ash). The very sparse to moderate (5-40%) herbaceous layer may include *Aralia nudicaulis* (wild sarsaparilla), *Chimaphila umbellata* (pipsissewa), *Clintonia borealis* (bluebead), *Cornus canadensis* (bunchberry dogwood), *Cypripedium acaule* (moccasin flower), *Cypripedium arietinum* (ram's head lady's slipper), *Goodyera oblongifolia* (western rattlesnake plantain), *Linnaea borealis* (twinflower), *Maianthemum canadense* (Canada mayflower), *Maianthemum stellatum* (starry false lily of the valley), *Pyrola asarifolia* (liverleaf wintergreen), and *Trientalis borealis* (starflower). Nonvascular species (5-40%), mostly mosses and lichens, include *Hylocomium splendens* (splendid feather moss), *Plagiomnium ciliare* (plagiomnium moss), and *Ptilium crista-castrensis* (knights plume moss). This community supports globally and state-vulnerable *Cypripedium arietinum* (ram's head lady's slipper) (including one very large population) and state-vulnerable *Cynoglossum virginianum* var. *boreale* (wild comfrey).
Global Vegetation: The tree layer of this community is dominated by *Pinus banksiana* (jack pine), often to the exclusion of other species. *Abies balsamea* (balsam fir), *Betula papyrifera* (paper birch), *Picea mariana* (black spruce), and *Populus tremuloides* (quaking aspen) dominate the sapling and seedling layers and sometimes occur in the canopy. There is a well-developed shrub layer containing species such as *Acer spicatum* (mountain maple), *Amelanchier alnifolia* (Saskatoon serviceberry), *Corylus cornuta* (beaked hazelnut), *Lonicera canadensis* (American fly honeysuckle), and *Vaccinium* (blueberry) spp. The herbaceous layer is dominated by dry-mesic forest species including *Aralia nudicaulis* (wild sarsaparilla), *Eurybia macrophylla* (bigleaf aster), *Clintonia borealis* (bluebead), *Coptis trifolia* (threeleaf goldthread), and *Galium boreale* (northern bedstraw). Mosses and lichens are common on the forest floor (Grigal and Ohmann 1975, Sims et al. 1989).

MOST ABUNDANT SPECIES

Pictured Rocks National Lakeshore

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Pinus banksiana* (jack pine)
Tree subcanopy	Needle-leaved tree	*Abies balsamea* (balsam fir)
Tall shrub/sapling	Needle-leaved tree	*Abies balsamea* (balsam fir)
Herb (field)	Forb	*Chimaphila umbellata* (pipsissewa), *Cypripedium arietinum* (ram's head lady's slipper), *Goodyera oblongifolia* (western rattlesnake plantain), *Maianthemum canadense* (Canada mayflower)

Global

Stratum	Lifeform	Species

CHARACTERISTIC SPECIES

Pictured Rocks National Lakeshore: *Abies balsamea* (balsam fir), *Pinus banksiana* (jack pine)
Global:

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OTHER NOTEWORTHY SPECIES

Pictured Rocks National Lakeshore: Vulnerable: *Cynoglossum virginianum* var. *boreale* (wild comfrey, state-vulnerable, G5T4T5), *Cypripedium arietinum* (ram's head lady's slipper, globally and state-vulnerable, G3); **Exotic/Invasive**: *Hieracium piloselloides* (tall hawkweed, exotic, Medium/Insignificant), *Taraxacum officinale* (common dandelion, exotic), *Veronica officinalis* (common gypsyweed, exotic), *Veronica serpyllifolia* (thymeleaf speedwell, exotic)
Global: Vulnerable: *Cypripedium arietinum* (ram's head lady's slipper, G3)

CONSERVATION STATUS RANK

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

CLASSIFICATION

Status: Standard
Classification Confidence: 2 - Moderate
Pictured Rocks National Lakeshore Comments:
Global Comments: This type represents a relatively more moist jack pine type in areas of the Canadian Shield, whereas *Pinus banksiana / (Quercus rubra, Quercus ellipsoidalis)* Forest (CEGL002440) is the drier type.
Global Similar Associations:
- *Pinus banksiana / (Quercus rubra, Quercus ellipsoidalis)* Forest (CEGL002440)

Global Related Concepts:
- Jack Pine (Fir) (Ohmann and Ream 1971) =
- Jack Pine / Low Shrub (V28) (Sims et al. 1989) B
- Jack Pine-Fir (Grigal and Ohmann 1975) =

OTHER COMMENTS

Other Comments:

ELEMENT DISTRIBUTION

Pictured Rocks National Lakeshore Range: This jack pine / balsam fir forest is located near Sable Falls at Grand Sable Dunes.
Global Range: This jack pine / fir forest type is found in the northern parts of the midwestern United States and in central Canada, ranging from northeastern Minnesota to northwestern Ontario and probably elsewhere.
Nations: CA, US
States/Provinces: MI, MN:S4, ON, QC
TNC Ecoregions: 47:C, 48:C, 64:C
USFS Ecoregions (1994/95): 212Ea:CCC, 212Hi:CCC, 212La:CCC, 212Lb:CCC, 212Nc:C??
Federal Lands: NPS (Grand Portage, Pictured Rocks, Voyageurs); USFS (Superior)

ELEMENT SOURCES

Pictured Rocks National Lakeshore Inventory Notes:
Pictured Rocks National Lakeshore Plots: PIRO.005, PIRO.401, PIRO.402.
Pictured Rocks National Lakeshore Map Code: FJF
Local Description Authors: M.J. Russo
Global Description Authors: J. Drake
References: Farrand and Bell 1982, Grigal and Ohmann 1975, MNNHP 1993, Midwestern Ecology Working Group n.d., Ohmann and Ream 1971, Sims et al. 1989

Jack Pine / Blueberry / Feathermoss Forest

***Pinus banksiana / Vaccinium* spp. / *Pleurozium schreberi* Forest**
Jack Pine / Blueberry species / Feathermoss Forest
Identifier: CEGL002441

NVC CLASSIFICATION

Division	North American Lowland Boreal Forest (1.D.1.a)
Macrogroup	Eastern & Central North American Boreal Conifer & Hardwood Forest (MG037)
Group	Jack Pine - Black Spruce Forest (G047)
Association (Common name)	Jack Pine / Blueberry / Feathermoss Forest
Ecological System(s):	Boreal Jack Pine-Black Spruce Forest (CES103.022)
	Laurentian Pine-Oak Barrens (CES201.718)

ELEMENT CONCEPT

Global Summary: This jack pine forest is found in the northern parts of the midwestern United States and in central Canada, with disjunct occurrences in the far northeastern United States. Sites occupy flat to rolling topography. The soils are sandy loams, fine sands, and loamy sands, shallow to deep, and with low organic content. The overstory of this forest community is largely made up of moderately to densely spaced conifers with a scattering of deciduous trees. The trees in this community are typically 15-20 m tall. *Pinus banksiana* (jack pine) is often the only tree of significance in the overstory. In some stands, smaller amounts of *Betula*

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papyrifera (paper birch), *Picea mariana* (black spruce), *Pinus resinosa* (red pine), and *Populus tremuloides* (quaking aspen) may be found. Tall shrubs are uncommon, but may occur in patches. The most common of these are *Alnus viridis* (green alder) and *Amelanchier alnifolia* (Saskatoon serviceberry). In the Midwest, occasional grubs of *Quercus ellipsoidalis* (northern pin oak) and *Quercus macrocarpa* (bur oak) may be present. Low shrubs are abundant. These include *Arctostaphylos uva-ursi* (kinnikinnick), *Diervilla lonicera* (northern bush honeysuckle), *Juniperus communis* (common juniper), *Linnaea borealis* (twinflower), *Rosa acicularis* (prickly rose), and *Vaccinium* (blueberry) spp. The herbaceous layer contains many species typical of northern coniferous forests, such as *Aralia nudicaulis* (wild sarsaparilla), *Anemone quinquefolia* (nightcaps), *Cornus canadensis* (bunchberry dogwood), *Fragaria virginiana* (Virginia strawberry), *Maianthemum canadense* (Canada mayflower), and *Trientalis borealis* (starflower). Mosses, especially *Pleurozium schreberi* (Schreber's big red stem moss), form a nearly continuous carpet.

ENVIRONMENTAL DESCRIPTION

Pictured Rocks National Lakeshore Environment: This jack pine forest was sampled at four locations in the park. The sites are flat to gently sloping northeast- and north-facing kame terraces and outwash plains. Soils are rapidly to well-drained sand. Surficial geology is lacustrine sand and gravel (Farrand and Bell 1982). The unvegetated surface is nearly entirely leaf litter (97-100% cover) with some wood (0-3%). These sites are utilized by wood thrush, woodpecker and other songbirds. Evidence of disturbance includes trails, old logging stumps, intense fire at the turn of the last century (1880s to 1900s), and more recently fire suppression.

Global Environment: This community is found on flat to rolling topography, such as glaciofluvial and lacustrine deposits, moraines, and other glacial features. The soils are sandy loams, fine sands, and loamy sands, shallow to deep, and with low organic content (Sims et al. 1989, MNNHP 1993). In Wisconsin, stands are found on the "sandscapes" of the Apostle Islands (E. Epstein pers. comm. 1999, NatureServe unpubl. data 2005).

VEGETATION DESCRIPTION

Pictured Rocks National Lakeshore Vegetation: The moderate (40-60% cover) tree canopy is of variable height (10-35 m tall) and is dominated exclusively by *Pinus banksiana* (jack pine). There may or may not be canopy and tall-shrub layers. When present, the very sparse (5%) subcanopy (5-15 m) and sparse (10%) tall-shrub layer (2-10 m) include *Acer rubrum* (red maple), *Pinus strobus* (eastern white pine), and *Pinus banksiana* (jack pine). The moderate to very dense (50-90%) short-shrub layer (0.5-1 m) is dominated by ericaceous species, including *Gaylussacia baccata* (black huckleberry), *Vaccinium angustifolium* (lowbush blueberry), *Vaccinium myrtilloides* (velvetleaf huckleberry), and *Gaultheria procumbens* (eastern teaberry). It may also include saplings of *Abies balsamea* (balsam fir), *Acer pensylvanicum* (striped maple), *Fagus grandifolia* (American beech), and *Pinus banksiana* (jack pine). *Epigaea repens* (trailing arbutus) forms a sparse (5-10%) dwarf-shrub layer (<0.5 m). The variable herbaceous layer (30-80%) may include *Carex pensylvanica* (Pennsylvania sedge), *Cypripedium acaule* (moccasin flower), *Danthonia spicata* (poverty oatgrass), *Maianthemum canadense* (Canada mayflower), *Melampyrum lineare* (narrowleaf cowwheat), and *Trientalis borealis* (starflower). However, the clear dominant species is the fern *Pteridium aquilinum* (western brackenfern) (30-80%). Abundant (70-80%) nonvascular species (mosses and lichens) cover the ground surface.

Global Vegetation: The overstory of this forest community is dominated by moderately to densely spaced conifers with a scattering of deciduous trees. The trees in this community are typically 15-20 m tall (Mueller-Dombois 1964). *Pinus banksiana* (jack pine) is often the only tree of significance in the overstory (Mueller-Dombois 1964, MNNHP 1993). In some stands, smaller amounts of *Betula papyrifera* (paper birch), *Picea mariana* (black spruce), *Pinus resinosa* (red pine), and *Populus tremuloides* (quaking aspen) may be found. Tall shrubs are uncommon, but may occur in patches (Sims et al. 1989). The most common of these are *Alnus viridis* (green alder) and *Amelanchier alnifolia* (Saskatoon serviceberry). In the Midwest, occasional grubs of *Quercus ellipsoidalis* (northern pin oak) and *Quercus macrocarpa* (bur oak) may be present. Low shrubs are abundant. These include *Arctostaphylos uva-ursi* (kinnikinnick), *Diervilla lonicera* (northern bush honeysuckle), *Juniperus communis* (common juniper), *Linnaea borealis* (twinflower), *Rosa acicularis* (prickly rose), and *Vaccinium* (blueberry) spp. The herbaceous layer contains many species typical of northern coniferous forests, such as *Aralia nudicaulis* (wild sarsaparilla), *Anemone quinquefolia* (nightcaps), *Cornus canadensis* (bunchberry dogwood), *Fragaria virginiana* (Virginia strawberry), *Maianthemum canadense* (Canada mayflower), and *Trientalis borealis* (starflower). Mosses, especially *Pleurozium schreberi* (Schreber's big red stem moss), form a nearly continuous carpet (Eyre 1980, Sims et al. 1989).

MOST ABUNDANT SPECIES

Pictured Rocks National Lakeshore

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Pinus banksiana* (jack pine)
Short shrub/sapling	Broad-leaved deciduous shrub	*Gaylussacia baccata* (black huckleberry), *Vaccinium angustifolium* (lowbush blueberry)
Short shrub/sapling	Broad-leaved evergreen shrub	*Gaultheria procumbens* (eastern teaberry)
Herb (field)	Dwarf-shrub	*Epigaea repens* (trailing arbutus)
Herb (field)	Fern or fern ally	*Pteridium aquilinum* (western brackenfern)

Global

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Stratum **Lifeform** **Species**

CHARACTERISTIC SPECIES

Pictured Rocks National Lakeshore: *Gaylussacia baccata* (black huckleberry), *Pinus banksiana* (jack pine), *Pteridium aquilinum* (western brackenfern), *Vaccinium angustifolium* (lowbush blueberry)
Global:

OTHER NOTEWORTHY SPECIES

Pictured Rocks National Lakeshore:
Global:

CONSERVATION STATUS RANK

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

CLASSIFICATION

Status: Standard
Classification Confidence: 2 - Moderate
Pictured Rocks National Lakeshore Comments:
Global Comments: *Pinus banksiana / Arctostaphylos uva-ursi* Forest (CEGL002438) in northwestern Minnesota and southeastern Manitoba appears to be similar to this community, but is on deeper sands. This type also overlaps with *Pinus banksiana - (Pinus resinosa) - Quercus ellipsoidalis / Carex pensylvanica* Forest (CEGL002478), 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 - (Picea mariana, Pinus strobus) / Vaccinium* spp. Rocky Woodland (CEGL002483)
- *Pinus banksiana - (Pinus resinosa) - Quercus ellipsoidalis / Carex pensylvanica* Forest (CEGL002478)--This is the mixed pine-oak type on sands.
- *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 / Quercus ellipsoidalis* Woodland (CEGL002484)
- *Pinus banksiana / Arctostaphylos uva-ursi* Forest (CEGL002438)--This community occurs on deep, sandy lacustrine plains and beach dunes, with a high fire frequency. It is drier and possible on less fertile soils.

Global Related Concepts:
- Dry Northern Forest - Jack Pine (Northern Pin Oak) (Chapman et al. 1989) =
- Jack Pine - Feathermoss (Zoladeski et al. 1995) =
- Jack Pine / Ericaceous Shrub / Feathermoss (V29) (Sims et al. 1989) B
- Jack Pine: 1, Jack pine - Feather moss (subtype b) (Eyre 1980) B
- Oligotrophic Fresh *Arctostaphylos-Linnaea* Type on Low Beta- and Gamma-gley Podzols (Mueller-Dombois 1964) =

OTHER COMMENTS

Other Comments:

ELEMENT DISTRIBUTION

Pictured Rocks National Lakeshore Range: This jack pine forest is found on sandy outwash plains in two main areas within the park: in the vicinity of Kingston Lake and Miners Beach; and as isolated pockets within Grand Sable Dunes. It is one of the most common conifer associations in the park.
Global Range: This jack pine forest community is found in the northern parts of the midwestern United States and in central Canada, ranging from northern Michigan and northern Wisconsin west and north to Minnesota, southeastern Manitoba, and northwestern Ontario. Disjunct occurrences are known from western Maine and possibly New York.
Nations: CA, US
States/Provinces: MB:S4S5, ME:S1, MI:S4, MN:S3, NB, NY, ON, QC, WI:S3
TNC Ecoregions: 47:C, 48:C, 63:C
USFS Ecoregions (1994/95): 212Ha:CC?, 212Hb:CCP, 212He:CC?, 212Hh:CC?, 212Hi:CCC, 212Hj:CC?, 212Hk:CC?, 212Hl:CCC, 212Hm:CCP, 212Ho:CCC, 212Hp:CCP, 212Hq:CCP, 212Hr:CCP, 212Hs:CCP, 212Ht:CCP, 212Hv:CCP, 212Hw:CCC, 212Hy:CCC, 212Ia:CCC, 212Ib:CCP, 212Ja:CCP, 212Jc:CCP, 212Jl:CCP, 212Jm:CCC, 212Jn:CCP, 212Jo:CC?, 212Ka:CCC, 212Na:CCC, 212Nb:CCP, 212Nc:CCC, M212Af:CCC, M212D:CP
Federal Lands: NPS (Apostle Islands, Pictured Rocks, Sleeping Bear Dunes); USFS (Chequamegon, Chequamegon-Nicolet, Chippewa, Hiawatha, Huron, Huron-Manistee, Manistee, Nicolet, Ottawa)

ELEMENT SOURCES

Pictured Rocks National Lakeshore Inventory Notes:
Pictured Rocks National Lakeshore Plots: PIRO.008, PIRO.011, PIRO.025, PIRO.138.
Pictured Rocks National Lakeshore Map Code: FJB

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Local Description Authors: M.J. Russo
Global Description Authors: J. Drake
References: Chapman et al. 1989, Epstein pers. comm., Eyre 1980, Farrand and Bell 1982, Gawler 2002, Greenall 1996, MNNHP 1993, Midwestern Ecology Working Group n.d., Mueller-Dombois 1964, Sims et al. 1989, WNHIP unpubl. data, Zoladeski et al. 1995

G048. White Spruce - Balsam Fir Forest

Balsam Fir - Paper Birch Forest
***Abies balsamea - Betula papyrifera / Diervilla lonicera* Forest**
Balsam Fir - Paper Birch / Northern Bush-honeysuckle Forest
Identifier: CEGL002474

NVC CLASSIFICATION

Division	North American Lowland Boreal Forest (1.D.1.a)
Macrogroup	Eastern & Central North American Boreal Conifer & Hardwood Forest (MG037)
Group	White Spruce - Balsam Fir Forest (G048)
Association (Common name)	Balsam Fir - Paper Birch Forest
Ecological System(s):	Boreal White Spruce-Fir-Hardwood Forest (CES103.021)

ELEMENT CONCEPT

Global Summary: This balsam fir - birch sub-boreal forest type is found in the northern Great Lakes region of the United States and Canada and elsewhere in central Canada. Stands occur on deep, moist to mesic, mineral soils, usually loams. It can be on flat to moderate slopes and, in northern Minnesota, tends to be near water. Canopy is either pure evergreen or mixed evergreen-deciduous. The overstory is usually dominated by *Abies balsamea* (balsam fir) and *Betula papyrifera* (paper birch) but some stands may have large amounts of *Populus tremuloides* (quaking aspen). Other common trees include *Picea glauca* (white spruce), *Picea mariana* (black spruce), *Pinus strobus* (eastern white pine), and *Thuja occidentalis* (northern white-cedar). *Abies balsamea* (balsam fir) is also abundant in the sapling/shrub stratum, along with *Acer spicatum* (mountain maple), *Betula papyrifera* (paper birch), *Diervilla lonicera* (northern bush honeysuckle), *Corylus cornuta* (beaked hazelnut), *Linnaea borealis* (twinflower), *Rubus pubescens* (dwarf red blackberry), *Sorbus americana* (American mountain-ash), and *Taxus canadensis* (Canada yew) (especially on Isle Royale and in northern Wisconsin). Herbaceous species found in this community include *Anemone quinquefolia* (nightcaps), *Aralia nudicaulis* (wild sarsaparilla), *Eurybia macrophylla* (bigleaf aster), *Clintonia borealis* (bluebead), *Coptis trifolia* (threeleaf goldthread), *Cornus canadensis* (bunchberry dogwood), *Maianthemum canadense* (Canada mayflower), *Mitella nuda* (naked miterwort), *Streptopus lanceolatus* var. *longipes* (twistedstalk), and *Trientalis borealis* (starflower). Mosses include *Hylocomium splendens* (splendid feather moss), *Plagiomnium cuspidatum* (toothed plagiomnium moss), *Pleurozium schreberi* (Schreber's big red stem moss), and *Ptilium crista-castrensis* (knights plume moss).

ENVIRONMENTAL DESCRIPTION

Pictured Rocks National Lakeshore Environment: This balsam fir - birch forest was observed twice in the park near Sable Lighthouse. This area is subject to high winds off Lake Superior, ice storms, heavy snow, etc., that have resulted in many windblown and fallen trees and the dominance and maintenance of birch in an early-successional stage.
Global Environment: This community is found on deep, moist to mesic, mineral soils, usually loams (Sims et al. 1989). It can be on flat to moderate slopes (5-30%) and, in northern Minnesota, tends to be near water (Ohmann and Ream 1971).

VEGETATION DESCRIPTION

Pictured Rocks National Lakeshore Vegetation: The moderately dense (70% cover) tree canopy, 20-35 m tall, is dominated by *Betula papyrifera* (paper birch) and may include lesser amounts of *Abies balsamea* (balsam fir), *Acer rubrum* (red maple), and *Picea glauca* (white spruce). The moderate (50%) subcanopy (5-10 m) is dominated by *Abies balsamea* (balsam fir), as is the moderately dense (70%) tall-shrub layer (2-5 m) and moderate (50%) short-shrub layer (0.5-1 m), which may also include *Acer pensylvanicum* (striped maple), *Acer rubrum* (red maple), *Acer spicatum* (mountain maple), and *Diervilla lonicera* (northern bush honeysuckle). *Linnaea borealis* (twinflower) may form a very sparse (10%) dwarf-shrub layer. The sparse (30%) herbaceous layer includes *Aralia nudicaulis* (wild sarsaparilla), *Goodyera oblongifolia* (western rattlesnake plantain), *Maianthemum canadense* (Canada mayflower), *Pteridium aquilinum* (western brackenfern), and *Trientalis borealis* (starflower). Nonvascular species (mosses) cover 30% of the ground surface and include *Dicranum polysetum* (dicranum moss), *Dicranum scoparium* (dicranum moss), *Hylocomium splendens* (splendid feather moss), and *Ptilium crista-castrensis* (knights plume moss).
Global Vegetation: The tree canopy is either pure evergreen or mixed evergreen-deciduous. The overstory is usually dominated by *Abies balsamea* (balsam fir) and *Betula papyrifera* (paper birch), but some stands may have large amounts of *Populus tremuloides* (quaking aspen). Other common trees include *Picea glauca* (white spruce), *Picea mariana* (black spruce), *Pinus strobus* (eastern white pine), and *Thuja occidentalis* (northern white-cedar). Canopy trees may typically be 15-25 m tall (Hansen et al. 1973). *Abies balsamea* (balsam fir) is also abundant in the sapling/shrub stratum, along with *Acer spicatum* (mountain maple), *Betula papyrifera* (paper birch), *Diervilla lonicera* (northern bush honeysuckle), *Corylus cornuta* (beaked hazelnut), *Linnaea borealis* (twinflower), *Rubus pubescens* (dwarf red blackberry), *Sorbus americana* (American mountain-ash), and *Taxus canadensis* (Canada yew) (especially on Isle Royale and in northern Wisconsin). Herbaceous species found in this community include *Anemone quinquefolia* (nightcaps), *Aralia nudicaulis* (wild sarsaparilla), *Eurybia macrophylla* (bigleaf aster), *Clintonia borealis* (bluebead), *Coptis trifolia* (threeleaf

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goldthread), *Cornus canadensis* (bunchberry dogwood), *Maianthemum canadense* (Canada mayflower), *Mitella nuda* (naked miterwort), *Streptopus lanceolatus* (twistedstalk), and *Trientalis borealis* (starflower). Mosses include *Hylocomium splendens* (splendid feather moss), *Plagiomnium cuspidatum* (toothed plagiomnium moss), *Pleurozium schreberi* (Schreber's big red stem moss), and *Ptilium crista-castrensis* (knights plume moss) (Sims et al. 1989).

MOST ABUNDANT SPECIES

Pictured Rocks National Lakeshore

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Abies balsamea* (balsam fir)
Tree canopy	Broad-leaved deciduous tree	*Betula papyrifera* (paper birch)
Tree subcanopy	Needle-leaved tree	*Abies balsamea* (balsam fir)
Tall shrub/sapling	Needle-leaved shrub	*Abies balsamea* (balsam fir)
Short shrub/sapling	Needle-leaved shrub	*Abies balsamea* (balsam fir)
Short shrub/sapling	Broad-leaved deciduous shrub	*Diervilla lonicera* (northern bush honeysuckle)
Herb (field)	Fern or fern ally	*Pteridium aquilinum* (western brackenfern)
Nonvascular	Moss	*Hylocomium splendens* (splendid feather moss)

Global

Stratum	Lifeform	Species

CHARACTERISTIC SPECIES

Pictured Rocks National Lakeshore: *Abies balsamea* (balsam fir), *Betula papyrifera* (paper birch)
Global:

OTHER NOTEWORTHY SPECIES

Pictured Rocks National Lakeshore:
Global:

CONSERVATION STATUS RANK

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

CLASSIFICATION

Status: Standard
Classification Confidence: 2 - Moderate
Pictured Rocks National Lakeshore Comments:
Global Comments: This type does not always have a pure evergreen canopy; it can grade into mixed evergreen-deciduous canopy in northern and central Ontario. It intergrades heavily with spruce-fir evergreen types, *Picea glauca - Abies balsamea / Acer spicatum / Rubus pubescens* Forest (CEGL002446), and spruce-fir-hardwood mixed evergreen-deciduous types, *Picea glauca - Abies balsamea - Populus tremuloides* / Mixed Herbs Forest (CEGL002475), and could perhaps be lumped with either of these two types. Sims et al. (1989) note that this type (their V14) is often uneven-aged with relatively closed canopies, and occurs less frequently on calcareous soils. In Manitoba this type can be common following insect infestation by spruce budworm or tree harvesting without replanting (J. Greenall pers. comm. 1999).
Global Similar Associations:
- *Picea glauca - Abies balsamea - Populus tremuloides* / Mixed Herbs Forest (CEGL002475)
- *Picea glauca - Abies balsamea / Acer spicatum / Rubus pubescens* Forest (CEGL002446)

Global Related Concepts:
- Balsam Fir - Yellow Birch - Paper Birch - White Spruce (Hansen et al. 1973) I
- Balsam Fir Mixedwood (V14) (Sims et al. 1989) =
- Fir - Birch (Ohmann and Ream 1971) =
- Fir - Birch - *Mitella* (Kurmis et al. 1986) B

OTHER COMMENTS

Other Comments:

ELEMENT DISTRIBUTION

Pictured Rocks National Lakeshore Range:
Global Range: This balsam fir - birch sub-boreal forest type is found in the northern Great Lakes region of the United States and Canada and elsewhere in central Canada, ranging from northern Minnesota and Manitoba east to Ontario.
Nations: CA, US
States/Provinces: MB:S4?, MI, MN:S4?, ON, QC:S4, WI
TNC Ecoregions: 47:C, 48:C
USFS Ecoregions (1994/95): 212Hi:CCC, 212Ia:CCC, 212Ib:CC?, 212Jl:C??, 212La:CCP, 212Lb:CC?, 212Lc:CCP, 212Ld:CC?, 212Mb:CPP, 212Na:CPP, 212Nb:CPP, 212Nc:CPP
Federal Lands: NPS (Apostle Islands, Pictured Rocks, Voyageurs); USFS (Chequamegon-Nicolet?, Chequamegon?, Chippewa, Nicolet?, Superior)

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ELEMENT SOURCES

Pictured Rocks National Lakeshore Inventory Notes:
Pictured Rocks National Lakeshore Plots: PIRO.319, PIRO.320.
Pictured Rocks National Lakeshore Map Code: FFB
Local Description Authors: M.J. Russo
Global Description Authors: J. Drake, mod. D. Faber-Langendoen 06-00
References: Greenall 1996, Hansen et al. 1973, Kurmis et al. 1986, MNNHP 1993, Midwestern Ecology Working Group n.d., Ohmann and Ream 1971, Sims et al. 1989

Paper Birch / Fir Forest

***Betula papyrifera / Diervilla lonicera - (Abies balsamea)* Forest**
Paper Birch / Northern Bush-honeysuckle - (Balsam Fir) Forest
Identifier: CEGL002463

NVC CLASSIFICATION

Division	North American Lowland Boreal Forest (1.D.1.a)
Macrogroup	Eastern & Central North American Boreal Conifer & Hardwood Forest (MG037)
Group	White Spruce - Balsam Fir Forest (G048)
Association (Common name)	Paper Birch / Fir Forest

Ecological System(s):

ELEMENT CONCEPT

Global Summary: This paper birch forest is found in the northern Great Lakes region of the United States and perhaps more widely in Canada. Stands occur on fresh to moist soils, coarse-textured, non-calcareous mineral soils. The soil texture is typically coarse loam. The canopy of this forested community is closed to moderately open. *Betula papyrifera* (paper birch) is the dominant canopy tree and can form nearly pure stands. *Populus tremuloides* (quaking aspen), *Abies balsamea* (balsam fir), *Picea glauca* (white spruce), and, especially in Canada, *Pinus banksiana* (jack pine) can also be found. Tree density can be high, but the growth form and size of the canopy dominants allow significant light to pass through. *Abies balsamea* (balsam fir) is common to dense in the understory as are shrubs such as *Corylus cornuta* (beaked hazelnut), *Diervilla lonicera* (northern bush honeysuckle), *Rosa acicularis* (prickly rose), and *Taxus canadensis* (Canada yew). The herbaceous layer is similar to other dry-mesic to mesic northern communities. Species found in this layer include *Aralia nudicaulis* (wild sarsaparilla), *Eurybia macrophylla* (bigleaf aster), *Clintonia borealis* (bluebead), *Cornus canadensis* (bunchberry dogwood), *Maianthemum canadense* (Canada mayflower), and *Trientalis borealis* (starflower).

ENVIRONMENTAL DESCRIPTION

Pictured Rocks National Lakeshore Environment: Information not available.
Global Environment: This community is found on fresh to moist soils (Hansen et al. 1973, Sims et al. 1989). In Ontario, it occurs on coarse-textured, non-calcareous mineral soils. The soil texture is typically coarse loam (Sims et al. 1989).

VEGETATION DESCRIPTION

Pictured Rocks National Lakeshore Vegetation:
Global Vegetation: The canopy of this forested community is closed to moderately open. *Betula papyrifera* (paper birch) is the dominant canopy tree and can form nearly pure stands. *Populus tremuloides* (quaking aspen), *Abies balsamea* (balsam fir), *Picea glauca* (white spruce), and, especially in Canada, *Pinus banksiana* (jack pine) can be found in minor amounts, as well. Tree density can be high, but the growth form and size of the canopy dominants allows significant light to pass through. *Abies balsamea* (balsam fir) is common to dense in the understory (Hansen et al. 1973) along with shrubs such as *Corylus cornuta* (beaked hazelnut), *Diervilla lonicera* (northern bush honeysuckle), *Rosa acicularis* (prickly rose), and *Taxus canadensis* (Canada yew). The herbaceous layer is similar to other dry-mesic to mesic northern communities. Species found in this layer include *Aralia nudicaulis* (wild sarsaparilla), *Eurybia macrophylla* (bigleaf aster), *Clintonia borealis* (bluebead), *Cornus canadensis* (bunchberry dogwood), *Maianthemum canadense* (Canada mayflower), and *Trientalis borealis* (starflower).

MOST ABUNDANT SPECIES

Pictured Rocks National Lakeshore

Stratum	Lifeform	Species

Global

Stratum	Lifeform	Species

CHARACTERISTIC SPECIES

Pictured Rocks National Lakeshore:
Global:

OTHER NOTEWORTHY SPECIES

Pictured Rocks National Lakeshore:
Global:

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CONSERVATION STATUS RANK

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

CLASSIFICATION

Status: Standard
Classification Confidence: 2 - Moderate
Pictured Rocks National Lakeshore Comments:
Global Comments: *Clintonia borealis* (bluebead), *Lycopodium annotinum* (stiff clubmoss), and mosses may be more common in this community while *Eurybia macrophylla* (bigleaf aster) may be more common in other early successional community types dominated by *Populus tremuloides* (quaking aspen) (MNNHP 1993). Stands should usually have >90% of their deciduous canopy composed of *Betula papyrifera* (paper birch) to be included in this community. Manitoba is not sure this type forms significant stands in that province (J. Greenall pers. comm. 1999). Some authors treat this type as synonymous with the aspen-paper birch type *Populus tremuloides - Betula papyrifera / (Abies balsamea, Picea glauca)* Forest (CEGL002466) (K. Rusterholz pers. comm. 2000).
Global Similar Associations:
- *Betula papyrifera / Acer saccharum* - Mixed Hardwoods Forest (CEGL002464)
- *Populus tremuloides - Betula papyrifera / (Abies balsamea, Picea glauca)* Forest (CEGL002466)

Global Related Concepts:
- Paper Birch - Aspen - White Spruce (1936) (Hansen et al. 1973) =
- White Birch Hardwood and Mixedwood (V4) (Sims et al. 1989) =

OTHER COMMENTS

Other Comments:

ELEMENT DISTRIBUTION

Pictured Rocks National Lakeshore Range:
Global Range: This paper birch forest type is found in the northern Great Lakes region of the United States and perhaps more widely in Canada, ranging from Minnesota and Manitoba east to Ontario and possibly Quebec.
Nations: CA, US
States/Provinces: MB:S3S4, MI, MN:S4?, ON, QC:S4?, WI
TNC Ecoregions: 47:C, 48:C
USFS Ecoregions (1994/95): 212Hi:CCC, 212Ia:CCC, 212Ib:CCC, 212La:CPP, 212Mb:CPP, 212Na:CPP, 212Nb:CPP, 212Nc:CPP
Federal Lands: NPS (Apostle Islands, Isle Royale, Pictured Rocks, Voyageurs); USFS (Chippewa, Superior?)

ELEMENT SOURCES

Pictured Rocks National Lakeshore Inventory Notes:
Pictured Rocks National Lakeshore Plots:
Pictured Rocks National Lakeshore Map Code: FGF
Local Description Authors:
Global Description Authors: J. Drake
References: Greenall 1996, Hansen et al. 1973, MNNHP 1993, Midwestern Ecology Working Group n.d., Sims et al. 1989

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 Lowland Boreal Forest (1.D.1.a)
Macrogroup	Eastern & Central North American Boreal Conifer & Hardwood Forest (MG037)
Group	White Spruce - Balsam Fir Forest (G048)
Association (Common name)	Spruce - Fir - Aspen Forest
Ecological System(s):	Boreal White Spruce-Fir-Hardwood Forest (CES103.021)

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

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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

Pictured Rocks National Lakeshore Environment: Information not available.

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

Pictured Rocks National Lakeshore Vegetation:

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 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* (nightcaps), *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

Pictured Rocks National Lakeshore

Stratum	Lifeform	Species

Global

Stratum	Lifeform	Species

CHARACTERISTIC SPECIES

Pictured Rocks National Lakeshore:

Global:

OTHER NOTEWORTHY SPECIES

Pictured Rocks National Lakeshore:

Global:

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

Pictured Rocks National Lakeshore Comments:

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:

- White Spruce Mixedwood (V13) (Zoladeski et al. 1995) =
- White Spruce Mixedwood (V15) (Sims et al. 1989) =

OTHER COMMENTS

Other Comments:

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ELEMENT DISTRIBUTION

Pictured Rocks National Lakeshore Range:
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 (Apostle Islands, Grand Portage, Isle Royale, Pictured Rocks, Saint Croix, Sleeping Bear Dunes, Voyageurs); USFS (Chippewa, Hiawatha, Huron, Huron-Manistee, Manistee, Ottawa, Superior)

ELEMENT SOURCES

Pictured Rocks National Lakeshore Inventory Notes:
Pictured Rocks National Lakeshore Plots:
Pictured Rocks National Lakeshore Map Code: FCP
Local Description Authors:
Global Description Authors: J. Drake
References: Epstein pers. comm., Greenall 1996, MNNHP 1993, Midwestern Ecology Working Group n.d., Sims et al. 1989, WNHIP unpubl. data, Zoladeski et al. 1995

Spruce - Fir / Mountain Maple Forest

***Picea glauca - Abies balsamea / Acer spicatum / Rubus pubescens* Forest**
White Spruce - Balsam Fir / Mountain Maple / Dwarf Red Raspberry Forest
Identifier: CEGL002446

NVC CLASSIFICATION

Division	North American Lowland Boreal Forest (1.D.1.a)
Macrogroup	Eastern & Central North American Boreal Conifer & Hardwood Forest (MG037)
Group	White Spruce - Balsam Fir Forest (G048)
Association (Common name)	Spruce - Fir / Mountain Maple Forest
Ecological System(s):	Boreal White Spruce-Fir-Hardwood Forest (CES103.021)

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* (nightcaps), *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 goose neck moss).

ENVIRONMENTAL DESCRIPTION

Pictured Rocks National Lakeshore Environment: Information not available.
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

Pictured Rocks National Lakeshore Vegetation:
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

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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* (nightcaps), *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 goose neck moss) (Sims et al. 1989, Chambers et al. 1997).

MOST ABUNDANT SPECIES

Pictured Rocks National Lakeshore

Stratum	Lifeform	Species

Global

Stratum	Lifeform	Species

CHARACTERISTIC SPECIES

Pictured Rocks National Lakeshore:
Global:

OTHER NOTEWORTHY SPECIES

Pictured Rocks National Lakeshore:
Global:

CONSERVATION STATUS RANK

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

CLASSIFICATION

Status: Standard
Classification Confidence: 1 - Strong
Pictured Rocks National Lakeshore Comments:
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) =
- Delaware Stand (Maycock 1961) =
- Dry-mesic Stands (Maycock and Curtis 1960) =
- White Spruce - Balsam Fir / Shrub Forest (Zoladeski et al. 1995) =
- White Spruce - Balsam Fir / Shrub Rich Forest (Sims et al. 1989) =

OTHER COMMENTS

Other Comments:

ELEMENT DISTRIBUTION

Pictured Rocks National Lakeshore Range:

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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, 212Ia:CCC, 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 (Apostle Islands, Grand Portage, Pictured Rocks, Saint Croix, Voyageurs); USFS (Chippewa, Hiawatha, Huron, Huron-Manistee, Manistee, Ottawa, Superior)

ELEMENT SOURCES

Pictured Rocks National Lakeshore Inventory Notes:
Pictured Rocks National Lakeshore Plots:
Pictured Rocks National Lakeshore Map Code: FSF
Local Description Authors:
Global Description Authors: J. Drake
References: Chambers et al. 1997, Greenall 1996, 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

1.D.2. Boreal Flooded & Swamp Forest

1.D.2.a. North American Boreal Flooded & Swamp Forest

MG038. Central & Eastern Boreal Flooded & Swamp Forest

G050. Black Spruce - Tamarack Acidic Swamp

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.a)
Macrogroup	Central & Eastern Boreal Flooded & Swamp Forest (MG038)
Group	Black Spruce - Tamarack Acidic Swamp (G050)
Association (Common name)	Black Spruce - Tamarack / Labrador-tea Poor Swamp
Ecological System(s):	Boreal-Laurentian Conifer Acidic Swamp (CES103.724)
	Boreal-Laurentian Bog (CES103.581)

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* (threeseeded 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

Pictured Rocks National Lakeshore Environment: This tamarack forest was sampled twice in the park. The sites are flat depressions with seasonally flooded to saturated, poorly to very poorly drained hummocky peat soil. Surficial geology is lacustrine sand and gravel (Farrand and Bell 1982). The unvegetated surface is entirely made up of leaf litter (100% cover). Evidence of disturbance includes past logging and insect damage.

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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

Pictured Rocks National Lakeshore Vegetation: The sparse to moderate (20-40% cover), somewhat stunted tree canopy, 10-15 m tall, is dominated by *Larix laricina* (tamarack) with lesser amounts of *Picea mariana* (black spruce) and *Pinus strobus* (eastern white pine) in the canopy and the sparse (5-20%) subcanopy (5-10 m). The sparse to moderate (10-50%) tall-shrub layer (2-5 m) is dominated by *Nemopanthus mucronatus* (catberry) with lesser amounts of *Acer rubrum* (red maple) and saplings of subcanopy species. *Chamaedaphne calyculata* (leatherleaf) dominates (up to 90%) the very dense (80-90%) short-shrub layer (0.5-1 m) which may also include *Abies balsamea* (balsam fir), *Amelanchier arborea* (common serviceberry), *Andromeda polifolia* var. *glaucophylla* (bog rosemary), *Gaultheria hispidula* (creeping snowberry), *Gaultheria procumbens* (eastern teaberry), *Kalmia polifolia* (bog laurel), *Ledum groenlandicum* (bog Labrador-tea), *Vaccinium myrtilloides* (velvetleaf huckleberry), *Vaccinium oxycoccos* (small cranberry), and *Viburnum nudum* var. *cassinoides* (withe-rod). The sparse herbaceous layer (20%) includes *Carex oligosperma* (fewseed sedge), *Maianthemum canadense* (Canada mayflower), *Maianthemum trifolium* (threeleaf false lily of the valley), and *Osmunda cinnamomea* (cinnamon fern). The nearly continuous nonvascular layer (sphagnum mosses) covers 90-100% of the ground surface.

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 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* (threeseeded 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

Pictured Rocks National Lakeshore

Stratum	Lifeform	Species
Tree (canopy & subcanopy)	Needle-leaved tree	*Picea mariana* (black spruce)
Tree canopy	Needle-leaved tree	*Larix laricina* (tamarack), *Pinus strobus* (eastern white pine)
Tall shrub/sapling	Needle-leaved shrub	*Picea mariana* (black spruce)
Tall shrub/sapling	Broad-leaved deciduous shrub	*Nemopanthus mucronatus* (catberry)
Short shrub/sapling	Needle-leaved shrub	*Abies balsamea* (balsam fir)
Short shrub/sapling	Broad-leaved deciduous shrub	*Vaccinium myrtilloides* (velvetleaf huckleberry)
Short shrub/sapling	Broad-leaved evergreen shrub	*Chamaedaphne calyculata* (leatherleaf), *Kalmia polifolia* (bog laurel), *Ledum groenlandicum* (bog Labrador-tea)

Global

Stratum	Lifeform	Species

CHARACTERISTIC SPECIES

Pictured Rocks National Lakeshore: *Carex oligosperma* (fewseed sedge), *Chamaedaphne calyculata* (leatherleaf), *Kalmia polifolia* (bog laurel), *Larix laricina* (tamarack), *Nemopanthus mucronatus* (catberry), *Vaccinium myrtilloides* (velvetleaf huckleberry), *Viburnum nudum* var. *cassinoides* (withe-rod)

Global:

OTHER NOTEWORTHY SPECIES

Pictured Rocks National Lakeshore:

Global:

CONSERVATION STATUS RANK

Global Rank & Reasons: G5 (27-Jun-2000).

CLASSIFICATION

Status: Standard

Classification Confidence: 2 - Moderate

Pictured Rocks National Lakeshore Comments:

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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 - *Kalmia* Type (Kurmis et al. 1986) =
- Black Spruce / Bunchberry / Sphagnum (Feathermoss) (V36) (Sims et al. 1989) F
- Black Spruce / Ericaceous Shrub / Sphagnum (V37) (Sims et al. 1989) F
- Black Spruce / Herb Poor / Sphagnum (Feathermoss) (Zoladeski et al. 1995) =
- Black Spruce / Labrador Tea / Feathermoss (Sphagnum) (V34) (Sims et al. 1989) F
- Black Spruce Bog (Woodland) (Thompson 1996) ?
- Black Spruce: 12 (Eyre 1980) B
- 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) F
- Poor conifer swamp: black spruce / Labrador Tea / bluejoint grass (W28) (Harris et al. 1996) F
- Spring-fen forest (Glaser 1992b) =

OTHER COMMENTS

Other Comments:

ELEMENT DISTRIBUTION

Pictured Rocks National Lakeshore Range: This tamarack swamp community is found in isolated pockets in low depressions over organic soils. It is a very rare community in Pictured Rocks.

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:S3S4

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

Pictured Rocks National Lakeshore Inventory Notes:

Pictured Rocks National Lakeshore Plots: PIRO.066, PIRO.130.

Pictured Rocks National Lakeshore Map Code: FSS, FTS

Local Description Authors: M.J. Russo

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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, Farrand and Bell 1982, Fike 1999, Gawler 2002, Glaser 1992b, Harris et al. 1996, Janssen 1967, Kurmis et al. 1986, MNNHP 1993, Midwestern Ecology Working Group n.d., Sims et al. 1989, Sperduto 2000b, Thompson 1996, Thompson and Sorenson 2000, WNHIP unpubl. data, Zoladeski et al. 1995

G051. Tamarack - Conifer Alkaline Swamp

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.a)
Macrogroup	Central & Eastern Boreal Flooded & Swamp Forest (MG038)
Group	Tamarack - Conifer Alkaline Swamp (G051)
Association (Common name)	White-cedar - (Mixed Conifer) / Alder Swamp
Ecological System(s):	Laurentian-Acadian Alkaline Conifer-Hardwood Swamp (CES201.575)
	Great Lakes Wooded Dune and Swale (CES201.726)

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 goose neck 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

Pictured Rocks National Lakeshore Environment: This northern white-cedar forest was sampled at nine locations in the park. Sites are all flat lowlands, basin floors, depressions and outwash plains. Soils are saturated to seasonally flooded, very poorly drained to somewhat poorly drained muck, peat, loam and clay loam. The unvegetated surface is dominated by leaf litter (70-99% cover) with some wood (1-30%), water (0-1%), and bare soil (0-1%). Evidence of animal use includes woodpecker tapping and cavities, white-throated sparrow, red squirrel warning call, bear scat, deer pellets, and tree frog. Evidence of disturbance includes altered hydrology, old logging stumps and skid trails, blowdown, and balsam fir mortality.

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

Pictured Rocks National Lakeshore Vegetation: The moderate to dense (30-80% cover) tree canopy is quite variable in height (5-35 m tall) as defined by the samplers. It is dominated by *Thuja occidentalis* (northern white-cedar) and may also include lesser amounts of *Abies balsamea* (balsam fir), *Acer rubrum* (red maple), *Betula alleghaniensis* (yellow birch), *Betula papyrifera* (paper birch), and *Picea mariana* (black spruce), among others. The moderate to dense (30-80% cover) subcanopy (5-15 m) is made up of

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canopy species along with *Acer saccharum* (sugar maple), *Acer spicatum* (mountain maple), *Alnus incana* ssp. *rugosa* (speckled alder), *Fraxinus nigra* (black ash), and *Tsuga canadensis* (eastern hemlock). The sparse to moderate (10-60%) tall-shrub layer (2-5 m) is dominated by *Abies balsamea* (balsam fir) and *Acer spicatum* (mountain maple). The sparse to very dense (20-90%) short-shrub layer (0.5-2 m) is dominated by saplings of trees from the upper layers, along with ericaceous species, including *Gaultheria hispidula* (creeping snowberry), *Gaultheria procumbens* (eastern teaberry), and *Ledum groenlandicum* (bog Labrador-tea). Other common short shrubs include *Amelanchier* (serviceberry) sp., *Amelanchier arborea* (common serviceberry), *Chamaedaphne calyculata* (leatherleaf), *Linnaea borealis* (twinflower), *Lonicera canadensis* (American fly honeysuckle), *Ribes* (currant) sp., *Rubus* (blackberry) sp., and *Sorbus decora* (northern mountain-ash). *Epigaea repens* (trailing arbutus) forms a sparse (0-5%) dwarf-shrub layer (<0.5 m). The herbaceous layer is highly variable (10-80%), with cover inversely proportional to the shrub cover. Common herbs include *Carex leptalea* (bristlystalked sedge), *Carex pedunculata* (longstalk sedge), *Carex trisperma* (threeseeded sedge), *Clintonia borealis* (bluebead), *Coptis trifolia* (threeleaf goldthread), *Galium triflorum* (fragrant bedstraw), *Goodyera oblongifolia* (western rattlesnake plantain), *Maianthemum canadense* (Canada mayflower), and *Trientalis borealis* (starflower); common ferns include *Athyrium filix-femina* (common ladyfern), *Botrychium virginianum* (rattlesnake fern), *Dryopteris carthusiana* (spinulose woodfern), *Dryopteris intermedia* (intermediate woodfern), *Gymnocarpium dryopteris* (western oakfern), and *Osmunda cinnamomea* (cinnamon fern). A total of 61 herbaceous taxa were recorded in 8 plots. Nonvascular species (mosses) cover 5-60% of the ground surface; one plot has 50% cover of *Sphagnum* (sphagnum) sp.

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 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 goose neck 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

Pictured Rocks National Lakeshore

Stratum	Lifeform	Species
Tree (canopy & subcanopy)	Needle-leaved tree	*Thuja occidentalis* (northern white-cedar)
Tree canopy	Needle-leaved tree	*Abies balsamea* (balsam fir)
Tree canopy	Broad-leaved deciduous tree	*Betula papyrifera* (paper birch)
Shrub/sapling (tall & short)	Needle-leaved shrub	*Abies balsamea* (balsam fir)
Tall shrub/sapling	Broad-leaved deciduous shrub	*Acer spicatum* (mountain maple)
Short shrub/sapling	Needle-leaved shrub	*Picea mariana* (black spruce), *Thuja occidentalis* (northern white-cedar)
Short shrub/sapling	Broad-leaved deciduous shrub	*Acer rubrum* (red maple), *Acer saccharum* (sugar maple), *Alnus incana* ssp. *rugosa* (speckled alder), *Lonicera canadensis* (American fly honeysuckle), *Sorbus decora* (northern mountain-ash)
Short shrub/sapling	Dwarf-shrub	*Gaultheria hispidula* (creeping snowberry), *Linnaea borealis* (twinflower)
Herb (field)	Forb	*Clintonia borealis* (bluebead), *Coptis trifolia* (threeleaf goldthread), *Cornus canadensis* (bunchberry dogwood), *Galium triflorum* (fragrant bedstraw), *Goodyera oblongifolia* (western rattlesnake plantain), *Maianthemum canadense* (Canada mayflower), *Mitella nuda* (naked miterwort), *Trientalis borealis* (starflower)

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Herb (field)	Graminoid	*Carex leptalea* (bristlystalked sedge), *Carex pedunculata* (longstalk sedge), *Carex trisperma* (threeseeded sedge), *Glyceria striata* (fowl mannagrass)
Herb (field)	Fern or fern ally	*Gymnocarpium dryopteris* (western oakfern)

Global Stratum	Lifeform	Species

CHARACTERISTIC SPECIES

Pictured Rocks National Lakeshore: *Abies balsamea* (balsam fir), *Acer spicatum* (mountain maple), *Betula alleghaniensis* (yellow birch), *Coptis trifolia* (threeleaf goldthread), *Cornus canadensis* (bunchberry dogwood), *Thuja occidentalis* (northern white-cedar)
Global:

OTHER NOTEWORTHY SPECIES

Pictured Rocks National Lakeshore: Exotic/Invasive: *Cirsium palustre* (marsh thistle, exotic, Medium/Low), *Streptopus amplexifolius* (claspleaf twistedstalk, exotic), *Veronica beccabunga* (european speedwell, exotic)
Global:

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
Pictured Rocks National Lakeshore Comments:
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) B
- Rich conifer swamp: cedar-(tamarack) (W32) (Harris et al. 1996) I
- Segments 7 and 8 of northern swamps (Clausen 1957) =
- White Cedar-Goldthread-Sphagnum (V38) (Chambers et al. 1997) =

OTHER COMMENTS

Other Comments:

ELEMENT DISTRIBUTION

Pictured Rocks National Lakeshore Range: This northern white-cedar - mixed conifer swamp is found throughout the park in low depressions over organic soils. It is frequent in the vicinity of Beaver Lake.
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,

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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

Pictured Rocks National Lakeshore Inventory Notes:

Pictured Rocks National Lakeshore Plots: PIRO.018, PIRO.037, PIRO.042, PIRO.044, PIRO.058, PIRO.063, PIRO.090, PIRO.119, PIRO.321.

Pictured Rocks National Lakeshore Map Code: FCS

Local Description Authors: M.J. Russo

Global Description Authors: J. Drake

References: Chambers et al. 1997, Chapman et al. 1989, Clausen 1957, Greenall 1996, Harris et al. 1996, MNNHP 1993, Midwestern Ecology Working Group n.d., Schwintzer 1981, Schwintzer and Tomberlin 1982, Sims et al. 1989, Van Deelen 1999, WNHIP unpubl. data, Wanek and Newman 1976

2. Shrubland & Grassland Vegetation

2.C.1. Temperate Grassland, Meadow & Shrubland

2.C.1.c. Eastern North American Grassland, Meadow & Shrubland

MG164. Eastern Temperate Forest Region Savanna & Barrens

G063. Eastern Shrub-Herb Sand Barrens

Bracken Grassland

***Pteridium aquilinum* - *Bromus kalmii* Herbaceous Vegetation**

Bracken Fern - Kalm's Brome Herbaceous Vegetation

Identifier: CEGL005142

NVC CLASSIFICATION

Division	Eastern North American Grassland, Meadow & Shrubland (2.C.1.c)
Macrogroup	Eastern Temperate Forest Region Savanna & Barrens (MG164)
Group	Eastern Shrub-Herb Sand Barrens (G063)
Association (Common name)	Bracken Grassland
Ecological System(s):	Laurentian Pine-Oak Barrens (CES201.718)

ELEMENT CONCEPT

Global Summary: This bracken grassland community is found in the northern Great Lakes region of the United States and adjacent Canada. Stands occur on level plains or rolling uplands and in depressions ("frost pockets") in pitted outwash topography. Soils range from loams to fine sands, and are somewhat acidic (pH 4.6). Soil characteristics vary depending on the age of the stand. Soil drainage is generally good. The vegetation is dominated by ferns and grasses. *Pteridium aquilinum* (western brackenfern) may form an almost continuous canopy of fronds. Grass dominants include *Elymus trachycaulus* (slender wheatgrass), *Bromus kalmii* (arctic brome), *Danthonia spicata* (poverty oatgrass), *Oryzopsis asperifolia* (roughleaf ricegrass), and *Poa compressa* (Canada bluegrass). Forbs of high constancy include *Anaphalis margaritacea* (western pearly everlasting), *Symphyotrichum ciliolatum* (Lindley's aster), *Fragaria virginiana* (Virginia strawberry), and *Solidago nemoralis* (gray goldenrod). Dwarf-shrubs include *Comptonia peregrina* (sweet fern) and *Vaccinium angustifolium* (lowbush blueberry). A high number of exotic or weedy species are present, including *Hieracium aurantiacum* (orange hawkweed), *Lactuca serriola* (prickly lettuce), *Phleum pratense* (timothy), *Poa compressa* (Canada bluegrass), *Poa pratensis* (Kentucky bluegrass), *Rumex acetosella* (common sheep sorrel), and *Verbascum thapsus* (common mullein).

ENVIRONMENTAL DESCRIPTION

Pictured Rocks National Lakeshore Environment: This bracken fern community was sampled twice in the park. One site is a gentle, northwest-facing midslope beach ridge at Au Sable Lighthouse, the other a moderate, southeast-facing midslope kettle surrounding Kettle Hole Lake. Soils are rapidly drained sand. The unvegetated surface is made up almost entirely of leaf litter (99-100% cover) with some wood (0-1%). During operation of the lighthouse (1880s to early 1900s), livestock grazing and gardening were probably quite prevalent and kept the area fairly bare and disturbed. Other disturbances include hiking trails, tree pathogens, past logging and fire, and the presence of exotic plants.

Global Environment: Stands occur on level plains or rolling uplands and in depressions ("frost pockets") in pitted outwash topography. Soils range from loams to fine sands and are somewhat acidic (pH 4.6). Soil characteristics vary depending on the age of the stand. Soil drainage is generally good (Curtis 1959).

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VEGETATION DESCRIPTION

Pictured Rocks National Lakeshore Vegetation: The herbaceous layer dominates this community. However, there may be a sparse (20% cover) short-shrub layer (0.5-1 m tall) that includes *Vaccinium angustifolium* (lowbush blueberry) and *Populus tremuloides* (quaking aspen). The dense (80-90%) herbaceous layer is dominated by *Pteridium aquilinum* (western brackenfern) (70-80%); also present in lesser amounts are *Carex pensylvanica* (Pennsylvania sedge), *Danthonia spicata* (poverty oatgrass), *Deschampsia flexuosa* (wavy hairgrass), *Fragaria virginiana* (Virginia strawberry), and the exotic *Rumex acetosa* (garden sorrel). Nonvascular species (*Cladina* (reindeer lichen) lichens) cover 30-80% of the ground surface.
Global Vegetation: The vegetation is dominated by ferns and grasses. *Pteridium aquilinum* (western brackenfern) may form an almost continuous canopy of fronds. Grass dominants include *Elymus trachycaulus* (slender wheatgrass), *Bromus kalmii* (arctic brome), *Danthonia spicata* (poverty oatgrass), *Oryzopsis asperifolia* (roughleaf ricegrass), and *Poa compressa* (Canada bluegrass). Forbs of high constancy include *Anaphalis margaritacea* (western pearly everlasting), *Symphyotrichum ciliolatum* (Lindley's aster), *Fragaria virginiana* (Virginia strawberry), and *Solidago nemoralis* (gray goldenrod). Dwarf-shrubs include *Comptonia peregrina* (sweet fern) and *Vaccinium angustifolium* (lowbush blueberry). A high number of exotic or weedy species are present, including *Hieracium aurantiacum* (orange hawkweed), *Lactuca serriola* (prickly lettuce), *Phleum pratense* (timothy), *Poa compressa* (Canada bluegrass), *Poa pratensis* (Kentucky bluegrass), *Rumex acetosella* (common sheep sorrel), and *Verbascum thapsus* (common mullein) (Curtis 1959).

MOST ABUNDANT SPECIES

Pictured Rocks National Lakeshore

Stratum	Lifeform	Species
Herb (field)	Graminoid	*Deschampsia flexuosa* (wavy hairgrass)
Herb (field)	Fern or fern ally	*Pteridium aquilinum* (western brackenfern)

Global

Stratum	Lifeform	Species

CHARACTERISTIC SPECIES

Pictured Rocks National Lakeshore: *Carex pensylvanica* (Pennsylvania sedge), *Pteridium aquilinum* (western brackenfern), *Vaccinium angustifolium* (lowbush blueberry)
Global:

OTHER NOTEWORTHY SPECIES

Pictured Rocks National Lakeshore: Exotic/Invasive: *Rumex acetosa* (garden sorrel, exotic)
Global: Exotic/Invasive: *Lactuca serriola* (prickly lettuce, exotic, Low/Insignificant), *Phleum pratense* (timothy, exotic, Medium), *Poa compressa* (Canada bluegrass, exotic, High/Low), *Rumex acetosella* (common sheep sorrel, exotic, Medium/Low), *Verbascum thapsus* (common mullein, exotic, Medium)

CONSERVATION STATUS RANK

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

CLASSIFICATION

Status: Standard
Classification Confidence: 2 - Moderate
Pictured Rocks National Lakeshore Comments:
Global Comments: This type may vary from natural to semi-natural, as most stands appear to have originated after clearcutting and intense burns of pine barrens, but some stands occur in frost pockets on pitted outwash plains. In Michigan this type has something of a natural analog in Dry Sand Prairies, *Schizachyrium scoparium - Danthonia spicata - Carex pensylvanica - (Viola pedata)* Herbaceous Vegetation (CEGL002318).
Global Similar Associations:
- *Schizachyrium scoparium - Carex tonsa* var. *rugosperma - Carex muehlenbergii - Lithospermum caroliniense - Opuntia humifusa* Herbaceous Vegetation (CEGL005099)--This has more of a prairie flora, but also contains a high number of exotics.
- *Schizachyrium scoparium - Danthonia spicata - Carex pensylvanica - (Viola pedata)* Herbaceous Vegetation (CEGL002318)--This has more of a prairie flora.

Global Related Concepts:
- Bracken Grassland (Curtis 1959) =
- Pine Barren (Chapman et al. 1989) B

OTHER COMMENTS

Other Comments:

ELEMENT DISTRIBUTION

Pictured Rocks National Lakeshore Range: This bracken grassland is found in old abandoned homesites, agricultural clearings, and also under early-successional aspen stands. It is found throughout the park on dry, sandy, nutrient-poor sites.
Global Range: This bracken grassland community type is found in the northern Great Lakes region of the United States and adjacent Canada, ranging from northern Wisconsin to Michigan and Ontario.

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Nations: CA, US
States/Provinces: MI, NY, ON, QC:S4, WI
TNC Ecoregions: 47:C, 48:C, 61:C
USFS Ecoregions (1994/95): 212Hb:CCP, 212Hi:CCC, 212Ho:CCC, 212Hw:CCC, 212Jj:CCP, 212Jk:CCC, 212Jm:CCC, 212Ka:CPP, 221Bc:CCC
Federal Lands: NPS (Pictured Rocks, Saratoga, Sleeping Bear Dunes); USFS (Chequamegon, Chequamegon-Nicolet, Nicolet)

ELEMENT SOURCES

Pictured Rocks National Lakeshore Inventory Notes:
Pictured Rocks National Lakeshore Plots: PIRO.075, PIRO.099.
Pictured Rocks National Lakeshore Map Code: HBF
Local Description Authors: M.J. Russo
Global Description Authors: D. Faber-Langendoen
References: Chapman et al. 1989, Curtis 1959, Midwestern Ecology Working Group n.d., NRCS 2004, WNHIP unpubl. data

2.C.2. Boreal Grassland, Meadow & Shrubland

2.C.2.a. North American Boreal Grassland, Meadow & Shrubland

MG055. North American Boreal Shrubland & Grassland

G339. Eastern North American Boreal Shrubland

Thimbleberry Shrubland

***Rubus parviflorus* Shrubland [Provisional]**
Thimbleberry Shrubland
Identifier: CEGL005248

NVC CLASSIFICATION

Division	North American Boreal Grassland, Meadow & Shrubland (2.C.2.a)
Macrogroup	North American Boreal Shrubland & Grassland (MG055)
Group	Eastern North American Boreal Shrubland (G339)
Association (Common name)	Thimbleberry Shrubland
Ecological System(s):	

ELEMENT CONCEPT

Global Summary: This thimbleberry shrubland occurs on Isle Royale, Michigan, and perhaps more widely in the boreal regions of the upper midwestern United States and Canada. At Isle Royale, stands occupy gentle to moderate slopes at fairly low elevations (190-230 m [620-750 feet]). It seems to be a short-lived successional stage following disturbance by burning or clearing. The vegetation forms a deciduous shrubland. There may be a sparse tree layer with 10-20% cover; the most common trees are *Betula papyrifera* (paper birch), *Picea glauca* (white spruce), and *Populus tremuloides* (quaking aspen). A tall-shrub layer may be present, and cover of tall shrubs varies from 0-40%; the most abundant tall shrubs are saplings or browsed scrub of *Abies balsamea* (balsam fir). The short-shrub layer (including dwarf-shrubs) has from 40-80% cover; *Rubus parviflorus* (thimbleberry) is the most abundant shrub (usually 25-50% cover). *Rubus idaeus* (American red raspberry) may also be present. Cover of the herbaceous layer varies from 20-90% cover; the most abundant herbs are *Aralia nudicaulis* (wild sarsaparilla), *Streptopus lanceolatus* (twistedstalk), *Eurybia macrophylla* (bigleaf aster), *Clintonia borealis* (bluebead), *Equisetum arvense* (field horsetail), *Galium triflorum* (fragrant bedstraw), *Gymnocarpium dryopteris* (western oakfern), and *Linnaea borealis* (twinflower). There may be up to about 10% cover of lichens. This shrubland seems to be a successional type following disturbance (for example, disturbance by fire or clearing) that will develop into a mixed or deciduous woodland or forest. Standing dead snags of *Betula papyrifera* (paper birch) are common in several examples.

ENVIRONMENTAL DESCRIPTION

Pictured Rocks National Lakeshore Environment: This thimbleberry shrubland was sampled once in the park. The site is located at the southernmost part of series of artificial openings above sandstone cliffs. The soil is well-drained loamy sand. Surficial geology is end moraines of medium-textured till (Farrand and Bell 1982). The unvegetated surface is made up entirely of leaf litter (100% cover). Evidence of disturbance includes past logging and trampling of the vegetation, possibly by bear.
Global Environment: At Isle Royale National Park, this community occupies gentle to moderate slopes at fairly low elevations (from 190-230 m [620-750 feet]) (C. Reschke pers. comm. 1999).

VEGETATION DESCRIPTION

Pictured Rocks National Lakeshore Vegetation: This extremely simple community is comprised of only two species: *Rubus parviflorus* (thimbleberry) (97% cover) in the short-shrub layer and *Allium tricoccum* (wild leek) in the herbaceous layer.
Global Vegetation: At Isle Royale National Park, thimbleberry shrubland is a deciduous shrubland. There may be a sparse tree layer with 10-20% cover; the most common trees are *Betula papyrifera* (paper birch), *Picea glauca* (white spruce), and *Populus tremuloides* (quaking aspen). A tall-shrub layer may be present, and cover of tall shrubs varies from 0-40%; the most abundant tall shrubs are

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saplings or browsed scrub of *Abies balsamea* (balsam fir). The short-shrub layer (including dwarf-shrubs) has from 40-80% cover; *Rubus parviflorus* (thimbleberry) is the most abundant shrub (usually 25-50% cover); *Rubus idaeus* (American red raspberry) may also be present. Cover of the herbaceous layer varies from 20-90% cover; the most abundant herbs are *Aralia nudicaulis* (wild sarsaparilla), *Streptopus lanceolatus* (twistedstalk), *Eurybia macrophylla* (bigleaf aster), *Clintonia borealis* (bluebead), *Equisetum arvense* (field horsetail), *Galium triflorum* (fragrant bedstraw), *Gymnocarpium dryopteris* (western oakfern), and *Linnaea borealis* (twinflower). There may be up to about 10% cover of lichens. This shrubland seems to be a successional type following disturbance (for example, disturbance by fire or clearing) that will develop into a mixed or deciduous woodland or forest. Standing dead snags of *Betula papyrifera* (paper birch) are common in several examples (C. Reschke pers. comm. 1999).

MOST ABUNDANT SPECIES

Pictured Rocks National Lakeshore

Stratum	Lifeform	Species
Short shrub/sapling	Broad-leaved deciduous shrub	*Rubus parviflorus* (thimbleberry)

Global

Stratum	Lifeform	Species

CHARACTERISTIC SPECIES

Pictured Rocks National Lakeshore: *Rubus parviflorus* (thimbleberry)
Global:

OTHER NOTEWORTHY SPECIES

Pictured Rocks National Lakeshore:
Global:

CONSERVATION STATUS RANK

Global Rank & Reasons: GNR (1-Dec-1997).

CLASSIFICATION

Status: Provisional
Classification Confidence: 3 - Weak
Pictured Rocks National Lakeshore Comments:
Global Comments: Type concept is taken from studies on Isle Royale and needs rangewide review.
Global Related Concepts:
- Boreal Shrubland (Chapman et al. 1989) ?

OTHER COMMENTS

Other Comments:

ELEMENT DISTRIBUTION

Pictured Rocks National Lakeshore Range: This thimbleberry shrubland may be the result of anthropogenic disturbance. It is found above Miners Beach parking lot near Potato Patch Campground at an abandoned agricultural clearing or homestead. This is the only location found in the park, although thimbleberry is infrequently associated with other types.
Global Range: This thimbleberry shrubland occurs on Isle Royale, Michigan, and perhaps more widely in the boreal regions of the upper midwestern United States and Canada.
Nations: CA?, US
States/Provinces: MI, ON?
TNC Ecoregions: 48:C
USFS Ecoregions (1994/95): 212Hi:CCC, 212Ib:CCC
Federal Lands: NPS (Isle Royale, Pictured Rocks)

ELEMENT SOURCES

Pictured Rocks National Lakeshore Inventory Notes:
Pictured Rocks National Lakeshore Plots: PIRO.107.
Pictured Rocks National Lakeshore Map Code: N/A
Local Description Authors: M.J. Russo
Global Description Authors: D. Faber-Langendoen
References: Chapman et al. 1989, Farrand and Bell 1982, Midwestern Ecology Working Group n.d., Reschke pers. comm.

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2.C.3. Temperate & Boreal Scrub & Herb Coastal Vegetation

2.C.3.a. Eastern North American Coastal Grassland & Shrubland

MG057. Eastern North American Coastal Grassland & Shrubland

G089. Great Lakes Coast Grassland & Shrubland

Great Lakes Beachgrass Dune

***Ammophila breviligulata* - *(Schizachyrium scoparium)* Herbaceous Vegetation**
American Beachgrass - (Little Bluestem) Herbaceous Vegetation
Identifier: CEGL005098

NVC CLASSIFICATION

Division	Eastern North American Coastal Grassland & Shrubland (2.C.3.a)
Macrogroup	Eastern North American Coastal Grassland & Shrubland (MG057)
Group	Great Lakes Coast Grassland & Shrubland (G089)
Association (Common name)	Great Lakes Beachgrass Dune
Ecological System(s):	Great Lakes Dune (CES201.026)
	Great Lakes Wooded Dune and Swale (CES201.726)

ELEMENT CONCEPT

Global Summary: This beachgrass dune community occurs along the Great Lakes shores region of the United States and Canada on stabilized foredunes. Component plant communities vary from sparsely vegetated, active dunes to communities dominated by grasses, shrubs, and trees, depending on the degree of sand deposition, sand erosion, and distance from the lake. Depositional areas, where Great Lakes beachgrass foredunes are found, are dominated by *Ammophila breviligulata* (American beachgrass) (or in the eastern part of the range *Ammophila champlainensis* (Champlain beachgrass)); erosional areas, such as slacks in blowouts and dune fields, by *Calamovilfa longifolia* (prairie sandreed); and stabilized areas by *Schizachyrium scoparium* (little bluestem). In dune fields and on the most stable dune ridges, especially around northern Lake Michigan and Lake Huron, low evergreen shrubs (*Arctostaphylos uva-ursi* (kinnikinnick), *Juniperus communis* (common juniper), *Juniperus horizontalis* (creeping juniper)) occupy dune crests and also the ground layer in the savanna edge of dunes; elsewhere, deciduous shrubs are dominant, including *Prunus pumila* (sandcherry), *Salix cordata* (heartleaf willow) and *Salix myricoides* (bayberry willow). These two shrubby phases are separated from this open grassland type, but could be treated as phases of this type.

ENVIRONMENTAL DESCRIPTION

Pictured Rocks National Lakeshore Environment: This common beachgrass dune community was sampled at nine locations in the park. Sites range from somewhat steep, west-facing dune summits and kame terraces, to moderate to gentle north- and northwest-facing shoreline, to flat to moderate west- and south-facing transverse dunes. Soils are rapidly drained sand. Surficial geology is lacustrine sand and gravel and coarse-textured glacial till (Farrand and Bell 1982). The unvegetated surface is highly variable with leaf litter (0-99% cover), large rocks (0-1%), small rocks (0-33%), bare sand (1-100%), and wood (0-12%). Evidence of disturbance includes hiking trails and human litter, exotic species, driftwood, wind, wave action (erosion), damage from winter storms and shore ice buildup, and lake currents.

Global Environment: Environmental processes include sand deposition, sand erosion, and stabilization. They are affected by the distance from the lake. Three sets of environmental habitats can be identified: depositional areas, erosional areas such as slacks in blowouts, and stabilized dune fields.

VEGETATION DESCRIPTION

Pictured Rocks National Lakeshore Vegetation: The very sparse to moderate (0-60%) short-shrub layer (0.5-1 m) is dominated by *Prunus pumila* (sandcherry) and may include saplings of *Acer* (maple) spp., *Betula papyrifera* (paper birch), *Pinus* (pine) spp., *Salix* (willow) spp., and *Populus balsamifera* (balsam poplar) along with *Hudsonia tomentosa* (woolly beach-heather), *Juniperus communis* (common juniper), *Vaccinium angustifolium* (lowbush blueberry), and *Vaccinium myrtilloides* (velvetleaf huckleberry). The highly variable (5-90%) herbaceous layer is dominated by *Ammophila breviligulata* (American beachgrass) (up to 80%); other common taxa include *Artemisia campestris* (field sagewort), *Fragaria virginiana* (Virginia strawberry), *Lathyrus japonicus* (beach pea), *Oenothera oakesiana* (Oakes' evening-primrose), and *Schizachyrium scoparium* (little bluestem). A total of 32 herbs were recorded from 9 plots. Nonvascular species (mosses and lichens) cover 0-100% of the ground surface. This community also supports globally and state-vulnerable *Cirsium pitcheri* (sand dune thistle), state-imperiled *Stellaria longipes* (longstalk starwort), and state-vulnerable *Tanacetum bipinnatum* ssp. *huronense* (Lake Huron tansy).

Global Vegetation: Component plant communities vary from sparsely vegetated, active dunes to communities dominated by grasses, shrubs, and trees, depending on the degree of sand deposition, sand erosion, and distance from the lake. Depositional areas, where Great Lakes beachgrass foredunes are found, are dominated by *Ammophila breviligulata; erosional areas, such as slacks in blowouts and dune fields, by Calamovilfa longifolia*; and stabilized areas by *Schizachyrium scoparium* (little bluestem). In dune fields and on the most stable dune ridges, especially around northern Lake Michigan and Huron, low evergreen shrubs (*Arctostaphylos uva-ursi* (kinnikinnick), *Juniperus communis* (common juniper), *Juniperus horizontalis* (creeping juniper)) occupy dune crests and also the

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ground layer in the savanna edge of dunes; elsewhere, deciduous shrubs are dominant, including *Prunus pumila* (sandcherry), *Salix cordata* (heartleaf willow) and *Salix myricoides* (bayberry willow). These two shrubby phases are separated from this open grassland type, but could be treated as phases of this type.

MOST ABUNDANT SPECIES

Pictured Rocks National Lakeshore

Stratum	Lifeform	Species
Short shrub/sapling	Broad-leaved deciduous shrub	*Prunus pumila* (sandcherry)
Herb (field)	Forb	*Artemisia campestris* (field sagewort), *Lathyrus japonicus* (beach pea), *Lithospermum caroliniense* (Carolina puccoon), *Maianthemum stellatum* (starry false lily of the valley), *Oenothera oakesiana* (Oakes' evening-primrose), *Rumex acetosella* (common sheep sorrel)
Herb (field)	Graminoid	*Ammophila breviligulata* (American beachgrass), *Festuca saximontana* (Rocky Mountain fescue), *Schizachyrium scoparium* (little bluestem)

Global

Stratum	Lifeform	Species

CHARACTERISTIC SPECIES

Pictured Rocks National Lakeshore: *Ammophila breviligulata* (American beachgrass), *Artemisia campestris* (field sagewort), *Festuca saximontana* (Rocky Mountain fescue), *Lathyrus japonicus* (beach pea), *Prunus pumila* (sandcherry)
Global:

OTHER NOTEWORTHY SPECIES

Pictured Rocks National Lakeshore: Vulnerable: *Cirsium pitcheri* (sand dune thistle, globally and state-vulnerable, G3), *Stellaria longipes* (longstalk starwort, state-imperiled, G5), *Tanacetum bipinnatum* ssp. *huronense* (Lake Huron tansy, state-vulnerable, G5T4T5); **Exotic/Invasive**: *Artemisia absinthium* (absinthium, exotic, Low), *Centaurea biebersteinii* (spotted knapweed, exotic, High/Medium), *Elymus repens* (quackgrass, exotic, High/Medium), *Hieracium piloselloides* (tall hawkweed, exotic, Medium/Insignificant), *Poa pratensis* (Kentucky bluegrass, exotic, Medium), *Rumex acetosella* (common sheep sorrel, exotic, Medium/Low)
Global: Vulnerable: *Cirsium pitcheri* (sand dune thistle, Federally listed threatened; restricted to Great Lakes beach-grass/sparse foredunes and adjacent dune fields, G3)

CONSERVATION STATUS RANK

Global Rank & Reasons: G3G5 (3-Oct-1996).

CLASSIFICATION

Status: Standard
Classification Confidence: 2 - Moderate
Pictured Rocks National Lakeshore Comments:
Global Comments: Perhaps 25-35% of Great Lakes dune species grow in maritime dunes (e.g., *Cakile edentula* (American searocket), *Ammophila breviligulata* (American beachgrass), *Hudsonia tomentosa* (woolly beach-heather), *Lathyrus japonicus* var. *maritimus* (beach pea)), but the many western species (such as *Schizachyrium scoparium* (little bluestem)) set Great Lakes dunes apart (as do its endemic plants, such as *Cirsium pitcheri* (sand dune thistle)). In Vermont (Lake Champlain) and New York (eastern Lake Ontario) the dunes apparently contain *Ammophila champlainensis* (Champlain beachgrass) instead of *Ammophila breviligulata* (American beachgrass). This type is linked in complexes with *Juniperus horizontalis - Arctostaphylos uva-ursi - Juniperus communis* Dune Dwarf-shrubland (CEGL005064) and *Prunus pumila - (Ptelea trifoliata*) Dune Shrubland (CEGL005075), which could be treated together as a single association, or treated as a complex open dune type. The sparsely vegetated parts of the dune are included in this association (old CEGL005161).
Global Similar Associations:
- *Cakile edentula* Great Lakes Shore Sparse Vegetation (CEGL005162)
- *Hudsonia tomentosa* Dune Dwarf-shrubland (CEGL004024)
- *Juniperus horizontalis - Arctostaphylos uva-ursi - Juniperus communis* Dune Dwarf-shrubland (CEGL005064)
- *Prunus pumila - (Ptelea trifoliata)* Dune Shrubland (CEGL005075)

Global Related Concepts:
- Lacustrine, Littoral, Unconsolidated Sand Shore, Intermittently Flooded (L2US2) (Cowardin et al. 1979) ?
- Lake Sand Beach (Thompson 1996) B
- Sand Dune Community (Thompson 1996) B

OTHER COMMENTS

Other Comments:

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ELEMENT DISTRIBUTION

Pictured Rocks National Lakeshore Range: This common beachgrass community occurs throughout the park along the lakeshore and foredunes.
Global Range: This community occurs along the Great Lakes shores of the United States and Canada on stabilized foredunes, ranging from Wisconsin to Ontario and New York in the Great Lakes, and in isolated occurrences along the shores of Lake Champlain, Vermont.
Nations: CA, US
States/Provinces: IL, IN, MI, NY, ON, VT, WI:S2?
TNC Ecoregions: 48:C, 64:C
USFS Ecoregions (1994/95): 212Hd:CCC, 212He:CCC, 212Hi:CCC, 212Hj:CCC, 212Hl:CCC, 212Hm:CCP, 212Hn:CCC, 212Ho:CCC, 212Hr:CCP, 212Hw:CCC, 212Hx:CCC, 212Ia:CCC, 212Ja:CCC, 212Oa:CCC, 212Ob:CCC, 212Pa:CCC, 221E:CC, 222Ja:CCC, 222Jj:CCC, 222Kg:CCC
Federal Lands: NPS (Apostle Islands, Indiana Dunes, Pictured Rocks, Sleeping Bear Dunes); USFS (Hiawatha, Huron, Huron-Manistee?, Manistee?)

ELEMENT SOURCES

Pictured Rocks National Lakeshore Inventory Notes:
Pictured Rocks National Lakeshore Plots: PIRO.003, PIRO.022, PIRO.032, PIRO.052, PIRO.108, PIRO.113, PIRO.116, PIRO.117, PIRO.131.
Pictured Rocks National Lakeshore Map Code: HAB
Local Description Authors: M.J. Russo
Global Description Authors: P. Comer
References: Cowardin et al. 1979, Farrand and Bell 1982, Midwestern Ecology Working Group n.d., Thompson 1996, Thompson and Sorenson 2000, WNHIP unpubl. data

Great Lakes Beach-heather Dune Dwarf-shrubland

***Hudsonia tomentosa* Dune Dwarf-shrubland**
Woolly Beach-heather Dune Dwarf-shrubland
Identifier: CEGL004024

NVC CLASSIFICATION

Division	Eastern North American Coastal Grassland & Shrubland (2.C.3.a)
Macrogroup	Eastern North American Coastal Grassland & Shrubland (MG057)
Group	Great Lakes Coast Grassland & Shrubland (G089)
Association (Common name)	Great Lakes Beach-heather Dune Dwarf-shrubland
Ecological System(s):	Great Lakes Wooded Dune and Swale (CES201.726)

ELEMENT CONCEPT

Global Summary: This dwarf_shrubland is found in the Great Lakes region of the United States. Stands occur on gently to moderately sloping dunes (dune-swale complex) and sandplains with rapidly drained sand soil. This unique community likely occurs because of the protection by the dunes from north winds and the slightly elevated location on low to midslopes. The slight slope and protection from the wind limit erosion and allow a stable surface for vegetation (versus the shifting sands of the higher dunes). This community is dominated by *Hudsonia tomentosa* (woolly beach-heather), which can often occur in monotypic stands. A very sparse taller shrub layer with species such as *Pinus banksiana* (jack pine), *Populus balsamifera* (balsam poplar), and *Salix interior* (sandbar willow) may be present. The sparse herbaceous layer includes *Ammophila breviligulata* (American beachgrass), *Deschampsia flexuosa* (wavy hairgrass), and *Maianthemum stellatum* (starry false lily of the valley).

ENVIRONMENTAL DESCRIPTION

Pictured Rocks National Lakeshore Environment: This dwarf-shrub dune community was sampled four times on Grand Sable Dunes and once at Sand Point. The sites are gentle to moderate lower to midslopes of dune-and-swale complexes with rapidly drained sand. The unvegetated surface is made up of leaf litter (30-100% cover) and bare sand/soil (0-60%).
Global Environment: This community consists of sandy or dunal areas dominated by *Hudsonia tomentosa* (woolly beach-heather). It is largely confined to the low and midslope areas of Great Lakes dunes. Stands often contain a cryptobiotic crust on the soil.

VEGETATION DESCRIPTION

Pictured Rocks National Lakeshore Vegetation: This community is defined by the sparse to moderately dense (5-70% cover) dwarf-shrub layer (<0.5 m tall) of *Hudsonia tomentosa* (woolly beach-heather). There may also be a very sparse (5-10%) emergent shrub layer (2-5 m) that includes *Pinus banksiana* (jack pine); sparse cover (0-20%) of short shrubs (0.5-1 m), when present, includes *Pinus banksiana* (jack pine), *Populus balsamifera* (balsam poplar), and *Salix interior* (sandbar willow). The sparse herbaceous layer (5-40%) includes *Ammophila breviligulata* (American beachgrass), *Deschampsia flexuosa* (wavy hairgrass), and *Maianthemum stellatum* (starry false lily of the valley). In addition, this community supports state-vulnerable *Cirsium pitcheri* (sand dune thistle) and *Tanacetum bipinnatum* ssp. *huronense* (Lake Huron tansy). Nonvascular species (mosses and lichens), including *Cladonia cristatella* (cup lichen), *Cladonia* (cup lichen) sp., and *Cladina rangiferina* (greygreen reindeer lichen), cover up to 50% of the ground surface.

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Global Vegetation: This community is dominated by a sparse to moderately dense (25-80% cover), often monotypic, dwarf-shrub layer of *Hudsonia tomentosa* (woolly beach-heather). There may also be a very sparse tall-shrub layer and sparse cover of short shrubs. When present, these include *Pinus banksiana* (jack pine), *Populus balsamifera* (balsam poplar), and *Salix interior* (sandbar willow). The sparse herbaceous layer includes *Ammophila breviligulata* (American beachgrass), *Deschampsia flexuosa* (wavy hairgrass), and *Maianthemum stellatum* (starry false lily of the valley). In addition, this community supports Michigan state-vulnerable *Cirsium pitcheri* (sand dune thistle) and *Tanacetum bipinnatum* ssp. *huronense* (Lake Huron tansy). Nonvascular species (mosses and lichens), including *Cladonia* (cup lichen) sp., and *Cladina rangiferina* (greygreen reindeer lichen), cover up to 50% of the ground surface.

MOST ABUNDANT SPECIES

Pictured Rocks National Lakeshore

Stratum	Lifeform	Species
Tall shrub/sapling	Needle-leaved shrub	*Pinus banksiana* (jack pine)
Herb (field)	Dwarf-shrub	*Hudsonia tomentosa* (woolly beach-heather)
Herb (field)	Forb	*Lathyrus japonicus* (beach pea)
Herb (field)	Graminoid	*Ammophila breviligulata* (American beachgrass)
Nonvascular	Lichen	*Cladina rangiferina* (greygreen reindeer lichen)

Global

Stratum	Lifeform	Species
Short shrub/sapling	Dwarf-shrub	*Hudsonia tomentosa* (woolly beach-heather)

CHARACTERISTIC SPECIES

Pictured Rocks National Lakeshore: *Ammophila breviligulata* (American beachgrass), *Hudsonia tomentosa* (woolly beach-heather)
Global: *Hudsonia tomentosa* (woolly beach-heather)

OTHER NOTEWORTHY SPECIES

Pictured Rocks National Lakeshore: Vulnerable: *Cirsium pitcheri* (sand dune thistle, globally and state-vulnerable, G3), *Tanacetum bipinnatum* ssp. *huronense* (Lake Huron tansy, state-vulnerable, G5T4T5)
Global:

CONSERVATION STATUS RANK

Global Rank & Reasons: GNR (29-May-2008).

CLASSIFICATION

Status: Standard
Classification Confidence: 2 - Moderate
Pictured Rocks National Lakeshore Comments:
Global Comments: This association is temporarily placed in an alliance found along the North Atlantic Coastal Plain. It may need to be moved to another alliance based on revisions to the NVC such that it occurs within a Great Lakes dunal group.
Global Similar Associations:

- *Ammophila breviligulata - (Schizachyrium scoparium)* Herbaceous Vegetation (CEGL005098)
- *Hudsonia tomentosa - Arctostaphylos uva-ursi* Dwarf-shrubland (CEGL006143)
- *Hudsonia tomentosa - Lupinus perennis* Dwarf-shrubland (CEGL006233)
- *Hudsonia tomentosa - Paronychia argyrocoma* Dwarf-shrubland (CEGL006232)
- *Hudsonia tomentosa / Panicum amarum* var. *amarulum* Dwarf-shrubland (CEGL003950)
- *Juniperus horizontalis - Arctostaphylos uva-ursi - Juniperus communis* Dune Dwarf-shrubland (CEGL005064)
- *Prunus pumila - (Ptelea trifoliata)* Dune Shrubland (CEGL005075)

Global Related Concepts:

OTHER COMMENTS

Other Comments:

ELEMENT DISTRIBUTION

Pictured Rocks National Lakeshore Range:
Global Range: This community is found along dunes and sandplains throughout the northern Great Lakes.
Nations: US
States/Provinces: MI, WI
TNC Ecoregions: 48:C
USFS Ecoregions (1994/95): 212Hi:CCC, 212Ia:CCC
Federal Lands: NPS (Apostle Islands, Pictured Rocks)

ELEMENT SOURCES

Pictured Rocks National Lakeshore Inventory Notes:
Pictured Rocks National Lakeshore Plots: PIRO.004, PIRO.008, PIRO.050, PIRO.457, PIRO.474.

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Pictured Rocks National Lakeshore Map Code: DBH
Local Description Authors: M.J. Russo
Global Description Authors: S.E. Menard
References: Midwestern Ecology Working Group n.d.

Great Lakes Juniper Dune Shrubland

***Juniperus horizontalis - Arctostaphylos uva-ursi - Juniperus communis* Dune Dwarf-shrubland**
Creeping Juniper - Kinnikinnick or Bearberry - Common Juniper Dune Dwarf-shrubland
Identifier: CEGL005064

NVC CLASSIFICATION

Division	Eastern North American Coastal Grassland & Shrubland (2.C.3.a)
Macrogroup	Eastern North American Coastal Grassland & Shrubland (MG057)
Group	Great Lakes Coast Grassland & Shrubland (G089)
Association (Common name)	Great Lakes Juniper Dune Shrubland
Ecological System(s):	Great Lakes Dune (CES201.026)
	Great Lakes Wooded Dune and Swale (CES201.726)

ELEMENT CONCEPT

Global Summary: This dwarf-shrub dune community is found throughout the western Great Lakes region of the United States and Canada. Stands are found on flat-topped, windswept, stabilized dunes. The dwarf-shrubs form an open to closed mat layer. Dominant shrubs include *Arctostaphylos uva-ursi* (kinnikinnick), *Juniperus communis* (common juniper), and *Juniperus horizontalis* (creeping juniper). *Hudsonia tomentosa* (woolly beach-heather) may also be present, along with a variety of other deciduous shrubs. *Ammophila breviligulata* (American beachgrass) and *Schizachyrium scoparium* (little bluestem) are among the herbaceous species found here.

ENVIRONMENTAL DESCRIPTION

Pictured Rocks National Lakeshore Environment: This dwarf-shrub dune community was sampled at two locations in the park. Sites are moderately sloping blowouts with western to variable aspects. Soils are rapidly drained sand, and surficial geology is coarse-textured glacial till (Farrand and Bell 1982). The unvegetated surface is almost entirely bare sand (97-98% cover) with some leaf litter (2-3%). Evidence of disturbance includes the presence of invasive species and impacts from wind and rain.
Global Environment: Stands are found on flat-topped, windswept, stabilized dunes.

VEGETATION DESCRIPTION

Pictured Rocks National Lakeshore Vegetation: The sparse (5-20% cover) short-shrub layer (1-2 m tall) is dominated by *Betula papyrifera* (paper birch) (20%) with lesser amounts of *Picea glauca* (white spruce), *Populus balsamifera* (balsam poplar), *Prunus pumila* (sandcherry), *Salix cordata* (heartleaf willow), and *Salix exigua* (narrowleaf willow). *Arctostaphylos uva-ursi* (kinnikinnick) forms a moderate (40%) dwarf-shrub layer. The sparse to moderate (10-50%) herbaceous layer is dominated by *Schizachyrium scoparium* (little bluestem) (20-30%); other common species include *Agrostis hyemalis* (winter bentgrass), *Ammophila breviligulata* (American beachgrass), *Artemisia campestris* (field sagewort), *Elymus trachycaulus* (slender wheatgrass), *Festuca saximontana* (Rocky Mountain fescue), *Fragaria virginiana* (Virginia strawberry), *Lithospermum caroliniense* (Carolina puccoon), *Solidago hispida* (hairy goldenrod), and several invasive exotic species. Globally and state-vulnerable *Cirsium pitcheri* (sand dune thistle) and state-vulnerable *Tanacetum bipinnatum* ssp. *huronense* (Lake Huron tansy) were also found. Nonvascular species (mosses and lichens) are not present.
Global Vegetation: The dwarf-shrubs form an open to closed mat layer. Dominant shrubs include *Arctostaphylos uva-ursi* (kinnikinnick), *Juniperus communis* (common juniper), and *Juniperus horizontalis* (creeping juniper). *Hudsonia tomentosa* (woolly beach-heather) may also be present, along with a variety of other deciduous shrubs. *Ammophila breviligulata* (American beachgrass) and *Schizachyrium scoparium* (little bluestem) are among the herbaceous species found here (Curtis 1959, especially plates 61 and 62, White and Madany 1978, Bakowsky and Lee 1996).

MOST ABUNDANT SPECIES

Pictured Rocks National Lakeshore

Stratum	Lifeform	Species
Short shrub/sapling	Broad-leaved deciduous shrub	*Prunus pumila* (sandcherry)
Short shrub/sapling	Dwarf-shrub	*Arctostaphylos uva-ursi* (kinnikinnick)
Herb (field)	Forb	*Artemisia campestris* (field sagewort), *Lithospermum caroliniense* (Carolina puccoon), *Solidago hispida* (hairy goldenrod), *Tanacetum bipinnatum* ssp. *huronense* (Lake Huron tansy)
Herb (field)	Graminoid	*Agrostis hyemalis* (winter bentgrass), *Ammophila breviligulata* (American beachgrass), *Elymus trachycaulus* (slender wheatgrass), *Festuca saximontana* (Rocky Mountain fescue), *Schizachyrium scoparium* (little bluestem)

Global

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Stratum **Lifeform** **Species**

CHARACTERISTIC SPECIES

Pictured Rocks National Lakeshore: *Arctostaphylos uva-ursi* (kinnikinnick), *Betula papyrifera* (paper birch), *Cirsium pitcheri* (sand dune thistle), *Festuca saximontana* (Rocky Mountain fescue), *Schizachyrium scoparium* (little bluestem)
Global:

OTHER NOTEWORTHY SPECIES

Pictured Rocks National Lakeshore: Vulnerable: *Cirsium pitcheri* (sand dune thistle, globally and state-vulnerable, G3), *Tanacetum bipinnatum* ssp. *huronense* (Lake Huron tansy, state-vulnerable, G5T4T5); **Exotic/Invasive**: *Agrostis gigantea* (redtop, exotic, Medium/Low), *Taraxacum officinale* (common dandelion, exotic), *Trifolium pratense* (red clover, exotic, Low/Insignificant)
Global: Vulnerable: *Cirsium pitcheri* (sand dune thistle, Federally listed threatened, G3)

CONSERVATION STATUS RANK

Global Rank & Reasons: G3G4 (24-Oct-2002). This dwarf-shrub dune community has a moderately wide range, being found throughout dune areas of the western Great Lakes region of the United States and Canada. But the dune habitat, per se, is of very limited area. Few Element Occurrences have been documented for this type, partly because it has often been treated as part of a larger dune grassland type. Sites where the type is expected are often under some form of protection. The type is susceptible to natural or human-caused disturbances that may cause dune "blow-outs."

CLASSIFICATION

Status: Standard
Classification Confidence: 2 - Moderate
Pictured Rocks National Lakeshore Comments:
Global Comments: Type is dominated by evergreen shrubs. Deciduous stands dominated by willows are placed in *Prunus pumila - (Ptelea trifoliata)* Dune Shrubland (CEGL005075). This type may be a minor component of other vegetation types, such as *Ammophila breviligulata - (Schizachyrium scoparium)* Herbaceous Vegetation (CEGL005098), or the Great Lakes Pine Barrens, *Pinus banksiana - (Pinus resinosa) - Pinus strobus / Juniperus horizontalis* Wooded Herbaceous Vegetation (CEGL005125), and it could conceivably be treated as a phase of CEGL005098.
Global Similar Associations:
- *Ammophila breviligulata - (Schizachyrium scoparium)* Herbaceous Vegetation (CEGL005098)
- *Hudsonia tomentosa* Dune Dwarf-shrubland (CEGL004024)
- *Pinus banksiana - (Pinus resinosa) - Pinus strobus / Juniperus horizontalis* Wooded Herbaceous Vegetation (CEGL005125)
- *Prunus pumila - (Ptelea trifoliata)* Dune Shrubland (CEGL005075)

Global Related Concepts:
- Open Dune (Chapman et al. 1989) B

OTHER COMMENTS

Other Comments:

ELEMENT DISTRIBUTION

Pictured Rocks National Lakeshore Range: This dwarf-shrub dune community occurs at Grand Sable Dunes. It is located in stabilized dune areas furthest away from the lake, just prior to forest transition.
Global Range: This dwarf-shrub dune community is found throughout dune areas of the western Great Lakes region of the United States and Canada, ranging from the shores of southern Michigan in Illinois, Indiana and Michigan northward to the shores of other Great Lakes, such as Lake Superior in Wisconsin.
Nations: CA, US
States/Provinces: IL, IN?, MI, ON:S2, WI
TNC Ecoregions: 48:C
USFS Ecoregions (1994/95): 212Hi:CCC, 212Ho:CCC, 212Hw:CCC, 212Ia:CCC, 212Ja:CCP, 222Kg:CCP
Federal Lands: NPS (Apostle Islands, Pictured Rocks, Sleeping Bear Dunes)

ELEMENT SOURCES

Pictured Rocks National Lakeshore Inventory Notes:
Pictured Rocks National Lakeshore Plots: PIRO.109, PIRO.110.
Pictured Rocks National Lakeshore Map Code: DJD
Local Description Authors: M.J. Russo
Global Description Authors: D. Faber-Langendoen
References: Bakowsky and Lee 1996, Chapman et al. 1989, Curtis 1959, Farrand and Bell 1982, Midwestern Ecology Working Group n.d., WNHIP unpubl. data, White and Madany 1978

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Great Lakes Coast Pine Barrens

***Pinus banksiana - (Pinus resinosa) - Pinus strobus / Juniperus horizontalis* Wooded Herbaceous Vegetation**

Jack Pine - (Red Pine) - Eastern White Pine / Creeping Juniper Wooded Herbaceous Vegetation

Identifier: CEGL005125

NVC CLASSIFICATION

Division	Eastern North American Coastal Grassland & Shrubland (2.C.3.a)
Macrogroup	Eastern North American Coastal Grassland & Shrubland (MG057)
Group	Great Lakes Coast Grassland & Shrubland (G089)
Association (Common name)	Great Lakes Coast Pine Barrens
Ecological System(s):	Great Lakes Wooded Dune and Swale (CES201.726)

ELEMENT CONCEPT

Global Summary: This pine barrens type is found in sandy areas along the Great Lakes shores of the United States and Canada. Stands occur on sands on former lake embayments and on some dune-and-swale complexes along the shores of the Great Lakes. Soils are circumneutral dry sands. Where this community occurs as part of a dune-and-swale complex it is found on the slopes and ridges of the dunes. The vegetation forms a coniferous savanna of scattered and clumped trees. Patches of bare sand are common. In the tree layer, *Pinus banksiana* (jack pine) is usually the single most abundant tree, but several other species, including *Pinus resinosa* (red pine) and *Pinus strobus* (eastern white pine) are typically present. Much of the shrub layer is composed of evergreen species, namely *Arctostaphylos uva-ursi* (kinnikinnick), *Hudsonia tomentosa* (woolly beach-heather), *Juniperus horizontalis* (creeping juniper), *Juniperus communis* (common juniper), and *Vaccinium angustifolium* (lowbush blueberry). The most abundant species of the ground layer include *Agrostis hyemalis* (winter bentgrass), *Arabis lyrata* (lyrate rockcress), *Ammophila breviligulata* (American beachgrass), *Calamovilfa longifolia* (prairie sandreed), *Danthonia spicata* (poverty oatgrass), *Deschampsia flexuosa* (wavy hairgrass), and *Toxicodendron radicans* (eastern poison-ivy). In dune-swale complexes, the swales between the dunes are often close enough to the water table to support more mesophytic, sometimes even semi-aquatic, plants. Along the shores of the Great Lakes there is often a dense low or creeping shrub layer.

ENVIRONMENTAL DESCRIPTION

Pictured Rocks National Lakeshore Environment: This jack pine - red pine forest was sampled only at seven locations in the park. Sites are generally flat to gently sloping outwash plains and dunes with rapidly drained to well-drained sand soils. The unvegetated surface is generally dominated by leaf litter (29-99% cover) with some wood (0-5%) and bare sand (0-70%). One site has 99% cover of exposed bedrock. Evidence of disturbance includes gall rust on jack pine, past fire, trails and an old roadbed, past logging (>60 years ago), and the presence of exotic species.

Global Environment: This community occurs on sandy former lake embayments and on some dune and swale complexes along the shores of the Great Lakes. Changes in the lake water levels periodically raises the water table. Soils are circumneutral (pH 6.6-7.3) dry sands (Chapman et al. 1989).

VEGETATION DESCRIPTION

Pictured Rocks National Lakeshore Vegetation: The very sparse to moderately dense (5-70% cover) tree canopy, 5-35 m tall, is dominated by *Pinus banksiana* (jack pine) or *Pinus strobus* (eastern white pine), as is the very sparse (5-20%) subcanopy (2-10 m) and the very sparse (5-10%) tall-shrub layer (2-5 m), which may also include small amounts of *Populus balsamifera* (balsam poplar) and *Betula papyrifera* (paper birch). The sparse to very dense (20-90%) short-shrub layer (0.5-1 m) is dominated by ericaceous species *Gaylussacia baccata* (black huckleberry), *Gaultheria procumbens* (eastern teaberry), and *Vaccinium angustifolium* (lowbush blueberry), along with saplings of the canopy species. *Epigaea repens* (trailing arbutus) forms a very sparse (5-10%) dwarf-shrub layer. The very sparse to dense (5-80%) herbaceous layer is dominated by *Pteridium aquilinum* (western brackenfern), *Carex pensylvanica* (Pennsylvania sedge), *Deschampsia flexuosa* (wavy hairgrass), and *Maianthemum canadense* (Canada mayflower). Nonvascular species (mostly lichens and some mosses) cover 30-90% of the ground surface; *Cladina rangiferina* (greygreen reindeer lichen) dominates.

Global Vegetation: The vegetation forms a coniferous savanna of scattered and clumped trees. Patches of bare sand are common. In the tree layer, *Pinus banksiana* (jack pine) is usually the single most abundant tree, but several other species, including *Pinus resinosa* (red pine) and *Pinus strobus* (eastern white pine) are typically present. Much of the shrub layer is composed of evergreen species, namely *Arctostaphylos uva-ursi* (kinnikinnick), *Hudsonia tomentosa* (woolly beach-heather), *Juniperus horizontalis* (creeping juniper), *Juniperus communis* (common juniper), and *Vaccinium angustifolium* (lowbush blueberry). The most abundant species of the ground layer include *Ammophila breviligulata* (American beachgrass), *Agrostis hyemalis* (winter bentgrass), *Arabis lyrata* (lyrate rockcress), *Calamovilfa longifolia* (prairie sandreed), *Danthonia spicata* (poverty oatgrass), *Deschampsia flexuosa* (wavy hairgrass), and *Toxicodendron radicans* (eastern poison-ivy). In dune-swale complexes, the swales between the dunes are often close enough to the water table to support more mesophytic, sometimes even semi-aquatic, plants. Along the shores of the Great Lakes there is often a dense low or creeping shrub layer (Chapman et al. 1989). Stunted individuals of *Quercus rubra* (northern red oak) are present in stands in Keweenaw County, MI (Chapman et al. 1989).

MOST ABUNDANT SPECIES

Pictured Rocks National Lakeshore

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Stratum	Lifeform	Species
Tree (canopy & subcanopy)	Needle-leaved tree	*Pinus banksiana* (jack pine), *Pinus strobus* (eastern white pine)
Short shrub/sapling	Broad-leaved deciduous shrub	*Gaylussacia baccata* (black huckleberry), *Vaccinium angustifolium* (lowbush blueberry)
Short shrub/sapling	Broad-leaved evergreen shrub	*Gaultheria procumbens* (eastern teaberry)
Short shrub/sapling	Dwarf-shrub	*Epigaea repens* (trailing arbutus)
Herb (field)	Forb	*Maianthemum canadense* (Canada mayflower)
Herb (field)	Graminoid	*Carex pensylvanica* (Pennsylvania sedge), *Deschampsia flexuosa* (wavy hairgrass)
Herb (field)	Fern or fern ally	*Pteridium aquilinum* (western brackenfern)

Global

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Pinus banksiana* (jack pine), *Pinus resinosa* (red pine), *Pinus strobus* (eastern white pine)
Shrub/sapling (tall & short)	Vine/Liana	*Toxicodendron radicans* (eastern poison-ivy)
Short shrub/sapling	Needle-leaved tree	*Juniperus communis* (common juniper)
Short shrub/sapling	Dwarf-shrub	*Arctostaphylos uva-ursi* (kinnikinnick), *Hudsonia tomentosa* (woolly beach-heather), *Juniperus horizontalis* (creeping juniper), *Linnaea borealis* (twinflower)
Herb (field)	Graminoid	*Ammophila breviligulata* (American beachgrass), *Calamovilfa longifolia* (prairie sandreed), *Danthonia spicata* (poverty oatgrass), *Deschampsia flexuosa* (wavy hairgrass), *Festuca saximontana* (Rocky Mountain fescue)

CHARACTERISTIC SPECIES

Pictured Rocks National Lakeshore: *Carex pensylvanica* (Pennsylvania sedge), *Gaultheria procumbens* (eastern teaberry), *Gaylussacia baccata* (black huckleberry), *Pinus banksiana* (jack pine), *Pinus strobus* (eastern white pine), *Pteridium aquilinum* (western brackenfern), *Vaccinium angustifolium* (lowbush blueberry)
Global: *Ammophila breviligulata* (American beachgrass), *Hudsonia tomentosa* (woolly beach-heather), *Juniperus horizontalis* (creeping juniper), *Pinus banksiana* (jack pine), *Pinus resinosa* (red pine), *Pinus strobus* (eastern white pine)

OTHER NOTEWORTHY SPECIES

Pictured Rocks National Lakeshore: Exotic/Invasive: *Centaurea biebersteinii* (spotted knapweed, exotic, High/Medium), *Elymus repens* (quackgrass, exotic, High/Medium), *Hypericum perforatum* (common St. Johnswort, exotic, High/Medium), *Leucanthemum vulgare* (oxeye daisy, exotic, Medium/Low), *Poa compressa* (Canada bluegrass, exotic, High/Low), *Trifolium pratense* (red clover, exotic, Low/Insignificant)
Global: Vulnerable: *Cirsium pitcheri* (sand dune thistle, Federally listed threatened; Herbaceous shoreline endemic of the western Great Lakes (Harrison 1988, Bowles et al. 1993). Has been found in this community in Michigan and has been studied by Bowles et al. (1993) in Illinois., G3)

CONSERVATION STATUS RANK

Global Rank & Reasons: G2 (22-Jun-1998). This community is restricted to the Great Lakes area and many sites have been degraded. Good occurrences are found on the Apostle Islands National Park, Wisconsin, and several others in Wisconsin could be restored (including several on Lake Michigan).

CLASSIFICATION

Status: Standard
Classification Confidence: 1 - Strong
Pictured Rocks National Lakeshore Comments:
Global Comments: In Wisconsin, this type occurs in Lake Superior on the Apostle Islands. The physiognomy of the understory is complex, containing patches of shrub, dwarf-shrub, herbaceous, and sparse vegetation. The ground layer vegetation is somewhat related to the Great Lakes Juniper Dune Shrubland type, *Juniperus horizontalis - Arctostaphylos uva-ursi - Juniperus communis* Dune Dwarf-shrubland (CEGL005064). Several stands on Lake Michigan contain a number of prairie disjuncts (E. Epstein pers. comm. 1999).
Global Similar Associations:
- *Juniperus horizontalis - Arctostaphylos uva-ursi - Juniperus communis* Dune Dwarf-shrubland (CEGL005064)
- *Pinus banksiana - (Quercus ellipsoidalis) / Schizachyrium scoparium* - Prairie Forbs Wooded Herbaceous Vegetation (CEGL002490)
- *Pinus banksiana - Pinus resinosa - Pinus strobus* Dune Forest (CEGL002589)

Global Related Concepts:
- Great Lakes Barren (Chapman et al. 1989) B

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OTHER COMMENTS

Other Comments:

ELEMENT DISTRIBUTION

Pictured Rocks National Lakeshore Range: This community is found in sandy outwash plains in the vicinity of Miners Beach and Kingston Lake. It was sampled at three locations in the vicinity of Miners Creek and Miners Lake and one location in the vicinity of Sand Point. This community may also occur as isolated pockets within the Grand Sable dunes or other dune fields.
Global Range: This pine barrens type is found along sandy areas of the Great Lakes shores in the United States and Canada, including areas in Wisconsin, Michigan, and Ontario.
Nations: CA, US
States/Provinces: IN, MI, ON, WI:S1?
TNC Ecoregions: 47:?, 48:C
USFS Ecoregions (1994/95): 212Hi:CCC, 212Hj:CCP, 212Ho:CCC, 212Hw:CCC, 212Ia:CCC, 212Ja:CPP, 212Jb:CP?, 212Jc:CP?, 212Jl:CP?, 212Jn:CP?, 212Oa:CCC, 222Jj:CCC
Federal Lands: NPS (Apostle Islands, Indiana Dunes, Pictured Rocks, Sleeping Bear Dunes); USFS (Hiawatha, Huron-Manistee, Huron?, Manistee)

ELEMENT SOURCES

Pictured Rocks National Lakeshore Inventory Notes:
Pictured Rocks National Lakeshore Plots: PIRO.002, PIRO.021, PIRO.023, PIRO.024, PIRO.103, PIRO.104, PIRO.132.
Pictured Rocks National Lakeshore Map Code: HPB, HPW
Local Description Authors: M.J. Russo
Global Description Authors: J. Drake and D. Faber-Langendoen
References: Bowles et al. 1993, Chapman et al. 1989, Harrison 1988, Midwestern Ecology Working Group n.d., WNHIP unpubl. data, Zimmerman 1956

Cottonwood Dune Open Woodland

***Populus deltoides - (Juniperus virginiana)* Dune Woodland**
Eastern Cottonwood - (Eastern Red-cedar) Dune Woodland
Identifier: CEGL005119

NVC CLASSIFICATION

Division	Eastern North American Coastal Grassland & Shrubland (2.C.3.a)
Macrogroup	Eastern North American Coastal Grassland & Shrubland (MG057)
Group	Great Lakes Coast Grassland & Shrubland (G089)
Association (Common name)	Cottonwood Dune Open Woodland
Ecological System(s):	Great Lakes Dune (CES201.026)
	Great Lakes Wooded Dune and Swale (CES201.726)

ELEMENT CONCEPT

Global Summary: This community occurs in dune fields and on the most stable dune ridges in the southern Great Lakes region of the United States and Canada, especially around Lake Erie and Lake Ontario. The canopy is typically open (25-80% cover) and may even be scrubby due to wind damage. The most common dominant is *Populus deltoides* (eastern cottonwood), often in association with *Juniperus virginiana* (eastern red-cedar). *Quercus* (oak) spp. (including *Quercus macrocarpa* (bur oak), *Quercus rubra* (northern red oak), and *Quercus velutina* (black oak)) may occur, particularly when there are adjacent oak forests. Shrub and vine species include *Cornus drummondii* (roughleaf dogwood), *Parthenocissus quinquefolia* (Virginia creeper), *Rhus typhina* (staghorn sumac), *Salix amygdaloides* (peachleaf willow), *Salix exigua* (narrowleaf willow), *Salix fragilis* (crack willow), and *Vitis riparia* (riverbank grape). *Morella pensylvanica* (northern bayberry) is common at Presque Isle in Pennsylvania. Herbaceous species are scattered, but include *Asclepias syriaca* (common milkweed), *Elymus virginicus* (Virginia wildrye), *Rumex acetosella* (common sheep sorrel), *Schizachyrium scoparium* (little bluestem), and *Strophostyles helvula* (trailing fuzzybean).

ENVIRONMENTAL DESCRIPTION

Pictured Rocks National Lakeshore Environment: This early-successional aspen forest was observed twice in the park. Sites are steep, upper slopes of dunes; one site has active sand deposition. The unvegetated surface is dominated by bare sand with some leaf litter and wood. This community appears to be associated with frequent disturbance and active sand deposition due to erosion.
Global Environment: This community occurs in dune fields and on the most stable dune ridges.

VEGETATION DESCRIPTION

Pictured Rocks National Lakeshore Vegetation: The two sampled stands are quite different in structure. One stand has a dense (80% cover) tree canopy, 10-15 m tall, and a sparse (20%) subcanopy (5-10 m) dominated by *Populus balsamifera* (balsam poplar), which also makes up the very sparse (5%) tall-shrub (2-5 m) and short-shrub (0.5-1 m) layers. *Prunus pumila* (sandcherry) forms a sparse (30%) dwarf-shrub layer. The other stand has a moderate (50%) tall-shrub layer (2-5 m) and sparse (10%) short-shrub layer (0.5-1 m) of *Populus balsamifera* (balsam poplar) along with lesser amounts of *Betula papyrifera* (paper birch), *Salix eriocephala*

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(Missouri River willow), and *Salix exigua* (narrowleaf willow). Both stands have moderately dense (70%) herbaceous layers dominated by *Ammophila breviligulata* (American beachgrass) and *Equisetum hyemale* (scouringrush horsetail) and may include *Artemisia campestris* ssp. *caudata* (field sagewort), *Equisetum arvense* (field horsetail), *Festuca saximontana* (Rocky Mountain fescue), *Lathyrus japonicus* (beach pea), *Schizachyrium scoparium* (little bluestem), and state-vulnerable *Tanacetum bipinnatum* ssp. *huronense* (Lake Huron tansy).

Global Vegetation: The canopy is typically open (25-80% cover) and may even be scrubby due to wind damage. The most common dominant is *Populus deltoides* (eastern cottonwood), often in association with *Juniperus virginiana* (eastern red-cedar). *Quercus* (oak) spp. (including *Quercus macrocarpa* (bur oak), *Quercus rubra* (northern red oak), and *Quercus velutina* (black oak)) may occur, particularly when there are adjacent oak forests. Shrub and vine species include *Cornus drummondii* (roughleaf dogwood), *Parthenocissus quinquefolia* (Virginia creeper), *Rhus typhina* (staghorn sumac), *Salix amygdaloides* (peachleaf willow), *Salix exigua* (narrowleaf willow), *Salix fragilis* (crack willow), and *Vitis riparia* (riverbank grape). *Morella pensylvanica* (northern bayberry) is common at Presque Isle in Pennsylvania. Herbaceous species are scattered, but include *Asclepias syriaca* (common milkweed), *Elymus virginicus* (Virginia wildrye), *Rumex acetosella* (common sheep sorrel), *Schizachyrium scoparium* (little bluestem), and *Strophostyles helvula* (trailing fuzzybean) (Anderson 1996, Fike 1999).

MOST ABUNDANT SPECIES

Pictured Rocks National Lakeshore

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Populus balsamifera* (balsam poplar)
Tree subcanopy	Broad-leaved deciduous tree	*Populus balsamifera* (balsam poplar)
Tall shrub/sapling	Broad-leaved deciduous shrub	*Populus balsamifera* (balsam poplar), *Salix eriocephala* (Missouri River willow)
Short shrub/sapling	Broad-leaved deciduous shrub	*Populus balsamifera* (balsam poplar)
Herb (field)	Dwarf-shrub	*Prunus pumila* (sandcherry)
Herb (field)	Graminoid	*Ammophila breviligulata* (American beachgrass), *Schizachyrium scoparium* (little bluestem)
Herb (field)	Fern or fern ally	*Equisetum hyemale* (scouringrush horsetail)

Global

Stratum	Lifeform	Species

CHARACTERISTIC SPECIES

Pictured Rocks National Lakeshore: *Ammophila breviligulata* (American beachgrass), *Equisetum hyemale* (scouringrush horsetail), *Populus balsamifera* (balsam poplar), *Schizachyrium scoparium* (little bluestem)

Global:

OTHER NOTEWORTHY SPECIES

Pictured Rocks National Lakeshore: Vulnerable: *Tanacetum bipinnatum* ssp. *huronense* (Lake Huron tansy, state-vulnerable, G5T4T5)

Global: Other: *Morella pensylvanica* (northern bayberry, was historically known from Ashtabula Co. dunes in Ohio (Anderson 1996)., G5)

CONSERVATION STATUS RANK

Global Rank & Reasons: G1G2 (22-Jun-1998). There are probably fewer than 60 occurrences rangewide. Occurrences tend to be small, averaging less than 20 acres, so there is probably less than 1000 acres rangewide. This community is restricted to shores of the eastern Great Lakes and Lake Champlain. There has been a significant decline in occurrences due to residential development along the shores of the eastern Great Lakes and Lake Champlain. The community requires stabilized sand dunes along these large lakes.

CLASSIFICATION

Status: Standard

Classification Confidence: 2 - Moderate

Pictured Rocks National Lakeshore Comments:

Global Comments: *Juniperus virginiana* (eastern red-cedar) may form enough of a dominant without *Populus deltoides* (eastern cottonwood) that it may deserve its own type (Lee et al. 1998).

Global Related Concepts:

- Sand Dune Community (Thompson 1996) B

OTHER COMMENTS

Other Comments:

ELEMENT DISTRIBUTION

Pictured Rocks National Lakeshore Range:

Global Range: This community occurs in dune fields and on the most stable dune ridges in the southern Great Lakes region, especially around Lake Erie and Lake Ontario, ranging from Ohio and Ontario east to Pennsylvania, New York, and Vermont.

Nations: CA, US

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States/Provinces: IN, MI, NY, OH, ON, PA, VT
TNC Ecoregions: 48:C, 64:C
USFS Ecoregions (1994/95): 212Ho:CCC, 212Hw:CCC, 222Jj:CCC, 222Qa:CCC
Federal Lands: NPS (Indiana Dunes, Pictured Rocks, Sleeping Bear Dunes)

ELEMENT SOURCES

Pictured Rocks National Lakeshore Inventory Notes:
Pictured Rocks National Lakeshore Plots: PIRO.304, PIRO.307.
Pictured Rocks National Lakeshore Map Code: WCD
Local Description Authors: M.J. Russo
Global Description Authors: D. Faber-Langendoen
References: Anderson 1996, Fike 1999, Lee et al. 1998, Midwestern Ecology Working Group n.d., Thompson 1996, Thompson and Sorenson 2000

Sand Cherry Dune Shrubland

***Prunus pumila - (Ptelea trifoliata)* Dune Shrubland**
Sand Cherry - (Hoptree) Dune Shrubland
Identifier: CEGL005075

NVC CLASSIFICATION

Division	Eastern North American Coastal Grassland & Shrubland (2.C.3.a)
Macrogroup	Eastern North American Coastal Grassland & Shrubland (MG057)
Group	Great Lakes Coast Grassland & Shrubland (G089)
Association (Common name)	Sand Cherry Dune Shrubland
Ecological System(s):	Great Lakes Dune (CES201.026)
	Great Lakes Wooded Dune and Swale (CES201.726)

ELEMENT CONCEPT

Global Summary: This shrub dune community is found on southern Great Lakes dunes or inland dune systems in the United States and Canada. Stands occur on stabilized foredunes. They are dominated by deciduous shrubs, with a relatively open canopy. *Prunus pumila* (sandcherry) is a characteristic dominant, but *Salix cordata* (heartleaf willow), *Salix myricoides* (bayberry willow), *Physocarpus opulifolius* (common ninebark), and *Ptelea trifoliata* (common hoptree) may also be present. The ground layer may consist of open sand with sparse herbaceous vegetation. Herbaceous species include *Ammophila breviligulata* (American beachgrass), *Schizachyrium scoparium* (little bluestem) and others.

ENVIRONMENTAL DESCRIPTION

Pictured Rocks National Lakeshore Environment: This sand cherry shrubland was sampled at five locations in the park. One site is a gentle south-facing foredune, the other a moderate east-facing midslope transverse dune with undulating terrain of dunes and blowouts. Both sites are typical of the rolling topography of blowouts and dunes at Grand Sable Dunes. Soils are rapidly to well-drained sand. The unvegetated surface is dominated by leaf litter (97-99% cover) with some wood (1-3%). Evidence of disturbance includes an old logging slide, wind and erosion, shifting sand, and the presence of exotic plants.
Global Environment: Stands occur on stabilized foredunes.

VEGETATION DESCRIPTION

Pictured Rocks National Lakeshore Vegetation: This shrubland community is dominated by a variable (20-80% cover) short-shrub layer, 0.1-1 m tall, dominated by *Salix eriocephala*; other taxa include *Prunus pumila* (sandcherry) and *Salix exigua* (narrowleaf willow). The sparse (10%) herbaceous layer includes *Ammophila breviligulata* (American beachgrass), *Artemisia absinthium* (absinthium), *Lathyrus japonicus* (beach pea), *Lithospermum caroliniense* (Carolina puccoon), and state-vulnerable *Tanacetum bipinnatum* ssp. *huronense* (Lake Huron tansy).
Global Vegetation: Stands are dominated by deciduous shrubs, with a relatively open canopy. *Prunus pumila* (sandcherry) is a characteristic dominant, but *Salix cordata* (heartleaf willow), *Salix myricoides* (bayberry willow), *Physocarpus opulifolius* (common ninebark), and *Ptelea trifoliata* (common hoptree) may also be present. The ground layer may consist of open sand with sparse herbaceous vegetation. Herbaceous species include *Ammophila breviligulata* (American beachgrass), *Schizachyrium scoparium* (little bluestem) and others (Chapman et al. 1989, Bakowsky and Lee 1996).

MOST ABUNDANT SPECIES

Pictured Rocks National Lakeshore

Stratum	Lifeform	Species
Tall shrub/sapling	Broad-leaved deciduous shrub	*Prunus pumila* (sandcherry), *Salix eriocephala* (Missouri River willow), *Salix exigua* (narrowleaf willow)
Herb (field)	Graminoid	*Ammophila breviligulata* (American beachgrass)

Global

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Stratum **Lifeform** **Species**

CHARACTERISTIC SPECIES

Pictured Rocks National Lakeshore: *Salix eriocephala* (Missouri River willow)
Global:

OTHER NOTEWORTHY SPECIES

Pictured Rocks National Lakeshore: Vulnerable: *Tanacetum bipinnatum* ssp. *huronense* (Lake Huron tansy, state-vulnerable, G5T4T5); **Exotic/Invasive**: *Artemisia absinthium* (absinthium, exotic, Low)
Global: Vulnerable: *Cirsium pitcheri* (sand dune thistle, Federally listed threatened, G3)

CONSERVATION STATUS RANK

Global Rank & Reasons: G2Q (22-Jun-1998). No occurrences have been documented, but the community is reported from Illinois, where it is ranked S1, Ontario (S?), and possibly Indiana (SP). It is found in 2 ecoregional sections. Stands are restricted to stabilized foredunes.

CLASSIFICATION

Status: Standard
Classification Confidence: 3 - Weak
Pictured Rocks National Lakeshore Comments:
Global Comments: Stands of this type are often intermingled with open grassland-dominated parts of the dune. This type may be of limited spatial extent, and there is some concern about the practicality of tracking it on a dynamic dune system. Inland dunes along the Illinois River may contain this type (B. McClain pers. comm. 1996). Lake dunes covered by *Juniperus horizontalis* (creeping juniper), *Juniperus communis* (common juniper), and/or *Arctostaphylos uva-ursi* (kinnikinnick) are placed in *Juniperus horizontalis - Arctostaphylos uva-ursi - Juniperus communis* Dune Dwarf-shrubland (CEGL005064).
Global Similar Associations:
- *Ammophila breviligulata - (Schizachyrium scoparium)* Herbaceous Vegetation (CEGL005098)
- *Hudsonia tomentosa* Dune Dwarf-shrubland (CEGL004024)
- *Juniperus horizontalis - Arctostaphylos uva-ursi - Juniperus communis* Dune Dwarf-shrubland (CEGL005064)

Global Related Concepts:
- Open Dune (Chapman et al. 1989) ?

OTHER COMMENTS

Other Comments:

ELEMENT DISTRIBUTION

Pictured Rocks National Lakeshore Range: This shrub dune community occurs at Grand Sable Dunes. It is found between the lakeshore and stable dunes in areas of drifting sand and active sand deposition.
Global Range: This shrub dune community is found on southern Great Lakes dunes or inland dune systems in the United States and Canada, ranging from Wisconsin to Michigan and Ontario.
Nations: CA, US
States/Provinces: IL, IN, MI, ON, WI
TNC Ecoregions: 48:C
USFS Ecoregions (1994/95): 212Hi:CCC, 212Ho:CCC, 212Hw:CCC, 222Ja:CCC, 222Jj:CCC, 222K:C?
Federal Lands: NPS (Indiana Dunes, Pictured Rocks, Sleeping Bear Dunes)

ELEMENT SOURCES

Pictured Rocks National Lakeshore Inventory Notes:
Pictured Rocks National Lakeshore Plots: PIRO.111, PIRO.114, PIRO.305, PIRO.306, PIRO.330.
Pictured Rocks National Lakeshore Map Code: SCW
Local Description Authors: M.J. Russo
Global Description Authors: D. Faber-Langendoen
References: Bakowsky and Lee 1996, Chapman et al. 1989, Midwestern Ecology Working Group n.d., WNHIP unpubl. data

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2.C.4. Temperate & Boreal Bog & Fen

2.C.4.a. North American Bog & Fen

MG062. North American Boreal Bog & Fen

G185. Boreal Alkaline Peatland

Bog Birch - (Willow species) Saturated Shrubland Alliance

***Betula pumila* - (*Salix* spp.) Saturated Shrubland Alliance**

NVC CLASSIFICATION

Division	North American Bog & Fen (2.C.4.a)
Macrogroup	North American Boreal Bog & Fen (MG062)
Group	Boreal Alkaline Peatland (G185)
Association (English name)	Bog Birch - (Willow species) Saturated Shrubland Alliance
Ecological System(s):	

ELEMENT CONCEPT

Global Summary: This alliance, found in the northeastern and midwestern United States and south-central Canada, is composed of poor and moderately rich shrub fens. It is found where surface waters are slightly acidic to slightly alkaline with moderate nutrient levels. It is usually on peat but can be found on mineral soils. The soil is saturated for much of the year and may flood periodically. In Nebraska, the water table has been reported to be within 15-30 cm and flooding to be less than 2 m deep. Shrubs less than 2 m tall and graminoids comprise the majority of the vegetation. Short trees are found in some stands. *Betula pumila* (bog birch), *Dasiphora fruticosa* ssp. *floribunda* (shrubby-cinquefoil), *Salix discolor* (pussy willow), *Salix petiolaris* (meadow willow), and other *Salix* (willow) spp. are found throughout this alliance's range. In the northern part of its range, *Andromeda polifolia* (bog rosemary), *Chamaedaphne calyculata* (leatherleaf), and *Vaccinium oxycoccos* (small cranberry) can be common in poor fen examples. Typical graminoids include *Calamagrostis canadensis* (bluejoint), *Carex* (sedge) spp. (including *Carex pellita* (woolly sedge), *Carex lasiocarpa* (woollyfruit sedge), *Carex interior* (inland sedge), *Carex nebrascensis* (Nebraska sedge), and *Carex oligosperma* (fewseed sedge)), and *Eriophorum* (cottongrass) spp. Some of the forbs of this alliance include *Doellingeria umbellata* (parasol whitetop), *Euthamia graminifolia* (flat-top goldentop), *Eleocharis* (spikerush) spp., *Menyanthes trifoliata* (buckbean) (in the North), *Sarracenia purpurea* (purple pitcherplant), and *Thelypteris palustris* (eastern marsh fern). *Sphagnum* (sphagnum) spp. are ubiquitous in this alliance. When trees do occur, they are almost always *Larix laricina* (tamarack) and *Picea mariana* (black spruce) in the North and *Fraxinus pennsylvanica* (green ash) in the Great Plains. Other tree species may be found in stands further east.

ENVIRONMENTAL DESCRIPTION

Pictured Rocks National Lakeshore Environment: Information not available.
Global Environment: Information not available.

VEGETATION DESCRIPTION

Pictured Rocks National Lakeshore Vegetation:
Global Vegetation:

MOST ABUNDANT SPECIES

Pictured Rocks National Lakeshore

Stratum	Lifeform	Species

Global

Stratum	Lifeform	Species

CHARACTERISTIC SPECIES

Pictured Rocks National Lakeshore:
Global:

OTHER NOTEWORTHY SPECIES

Pictured Rocks National Lakeshore:
Global:

CONSERVATION STATUS RANK

Global Rank & Reasons: GNR (28-Oct-2009).

CLASSIFICATION

Status: Nonstandard
Classification Confidence:
Pictured Rocks National Lakeshore Comments:
Global Comments:

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Global Related Concepts:

OTHER COMMENTS

Other Comments:

ELEMENT DISTRIBUTION

Pictured Rocks National Lakeshore Range:
Global Range:
Nations: US
States/Provinces: MI
TNC Ecoregions:
USFS Ecoregions (1994/95):
Federal Lands: NPS (Pictured Rocks)

ELEMENT SOURCES

Pictured Rocks National Lakeshore Inventory Notes:
Pictured Rocks National Lakeshore Plots:
Pictured Rocks National Lakeshore Map Code: SBB
Local Description Authors:
Global Description Authors:
References: Midwestern Ecology Working Group n.d.

Wiregrass Sedge Shore Fen

***Carex lasiocarpa* - *(Carex rostrata)* - *Equisetum fluviatile* Herbaceous Vegetation**
Wiregrass Sedge - (Beaked Sedge) - Water Horsetail Herbaceous Vegetation
Identifier: CEGL005229

NVC CLASSIFICATION

Division	North American Bog & Fen (2.C.4.a)
Macrogroup	North American Boreal Bog & Fen (MG062)
Group	Boreal Alkaline Peatland (G185)
Association (Common name)	Wiregrass Sedge Shore Fen
Ecological System(s):	Laurentian-Acadian Alkaline Fen (CES201.585)

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

Pictured Rocks National Lakeshore Environment: This small-patch sedge - horsetail wetland community was sampled at three locations in the park. Sites include a dune field, kettled outwash plain, and shoreline that range from semipermanently to permanently flooded. Soils are poorly to very poorly drained peat and muck. The unvegetated surface is dominated by leaf litter (55-98% cover) with some standing water (1-45%). Evidence of disturbance includes beaver activity, use by recreationists, wave action and flooding, and past logging (1880-1940s) of surrounding areas.
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

Pictured Rocks National Lakeshore Vegetation: Herbaceous vegetation dominates this community. Small amounts (5-10% cover) of *Alnus incana* ssp. *rugosa* (speckled alder), *Myrica gale* (sweetgale), *Salix lucida* (shining willow), and *Salix petiolaris* (meadow willow), 0.5-2 m tall, may also be present. The dense herbaceous layer (80-100%) is dominated by *Carex lasiocarpa* (woollyfruit sedge); other species include *Equisetum fluviatile* (water horsetail), *Eupatorium maculatum* (spotted joepyeweed), *Juncus canadensis* (Canadian rush), *Juncus effusus* (common rush), *Schoenoplectus acutus* var. *acutus* (hardstem bulrush), *Scirpus cyperinus* (woolgrass), and *Typha latifolia* (broadleaf cattail). *Sphagnum* (sphagnum) spp. can cover up to 90% of the ground surface.

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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

Pictured Rocks National Lakeshore

Stratum	Lifeform	Species
Short shrub/sapling	Broad-leaved evergreen shrub	*Myrica gale* (sweetgale)
Herb (field)	Forb	*Eupatorium maculatum* (spotted joepyeweed)
Herb (field)	Graminoid	*Carex lasiocarpa* (woollyfruit sedge), *Juncus canadensis* (Canadian rush), *Schoenoplectus acutus* var. *acutus* (hardstem bulrush), *Scirpus cyperinus* (woolgrass)
Herb (field)	Fern or fern ally	*Equisetum fluviatile* (water horsetail)

Global

Stratum	Lifeform	Species

CHARACTERISTIC SPECIES

Pictured Rocks National Lakeshore: *Carex lasiocarpa* (woollyfruit sedge), *Equisetum fluviatile* (water horsetail), *Eupatorium maculatum* (spotted joepyeweed), *Juncus canadensis* (Canadian rush)
Global:

OTHER NOTEWORTHY SPECIES

Pictured Rocks National Lakeshore:
Global:

CONSERVATION STATUS RANK

Global Rank & Reasons: GNR (1-Dec-1997).

CLASSIFICATION

Status: Standard
Classification Confidence: 2 - Moderate
Pictured Rocks National Lakeshore Comments:
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) =

OTHER COMMENTS

Other Comments:

ELEMENT DISTRIBUTION

Pictured Rocks National Lakeshore Range: This small-patch wetland community may be found throughout the park on semipermanently or permanently flooded sites of poorly to very poorly drained peat and muck.
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, VT, WI:S3

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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

Pictured Rocks National Lakeshore Inventory Notes:
Pictured Rocks National Lakeshore Plots: PIRO.047, PIRO.076, PIRO.081.
Pictured Rocks National Lakeshore Map Code: HSS
Local Description Authors: M.J. Russo
Global Description Authors: D. Faber-Langendoen
References: Chapman et al. 1989, Edinger et al. 2002, Harris et al. 1996, Midwestern Ecology Working Group n.d., WNHIP unpubl. data

Sweet Gale Shrub Fen

***Myrica gale* Fen Shrubland**
Sweetgale Fen Shrubland
Identifier: CEGL005141

NVC CLASSIFICATION

Division	North American Bog & Fen (2.C.4.a)
Macrogroup	North American Boreal Bog & Fen (MG062)
Group	Boreal Alkaline Peatland (G185)
Association (Common name)	Sweet Gale Shrub Fen

Ecological System(s):

ELEMENT CONCEPT

Global Summary: This shrub fen community is potentially found in the northern Great Lakes region of the United States and Canada. It has not been well-described by any authors. Stands are dominated by the deciduous shrub *Myrica gale* (sweetgale). Codominates may include *Chamaedaphne calyculata* (leatherleaf) in more nutrient-poor examples and *Dasiphora fruticosa* ssp. *floribunda* (shrubby-cinquefoil) in richer examples. Further work is needed to determine the characteristics of this type.

ENVIRONMENTAL DESCRIPTION

Pictured Rocks National Lakeshore Environment: Information not available.
Global Environment: Information not available.

VEGETATION DESCRIPTION

Pictured Rocks National Lakeshore Vegetation:
Global Vegetation: This shrub fen has not been well-described by any authors. Stands are dominated by *Myrica gale* (sweetgale), and may be codominated by *Chamaedaphne calyculata* (leatherleaf) in more nutrient-poor examples, and by *Dasiphora fruticosa* ssp. *floribunda* (shrubby-cinquefoil) in richer examples. Further work is needed to determine the characteristics of this type.

MOST ABUNDANT SPECIES

Pictured Rocks National Lakeshore

Stratum	Lifeform	Species

Global

Stratum	Lifeform	Species

CHARACTERISTIC SPECIES

Pictured Rocks National Lakeshore:
Global:

OTHER NOTEWORTHY SPECIES

Pictured Rocks National Lakeshore:
Global:

CONSERVATION STATUS RANK

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

CLASSIFICATION

Status: Standard
Classification Confidence: 3 - Weak
Pictured Rocks National Lakeshore Comments:
Global Comments: This type may overlap in concept with other shrub fens, e.g., the leatherleaf-sweet gale shore fen, *Chamaedaphne calyculata - Myrica gale / Carex lasiocarpa* Dwarf-shrubland (CEGL005228), and may not warrant its own type. Ontario (Lee et al. 1998) list a sweet gale shore fen type. In Minnesota, *Myrica gale* (sweetgale) is found in the poor fen, shrub

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subtype or perhaps an open bog, intermediate subtype. See also types in the open shrub/herb fen category, as used in the Eastern Region (formation V.A.7.N.p), e.g., *Myrica gale / Carex lasiocarpa - Lobelia kalmii - Trichophorum alpinum* Shrub Herbaceous Vegetation [Provisional] (CEGL006160).

Global Similar Associations:

- *Chamaedaphne calyculata - Myrica gale / Carex lasiocarpa* Dwarf-shrubland (CEGL005228)
- *Myrica gale / Carex lasiocarpa - Lobelia kalmii - Trichophorum alpinum* Shrub Herbaceous Vegetation [Provisional] (CEGL006160)
- *Myrica gale* Organic Swamp Shrubland (CEGL005077)

Global Related Concepts:

- Low shrub shore fen: leatherleaf - sweet gale / graminoid (W15) (Harris et al. 1996) ?

OTHER COMMENTS

Other Comments:

ELEMENT DISTRIBUTION

Pictured Rocks National Lakeshore Range:
Global Range: This sweet gale shrub fen is found in the northern Great Lakes region of the United States and Canada.
Nations: CA, US
States/Provinces: MI, MN, ON, OR:S1, QC
TNC Ecoregions: 48:C
USFS Ecoregions (1994/95): 212Hi:CCC, 212Hw:CC?
Federal Lands: NPS (Isle Royale, Pictured Rocks); USFS (Huron-Manistee?, Huron?, Manistee?)

ELEMENT SOURCES

Pictured Rocks National Lakeshore Inventory Notes:
Pictured Rocks National Lakeshore Plots:
Pictured Rocks National Lakeshore Map Code: SSF
Local Description Authors:
Global Description Authors: D. Faber-Langendoen
References: Harris et al. 1996, Kagan et al. 2004, Lee et al. 1998, Midwestern Ecology Working Group n.d.

G053. North American Boreal Acidic Peatland

Northern Sedge Poor Fen

***Carex lasiocarpa* - *Carex oligosperma* / *Sphagnum* spp. Herbaceous Vegetation**
Wiregrass Sedge - Few-seed Sedge / Peatmoss species Herbaceous Vegetation
Identifier: CEGL002265

NVC CLASSIFICATION

Division	North American Bog & Fen (2.C.4.a)
Macrogroup	North American Boreal Bog & Fen (MG062)
Group	North American Boreal Acidic Peatland (G053)
Association (Common name)	Northern Sedge Poor Fen
Ecological System(s):	Great Plains Prairie Pothole (CES303.661)
	Boreal-Laurentian-Acadian Acidic Basin Fen (CES201.583)
	Boreal-Laurentian Conifer Acidic Swamp (CES103.724)
	North-Central Interior Shrub-Graminoid Alkaline Fen (CES202.702)

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.

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ENVIRONMENTAL DESCRIPTION

Pictured Rocks National Lakeshore Environment: This floating-mat sedge / peatmoss wetland was sampled at three locations in the park. The sites are flat depressions with very poorly drained, saturated peat soils with the water table at the surface. The unvegetated surface is made up entirely of leaf litter (100% cover). The only sign of disturbance is past logging (1880-1940s) of surrounding areas.

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

Pictured Rocks National Lakeshore Vegetation: The herbaceous layer dominates this wetland community. However, there is a sparse (10-20% cover) short-shrub layer (0.5-1 m) of *Acer rubrum* (red maple), *Andromeda polifolia* var. *glaucophylla* (bog rosemary), *Chamaedaphne calyculata* (leatherleaf), *Kalmia polifolia* (bog laurel), and *Vaccinium oxycoccos* (small cranberry), among others. The very dense to total (90-100%) herbaceous layer includes *Carex oligosperma* (fewseed sedge), *Carex limosa* (mud sedge), *Carex pauciflora* (fewflower sedge), *Drosera rotundifolia* (roundleaf sundew), *Iris versicolor* (harlequin blueflag), *Lycopus uniflorus* (northern bugleweed), *Platanthera clavellata* (small green wood orchid), *Rhynchospora alba* (white beaksedge), *Rhynchospora fusca* (brown beaksedge), *Sarracenia purpurea* (purple pitcherplant), *Thelypteris palustris* (eastern marsh fern) and *Xyris montana* (northern yelloweyed grass). *Sphagnum* (sphagnum) spp. nearly cover the entire (90-98%) 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

Pictured Rocks National Lakeshore

Stratum	Lifeform	Species
Short shrub/sapling	Broad-leaved evergreen shrub	*Andromeda polifolia* var. *glaucophylla* (bog rosemary), *Chamaedaphne calyculata* (leatherleaf), *Kalmia polifolia* (bog laurel)
Short shrub/sapling	Dwarf-shrub	*Vaccinium oxycoccos* (small cranberry)
Herb (field)	Forb	*Drosera rotundifolia* (roundleaf sundew), *Iris versicolor* (harlequin blueflag), *Menyanthes trifoliata* (buckbean), *Sarracenia purpurea* (purple pitcherplant), *Xyris montana* (northern yelloweyed grass)
Herb (field)	Graminoid	*Carex oligosperma* (fewseed sedge), *Rhynchospora alba* (white beaksedge)

Global

Stratum	Lifeform	Species

CHARACTERISTIC SPECIES

Pictured Rocks National Lakeshore: *Carex limosa* (mud sedge), *Carex oligosperma* (fewseed sedge), *Carex pauciflora* (fewflower sedge), *Lycopus uniflorus* (northern bugleweed), *Rhynchospora alba* (white beaksedge), *Rhynchospora fusca* (brown beaksedge), *Sarracenia purpurea* (purple pitcherplant)

Global:

OTHER NOTEWORTHY SPECIES

Pictured Rocks National Lakeshore:

Global:

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

Pictured Rocks National Lakeshore Comments:

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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:

- Sphagnum lawn poor fen, flark? (Glaser 1992b) ?
- poor fen: ericaceous shrub / wire sedge / *Sphagnum* (W20) (Harris et al. 1996) B

OTHER COMMENTS

Other Comments:

ELEMENT DISTRIBUTION

Pictured Rocks National Lakeshore Range: This graminoid poor fen community was sampled at three locations in the eastern half of Pictured Rocks, although this community could potentially occur in saturated depressions throughout the park.
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

Pictured Rocks National Lakeshore Inventory Notes:
Pictured Rocks National Lakeshore Plots: PIRO.065, PIRO.123, PIRO.125.
Pictured Rocks National Lakeshore Map Code: HSP
Local Description Authors: M.J. Russo
Global Description Authors: D. Faber-Langendoen
References: Chapman et al. 1989, Glaser 1992b, Greenall 1996, Harris et al. 1996, INAI unpubl. data, MNNHP 1993, Midwestern Ecology Working Group n.d., NDNHI unpubl. data, WNHIP unpubl. data

Leatherleaf - Sweetgale Shore Fen

***Chamaedaphne calyculata - Myrica gale / Carex lasiocarpa* Dwarf-shrubland**
Leatherleaf - Sweetgale / Wiregrass Sedge Dwarf-shrubland
Identifier: CEGL005228

NVC CLASSIFICATION

Division	North American Bog & Fen (2.C.4.a)
Macrogroup	North American Boreal Bog & Fen (MG062)

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Group	North American Boreal Acidic Peatland (G053)
Association (Common name)	Leatherleaf - Sweetgale Shore Fen
Ecological System(s):	Great Lakes Wooded Dune and Swale (CES201.726)
	Laurentian-Acadian Alkaline Fen (CES201.585)

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

Pictured Rocks National Lakeshore Environment: This leatherleaf - sweet gale dwarf-shrubland was sampled at four locations in the park. Sites include flat depressions, swales, and dune fields that are semipermanently to permanently flooded. Soils are somewhat poorly to very poorly drained muck and peat. The unvegetated surface is dominated by leaf litter (95-100% cover) with some bare soil (0-1%) and standing water (0-5%). Evidence of disturbance includes past and present beaver activity, alterations to hydrology, wind damage, and the presence of an elevated wooden walkway.

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

Pictured Rocks National Lakeshore Vegetation: A tall-shrub layer (2-5 m tall) may be absent or very sparse to moderate (5-50% cover) and includes *Spiraea alba* (white meadowsweet), *Salix petiolaris* (meadow willow), and *Ilex verticillata* (common winterberry). The dominant and, in some cases, continuous (90-100%) short-shrub layer (0.5-2 m) is dominated by *Chamaedaphne calyculata* (leatherleaf) and *Myrica gale* (sweetgale); one plot has 97% cover of *Spiraea alba* (white meadowsweet). Other shrub species may include *Alnus incana* ssp. *rugosa* (speckled alder), *Cornus sericea* ssp. *sericea* (red-osier dogwood), and *Rosa palustris* (swamp rose). The variable (10-80%) herbaceous layer is dominated by *Typha latifolia* (broadleaf cattail) and *Carex* (sedge) spp. (particularly *Carex lasiocarpa* (woollyfruit sedge)). Nonvascular species (sphagnum mosses) cover 0-80% of the ground surface. Globally and state-vulnerable *Iris lacustris* (dwarf lake iris) was reported from one plot.

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

Pictured Rocks National Lakeshore

Stratum	Lifeform	Species
Short shrub/sapling	Broad-leaved deciduous shrub	*Rosa palustris* (swamp rose)
Short shrub/sapling	Broad-leaved evergreen shrub	*Chamaedaphne calyculata* (leatherleaf), *Myrica gale* (sweetgale)
Herb (field)	Graminoid	*Carex lasiocarpa* (woollyfruit sedge)

Global

Stratum	Lifeform	Species

CHARACTERISTIC SPECIES

Pictured Rocks National Lakeshore: *Andromeda polifolia* var. *glaucophylla* (bog rosemary), *Chamaedaphne calyculata* (leatherleaf), *Cornus sericea* (red-osier dogwood), *Myrica gale* (sweetgale), *Salix petiolaris* (meadow willow), *Spiraea alba* (white meadowsweet), *Typha latifolia* (broadleaf cattail)

Global:

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OTHER NOTEWORTHY SPECIES

Pictured Rocks National Lakeshore: Vulnerable: *Iris lacustris* (dwarf lake iris, globally and state-vulnerable, G3)
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.

CLASSIFICATION

Status: Standard
Classification Confidence: 2 - Moderate
Pictured Rocks National Lakeshore Comments:
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)

OTHER COMMENTS

Other Comments:

ELEMENT DISTRIBUTION

Pictured Rocks National Lakeshore Range: This leatherleaf - sweet gale dwarf-shrubland is found throughout the park in depressions over organic soil. It occurs away from the direct influence from Lake Superior and is the most common wetland shrubland type in the park.
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?, VT, 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

Pictured Rocks National Lakeshore Inventory Notes:
Pictured Rocks National Lakeshore Plots: PIRO.046, PIRO.048, PIRO.073, PIRO.086.
Pictured Rocks National Lakeshore Map Code: DLS
Local Description Authors: M.J. Russo

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Global Description Authors: D. Faber-Langendoen
References: Chapman et al. 1989, Edinger et al. 2002, Harris et al. 1996, Midwestern Ecology Working Group n.d., WNHIP unpubl. data

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.a)
Macrogroup	North American Boreal Bog & Fen (MG062)
Group	North American Boreal Acidic Peatland (G053)
Association (Common name)	Leatherleaf Poor Fen
Ecological System(s):	Boreal-Laurentian Bog (CES103.581)
	Boreal-Laurentian-Acadian Acidic Basin Fen (CES201.583)
	Boreal-Laurentian Conifer Acidic Swamp (CES103.724)

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

Pictured Rocks National Lakeshore Environment: This tamarack shrubland was sampled at four locations in the park. Sites are all flat depressions with saturated, very poorly drained peat soils. The unvegetated surface is dominated by leaf litter (95-100% cover) with some wood (0-1%) and dead snags (0-5%). Evidence of disturbance includes logging in surrounding uplands. Dwarf mistletoe on black spruce has caused lost vigor and mortality resulting in multi-stemmed and multi-branched individuals.
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

Pictured Rocks National Lakeshore Vegetation: One plot has a sparse (20% cover) emergent tree canopy (10-15 m tall) comprised of *Larix laricina* (tamarack), *Pinus strobus* (eastern white pine), and *Picea mariana* (black spruce), as is the sparse (5-10%) tall-shrub layer (2-5 m). The dominant layer (80-90%) is made up of short shrubs (0.5-1 m) of *Chamaedaphne calyculata* (leatherleaf) (50-80%) and may include lesser amounts of *Andromeda polifolia* var. *glaucophylla* (bog rosemary), *Gaultheria hispidula* (creeping snowberry), *Kalmia polifolia* (bog laurel), *Ledum groenlandicum* (bog Labrador-tea), *Nemopanthus mucronatus* (catberry), *Vaccinium angustifolium* (lowbush blueberry), *Vaccinium myrtilloides* (velvetleaf huckleberry), and *Vaccinium oxycoccos* (small cranberry). The sparse to moderate (10-60%) herbaceous layer is dominated by *Maianthemum trifolium* (threeleaf false lily of the valley) (10-50%) and may include *Carex trisperma* (threeseeded sedge), *Drosera rotundifolia* (roundleaf sundew), *Rhynchospora alba* (white beaksedge), and *Sarracenia purpurea* (purple pitcherplant). Nonvascular species (sphagnum mosses) cover all or most of the ground surface (90-100%).
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

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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).

MOST ABUNDANT SPECIES

Pictured Rocks National Lakeshore

Stratum	Lifeform	Species
Tree (canopy & subcanopy)	Needle-leaved tree	*Larix laricina* (tamarack), *Picea mariana* (black spruce)
Tall shrub/sapling	Needle-leaved shrub	*Picea mariana* (black spruce)
Short shrub/sapling	Broad-leaved deciduous shrub	*Vaccinium myrtilloides* (velvetleaf huckleberry)
Short shrub/sapling	Broad-leaved evergreen shrub	*Chamaedaphne calyculata* (leatherleaf), *Gaultheria hispidula* (creeping snowberry), *Kalmia polifolia* (bog laurel), *Ledum groenlandicum* (bog Labrador-tea), *Vaccinium oxycoccos* (small cranberry)
Herb (field)	Forb	*Maianthemum trifolium* (threeleaf false lily of the valley)

Global

Stratum	Lifeform	Species

CHARACTERISTIC SPECIES

Pictured Rocks National Lakeshore: *Andromeda polifolia* var. *glaucophylla* (bog rosemary), *Chamaedaphne calyculata* (leatherleaf), *Kalmia polifolia* (bog laurel), *Larix laricina* (tamarack), *Ledum groenlandicum* (bog Labrador-tea), *Maianthemum trifolium* (threeleaf false lily of the valley), *Nemopanthus mucronatus* (catberry), *Picea mariana* (black spruce), *Vaccinium myrtilloides* (velvetleaf huckleberry)
Global:

OTHER NOTEWORTHY SPECIES

Pictured Rocks National Lakeshore:
Global:

CONSERVATION STATUS RANK

Global Rank & Reasons: G5 (29-Mar-2000).

CLASSIFICATION

Status: Standard
Classification Confidence: 2 - Moderate
Pictured Rocks National Lakeshore Comments:
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:
- Poor fen: black spruce - tamarack / ericaceous shrub / Sphagnum (W22) (Harris et al. 1996) F
- Poor fen: ericaceous shrub / Sphagnum (W21) (Harris et al. 1996) F

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OTHER COMMENTS

Other Comments:

ELEMENT DISTRIBUTION

Pictured Rocks National Lakeshore Range: This tamarack / ericaceous scrub poor fen is located inland, away from direct influence of Lake Superior, in flat depressions with saturated soils of very poorly drained peat. The community occurs in the central to northern half of park.
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

Pictured Rocks National Lakeshore Inventory Notes:
Pictured Rocks National Lakeshore Plots: PIRO.053, PIRO.054, PIRO.064, PIRO.124.
Pictured Rocks National Lakeshore Map Code: DLF
Local Description Authors: M.J. Russo
Global Description Authors: D. Faber-Langendoen
References: Harris et al. 1996, MNNHP 1993, Midwestern Ecology Working Group n.d., WNHIP unpubl. data

2.C.5. Temperate & Boreal Freshwater Wet Meadow & Marsh

2.C.5.a. Eastern North America Freshwater Wet Meadow, Riparian & Marsh

MG069. Eastern & North-Central North American Marsh & Wet Meadow

G125. Eastern North American Freshwater Marsh

Water Horsetail - Spikerush Marsh

***Equisetum fluviatile* - *(Eleocharis palustris)* Herbaceous Vegetation**
Water Horsetail - (Common Spikerush) Herbaceous Vegetation
Identifier: CEGL005258

NVC CLASSIFICATION

Division	Eastern North America Freshwater Wet Meadow, Riparian & Marsh (2.C.5.a)
Macrogroup	Eastern & North-Central North American Marsh & Wet Meadow (MG069)
Group	Eastern North American Freshwater Marsh (G125)
Association (Common name)	Water Horsetail - Spikerush Marsh
Ecological System(s):	Laurentian-Acadian Wet Meadow-Shrub Swamp (CES201.582)
	Laurentian-Acadian Freshwater Marsh (CES201.594)

ELEMENT CONCEPT

Global Summary: This low graminoid marsh community is found in the boreal regions of the Great Lakes and perhaps more widely in Canada. Stands occur in wave-washed shores, sandbars, and stream channels. Substrate is mineral soil (often sand), sometimes held together by root mats. The water regime is permanently flooded to intermittently exposed, and water depth is generally less than 1 m. A layer of partially decomposed stalks may be present. Emergent cover is greater than 25%, and floating-leaved and submergent cover is low. Emergent graminoids <1 m dominate the stands, including *Equisetum fluviatile* (water horsetail) and/or *Eleocharis palustris* (common spikerush). Associated species of low constancy include *Glyceria borealis* (small floating mannagrass), *Isoetes tenella* (spiny-spore quillwort), *Potamogeton gramineus* (variableleaf pondweed), and *Utricularia macrorhiza* (common bladderwort).

ENVIRONMENTAL DESCRIPTION

Pictured Rocks National Lakeshore Environment: This horsetail marsh community was sampled twice in the park. The sites are flat, permanently flooded shorelines with very poorly drained muck soil. The unvegetated surface at one site is made up entirely of standing water (100% cover), while at the other, bare soil dominates (80%) with some standing water (15%). The surrounding lowland and upland areas were logged in the past (1880-1940s).
Global Environment: Stands occur in wave-washed shores, sandbars, and stream channels. Substrate is mineral soil (often sand), sometimes held together by root mats. The water regime is permanently flooded to intermittently exposed, and water depth is generally less than 1 m (Harris et al. 1996).

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VEGETATION DESCRIPTION

Pictured Rocks National Lakeshore Vegetation: This is a densely vegetated (80-90% cover) herbaceous community dominated by *Equisetum fluviatile* (water horsetail) with lesser amounts of *Eleocharis palustris* (common spikerush). Other herbs include *Carex hystericina* (bottlebrush sedge), *Lysimachia thyrsiflora* (tufted loosestrife), *Sagittaria latifolia* (broadleaf arrowhead), *Polygonum amphibium* (water knotweed), *Spirodela polyrrhiza* (common duckmeat), and the floating aquatic *Lemna minor* (common duckweed).
Global Vegetation: Emergent cover is greater than 25%, and floating-leaved and submergent cover is low. Emergent graminoids <1 m dominate the stands, including *Equisetum fluviatile* (water horsetail) and/or *Eleocharis palustris* (common spikerush). Associated species of low constancy include *Glyceria borealis* (small floating mannagrass), *Isoetes tenella* (spiny-spore quillwort), *Potamogeton gramineus* (variableleaf pondweed), and *Utricularia macrorhiza* (common bladderwort) (Harris et al. 1996).

MOST ABUNDANT SPECIES

Pictured Rocks National Lakeshore

Stratum	Lifeform	Species
Herb (field)	Graminoid	*Eleocharis palustris* (common spikerush)
Herb (field)	Fern or fern ally	*Equisetum fluviatile* (water horsetail)

Global

Stratum	Lifeform	Species

CHARACTERISTIC SPECIES

Pictured Rocks National Lakeshore: *Eleocharis palustris* (common spikerush), *Equisetum fluviatile* (water horsetail)
Global:

OTHER NOTEWORTHY SPECIES

Pictured Rocks National Lakeshore:
Global:

CONSERVATION STATUS RANK

Global Rank & Reasons: G4 (1-Feb-1996).

CLASSIFICATION

Status: Standard
Classification Confidence: 2 - Moderate
Pictured Rocks National Lakeshore Comments:
Global Comments: This type can occur as reed swamp communities. It can grade into bulrush-dominated communities, or occur in conjunction with wild rice marshes. The range limit westward for this type (CEGL005258) remains to be worked out. The Northern Great Lakes Emergent Marsh type, *Schoenoplectus acutus - Schoenoplectus subterminalis - Eleocharis palustris - (Schoenoplectus americanus)* Northern Great Lakes Shore Herbaceous Vegetation (CEGL005274), may resemble this type to some degree.
Global Similar Associations:
- *Equisetum fluviatile* Herbaceous Vegetation (CEGL002746)--is a western type. The range limit westward for CEGL005258 and eastward for CEGL001960 remains to be worked out.
- *Nuphar advena - Nymphaea odorata* Herbaceous Vegetation (CEGL002386)
- *Nymphaea tetragona - Nuphar (microphylla, variegata)* Herbaceous Vegetation (CEGL002563)
- *Schoenoplectus acutus - Schoenoplectus subterminalis - Eleocharis palustris - (Schoenoplectus americanus)* Northern Great Lakes Shore Herbaceous Vegetation (CEGL005274)

Global Related Concepts:
- Marsh: spikerush-water horsetail: mineral substrate (W6) (Harris et al. 1996) =

OTHER COMMENTS

Other Comments:

ELEMENT DISTRIBUTION

Pictured Rocks National Lakeshore Range: This low graminoid marsh community occurs along inland lakes and waterways, in low-flow situations, and is found throughout the park.
Global Range: This low graminoid marsh community is found in the boreal regions of the Great Lakes and perhaps more widely in Canada.
Nations: CA, US
States/Provinces: MB:S4, MI, MN, ON, QC
TNC Ecoregions: 47:C, 48:C
USFS Ecoregions (1994/95): 212Hi:CCC, 212La:CCC, 212Lb:CCC, 212Lc:CCC
Federal Lands: NPS (Grand Portage, Isle Royale, Pictured Rocks, Voyageurs)

ELEMENT SOURCES

Pictured Rocks National Lakeshore Inventory Notes:
Pictured Rocks National Lakeshore Plots: PIRO.080, PIRO.088.

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Pictured Rocks National Lakeshore Map Code: HHT
Local Description Authors: M.J. Russo
Global Description Authors: D. Faber-Langendoen
References: Harris et al. 1996, Midwestern Ecology Working Group n.d.

Midwest Mixed Emergent Deep Marsh

***Typha* spp. - *Schoenoplectus acutus* - Mixed Herbs Midwest Herbaceous Vegetation**
Cattail species - Hardstem Bulrush - Mixed Herbs Midwest Herbaceous Vegetation
Identifier: CEGL002229

NVC CLASSIFICATION

Division	Eastern North America Freshwater Wet Meadow, Riparian & Marsh (2.C.5.a)
Macrogroup	Eastern & North-Central North American Marsh & Wet Meadow (MG069)
Group	Eastern North American Freshwater Marsh (G125)
Association (Common name)	Midwest Mixed Emergent Deep Marsh
Ecological System(s):	Eastern Great Plains Wet Meadow, Prairie and Marsh (CES205.687)
	Laurentian-Acadian Freshwater Marsh (CES201.594)
	North-Central Interior Freshwater Marsh (CES202.899)

ELEMENT CONCEPT

Global Summary: This deep freshwater marsh community is found in glacial potholes, river valleys, ponds, and on lake plains throughout the midwestern and parts of the eastern United States. These marshes have hydric soils and are flooded with water levels ranging from several centimeters to more than 1 m for a significant part of the growing season. Soils that support this community can be mineral or organic but are saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions in the upper part. This deepwater emergent marsh community is dominated by perennial, coarse-leaved graminoid vegetation. A typical example of this marsh contains a mosaic of emergents, submergents, and floating-leaved plants interspersed with areas of open water. Occurrences may contain extensive areas of open water, but the vegetation covers at least 3% of the surface. *Typha latifolia* (broadleaf cattail), *Typha angustifolia* (narrowleaf cattail), and *Schoenoplectus acutus* (hardstem bulrush) dominate this dynamic ecosystem. Sedges are also common (e.g., *Carex lupuliformis* (false hop sedge) and *Carex hyalinolepis* (shoreline sedge) in the eastern part of the range), and a diverse assemblage of grasses, floating-leaved aquatics, and submerged aquatics are present. Vegetative diversity and density are highly variable in response to water depth, water chemistry, and natural forces.

ENVIRONMENTAL DESCRIPTION

Pictured Rocks National Lakeshore Environment: This bulrush marsh was sampled only once in the park. The site is a flat, seasonally flooded/saturated floodplain with very poorly drained peat soil. The unvegetated surface is made up almost entirely of leaf litter (99% cover) with some wood (1%). Drought conditions at the time of sampling may have dropped the water table below the surface.

Global Environment: These highly productive 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. Seasonal flooding during winter and spring or flooding during heavy rains help maintain these marshes by causing water exchange which replenishes freshwater and circulates nutrients and organic debris. Soils can be mineral or organic but are saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions in the upper part. Vegetative diversity and density are highly variable in response to water depth, water chemistry, and natural forces.

VEGETATION DESCRIPTION

Pictured Rocks National Lakeshore Vegetation: This is a 1- to 2-m tall monotypic stand of *Schoenoplectus acutus* var. *acutus* (hardstem bulrush) with 80% cover.

Global Vegetation: This deepwater emergent marsh community is dominated by perennial herbaceous vegetation with graminoid leaves. A typical example of this marsh contains a mosaic of emergents, submergents, and floating-leaved plants interspersed with areas of open water (Harris et al. 1996). Various kinds of emergents may dominate a marsh depending on the water depth. Quite often the vegetation arranges itself in belts (wetland zonation), with a particular species or range of species occupying specific depths from the shoreline to deep open water. Marshes may display areas of open water, but vegetation dominates (>30% cover). *Typha latifolia* (broadleaf cattail), *Typha angustifolia* (narrowleaf cattail), and *Schoenoplectus acutus* (hardstem bulrush) dominate this dynamic ecosystem. Sedges are also common (e.g., *Carex lupuliformis* (false hop sedge) and *Carex hyalinolepis* (shoreline sedge) in the eastern part of the range). A diverse assemblage of grasses, floating-leaved aquatics, and submerged aquatics are present (TNC 1995a).

MOST ABUNDANT SPECIES

Pictured Rocks National Lakeshore

Stratum	Lifeform	Species
Herb (field)	Graminoid	*Schoenoplectus acutus* var. *acutus* (hardstem bulrush)

Global

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Stratum	Lifeform	Species
Herb (field)	Graminoid	*Carex hyalinolepis* (shoreline sedge), *Phragmites australis* (common reed), *Schoenoplectus acutus* (hardstem bulrush), *Typha latifolia* (broadleaf cattail)
Floating aquatic	Aquatic herb (floating & submergent)	*Lemna minor* (common duckweed)
Submerged aquatic	Aquatic herb (floating & submergent)	*Nelumbo lutea* (American lotus)

CHARACTERISTIC SPECIES

Pictured Rocks National Lakeshore: *Schoenoplectus acutus* var. *acutus* (hardstem bulrush)
Global:

OTHER NOTEWORTHY SPECIES

Pictured Rocks National Lakeshore:
Global: Vulnerable: *Calephelis muticum* (swamp metalmark, G3), *Cryptobranchus alleganiensis* (hellbender, G3G4); **Exotic/Invasive**: *Lythrum salicaria* (purple loosestrife, an aggressive exotic species which threatens this community in Canada, the northeast, and more recently in the midwest., High); **Other**: *Acris gryllus* (southern cricket frog, G5), *Agkistrodon piscivorus* (cottonmouth, G5), *Aix sponsa* (wood duck, G5), *Ambystoma maculatum* (spotted salamander, G5), *Ambystoma tigrinum* (tiger salamander, G5), *Anas acuta* (northern pintail, G5), *Anas americana* (american wigeon, G5), *Anas clypeata* (northern shoveler, G5), *Anas crecca* (green-winged teal, G5), *Anas discors* (blue-winged teal, G5), *Anas platyrhynchos* (mallard, G5), *Anas strepera* (gadwall, G5), *Ardea alba* (great egret, G5), *Ardea herodias* (great blue heron, G5), *Aythya affinis* (lesser scaup, G5), *Aythya americana* (redhead, G5), *Aythya collaris* (ring-necked duck, G5), *Aythya valisineria* (canvasback, G5), *Botaurus lentiginosus* (american bittern, G4), *Branta canadensis* (canada goose, G5), *Bubulcus ibis* (cattle egret, G5), *Bucephala clangula* (common goldeneye, G5), *Butorides virescens* (green heron, G5), *Chen caerulescens* (snow goose, G5), *Chlidonias niger* (black tern, G4), *Chrysemys picta* (northern painted turtle, G5), *Cistothorus palustris* (marsh wren, G5), *Cistothorus platensis* (sedge wren, G5), *Drosophila melanogaster* (vinegar fly, GNR), *Fulica americana* (american coot, G5), *Gallinula chloropus* (common moorhen, G5), *Gambusia affinis* (western mosquitofish, G5), *Himantopus mexicanus* (black-necked stilt, G5), *Hydroprogne caspia* (caspian tern, G5), *Ictinia mississippiensis* (mississippi kite, G5), *Ixobrychus exilis* (least bittern, G5), *Lontra canadensis* (north american river otter, G5), *Lycaena xanthoides* (great copper, G4), *Melospiza georgiana* (swamp sparrow, G5), *Mergus merganser* (common merganser, G5), *Necturus maculosus* (mudpuppy, G5), *Neovison vison* (american mink, G5), *Nerodia sipedon* (northern watersnake, G5), *Ondatra zibethicus* (common muskrat, G5), *Orconectes lancifer* (shrimp crayfish, G5), *Oryzomys palustris* (marsh oryzomys, G5), *Oxyura jamaicensis* (ruddy duck, G5), *Porphyrio martinica* (purple gallinule, G5), *Porzana carolina* (sora, G5), *Procyon lotor* (raccoon, G5), *Pseudacris crucifer* (spring peeper, G5), *Pseudacris nigrita* (southern chorus frog, G5), *Pseudacris streckeri* (strecker's chorus frog, G5), *Rallus elegans* (king rail, G4), *Rallus limicola* (virginia rail, G5), *Rallus longirostris* (clapper rail, G5), *Rana catesbeiana* (bullfrog, G5), *Rana clamitans* (green frog, G5), *Rana pipiens* (northern leopard frog, G5), *Recurvirostra americana* (american avocet, G5), *Schoenoplectus californicus* (California bulrush, occasionally found in this community, G5), *Sterna forsteri* (forster's tern, G5), *Sylvilagus palustris* (marsh rabbit, G5), *Tringa semipalmata* (willet, G5), *Xanthocephalus xanthocephalus* (yellow-headed blackbird, G5)

CONSERVATION STATUS RANK

Global Rank & Reasons: G4? (26-Jan-2000). This type is subject to many forms of human impact, particularly draining for farmland.

CLASSIFICATION

Status: Standard
Classification Confidence: 2 - Moderate
Pictured Rocks National Lakeshore Comments:
Global Comments: This community type is very broadly defined. It can be highly dynamic from one season to the next, and species composition and density are very dependent on water regime and sometimes the mineral content of water and soil (Niering 1985). Deep marsh is defined as having water depths of 15 cm to over 1 m throughout all or most of the growing season (Shaw and Fredine 1971, in Eggers and Reed 1987). The concept and distribution of this community in the Southeast needs reassessment; it should be compared to *Typha latifolia* (broadleaf cattail) Southern Herbaceous Vegetation (CEGL004150), particularly in the Mississippi alluvial plain of Missouri (M. Leahy pers. comm. 1999). Many of the presettlement occurrences of this community have been drained and converted to cropland or destroyed by siltation, which greatly accelerates the natural successional process from shallow inundation to moist soil. *Lythrum salicaria* (purple loosestrife) is an aggressive exotic species that threatens this community in Canada, the Northeast, and more recently in the Midwest. Stands in Province 212 may deserve to be recognized as a separate northern type, but further data are needed.
Global Similar Associations:
- *Schoenoplectus acutus - Typha latifolia - (Schoenoplectus tabernaemontani)* Sandhills Herbaceous Vegetation (CEGL002030)
- *Schoenoplectus acutus* Herbaceous Vegetation (CEGL001840)
- *Schoenoplectus tabernaemontani - Typha* spp. - (*Sparganium* spp., *Juncus* spp.) Herbaceous Vegetation (CEGL002026)
- *Typha (angustifolia, latifolia) - (Schoenoplectus* spp.) Eastern Herbaceous Vegetation (CEGL006153)
- *Typha latifolia - Caltha palustris* Herbaceous Vegetation (CEGL006245)
- *Typha latifolia* Southern Herbaceous Vegetation (CEGL004150)

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- *Typha* spp. Midwest Herbaceous Vegetation (CEGL002233)

Global Related Concepts:

- Freshwater Marsh (Nelson 1985) B
- Inland Emergent Marsh (Chapman et al. 1989) B
- Marsh: Mixed: Mineral Substrate (W5) (Harris et al. 1996) B
- Marsh: Mixed: Organic Substrate (W10) (Harris et al. 1996) B
- Palustrine Emergent Wetland (Cowardin et al. 1979) F
- Palustrine: Herbaceous Wetland: Riparian (TNC 1985) B
- Palustrine: Palustrine Emergent Wetland (Cowardin et al. 1979) F
- UNESCO FORMATION CODE: V.A. (UNESCO 1973) B

OTHER COMMENTS

Other Comments:

ELEMENT DISTRIBUTION

Pictured Rocks National Lakeshore Range: This bulrush community is found throughout the park in poorly drained soils.
Global Range: This community is found in glacial potholes, river valleys, ponds, and on lakeplains throughout the midwestern and parts of the eastern United States, ranging from Ohio and Ontario west to North Dakota, south to Nebraska and east to Alabama.
Nations: CA, US
States/Provinces: AL, IA:S4, IL, IN, KY, MI, MN, MO, ND, NE:S3, OH, ON, SD, TN, WI:S4, WY
TNC Ecoregions: 35:C, 36:C, 37:P, 43:C, 44:P, 46:C, 47:C, 48:C, 50:?
USFS Ecoregions (1994/95): 212He:CCC, 212Hi:CCC, 212Hj:CCP, 212Ho:CCC, 212Hq:CCP, 212Ht:CCC, 212Hv:CCC, 212Hw:CCC, 212Ib:C??, 212Ja:CPP, 212Jb:CP?, 212Jc:CP?, 212Jf:CPP, 212Jj:CPP, 212Jl:CPP, 212Jm:CPP, 212Jn:CP?, 212Jo:CP?, 212Ka:CPP, 212Mb:CPP, 212Na:CCP, 212Nb:CCP, 212Nc:CCC, 212Nd:CC?, 222A:CP, 222D:CP, 222E:CP, 222G:CP, 222Ha:CCC, 222Hb:CCC, 222Ia:CCC, 222Jc:CCC, 222Jg:CCC, 222Jh:CCC, 222Ji:CCC, 222Jj:CCC, 222Kd:CCC, 222Ke:CCC, 222Kf:CCC, 222Kg:CCC, 222Kj:CCC, 222Mc:CCC, 222Md:CCC, 222Me:CCC, 222Na:CCC, 234A:PP, 251Aa:CCC, 251Ab:CCC, 251Bb:CCC, 251Bd:CCC, 251Be:CCC, 251Cb:CCC, 251Cf:CCC, 251Cg:CCC, 251Ch:CCC, 251Cm:CCC, 251Cp:CCC, 251Dg:CCC, 251Eb:CCC
Federal Lands: NPS (Isle Royale, Pictured Rocks, Sleeping Bear Dunes); USFS (Chequamegon, Chequamegon-Nicolet, Chippewa, Huron, Huron-Manistee, Nicolet, Ottawa?)

ELEMENT SOURCES

Pictured Rocks National Lakeshore Inventory Notes:
Pictured Rocks National Lakeshore Plots: PIRO.092.
Pictured Rocks National Lakeshore Map Code: HCM
Local Description Authors: M.J. Russo
Global Description Authors: M. Guetersloh, mod. D. Faber-Langendoen
References: Benyus 1989, Chapman et al. 1989, Cowardin et al. 1979, Duncan and Duncan 1988, Eggers and Reed 1987, Faircloth 1971, Fehrenbacher et al. 1982, Harris et al. 1996, INAI unpubl. data, Illinois Nature Preserve Commission 1973, Midwestern Ecology Working Group n.d., Mitsch and Gosselink 1993, Mohlenbrock 1959, NDNHI unpubl. data, Nelson 1985, Niering 1985, Schotz pers. comm., Shaw and Fredine 1971, TDNH unpubl. data, TNC 1985, TNC 1995a, UNESCO 1973, WNHIP unpubl. data, Wharton 1978, Wharton 1989, White and Madany 1978, Whitley et al. 1990

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 America Freshwater Wet Meadow, Riparian & Marsh (2.C.5.a)
Macrogroup	Eastern & North-Central North American Marsh & Wet Meadow (MG069)
Group	Eastern North American Wet Meadow (G112)
Association (Common name)	Bluejoint Wet Meadow
Ecological System(s):	Eastern Great Plains Wet Meadow, Prairie and Marsh (CES205.687)
	Eastern Boreal Floodplain (CES103.588)
	North-Central Interior Wet Meadow-Shrub Swamp (CES202.701)
	Laurentian-Acadian Wet Meadow-Shrub Swamp (CES201.582)
	Central Appalachian River Floodplain (CES202.608)
	High Allegheny Wetland (CES202.069)

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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

Pictured Rocks National Lakeshore Environment: This wet meadow vegetation was sampled twice in the park in flat, seasonally flooded, basin floor depressions. Soils are somewhat poorly to very poorly drained muck over sand. The unvegetated surface is made up entirely of leaf litter (100% cover). Evidence of disturbance includes beaver activity which has changed the hydrology; surrounding upland hardwoods and white-cedar have been logged extensively.

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

Pictured Rocks National Lakeshore Vegetation: The graminoid herbaceous layer dominates this community. However, one plot has a sparse (20% cover) short-shrub layer (0.5-1 m tall) dominated by *Myrica gale* (sweetgale). The dense to total (80-100%) herbaceous layer (0.5-2 m) is dominated by *Calamagrostis canadensis* (bluejoint) (30-80%) along with *Carex lasiocarpa* (woollyfruit sedge), *Carex stricta* (upright sedge), *Dulichium arundinaceum* (threeway sedge), *Juncus brevicaudatus* (narrowpanicle rush), *Juncus nodosus* (knotted rush), and *Phalaris arundinacea* (reed canarygrass).

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.

MOST ABUNDANT SPECIES

Pictured Rocks National Lakeshore

Stratum	Lifeform	Species
Herb (field)	Forb	*Polygonum amphibium* (water knotweed)
Herb (field)	Graminoid	*Calamagrostis canadensis* (bluejoint)

Global

Stratum	Lifeform	Species
Herb (field)	Graminoid	*Calamagrostis canadensis* (bluejoint)

CHARACTERISTIC SPECIES

Pictured Rocks National Lakeshore: *Calamagrostis canadensis* (bluejoint), *Carex lasiocarpa* (woollyfruit sedge), *Myrica gale* (sweetgale), *Phalaris arundinacea* (reed canarygrass)

Global: *Calamagrostis canadensis* (bluejoint)

OTHER NOTEWORTHY SPECIES

Pictured Rocks National Lakeshore: Exotic/Invasive: *Cirsium palustre* (marsh thistle, exotic, Medium/Low)

Global: Vulnerable: *Polemonium vanbruntiae* (Vanbrunt's polemonium, G3G4)

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

OTHER COMMENTS

Other Comments:

ELEMENT DISTRIBUTION

Pictured Rocks National Lakeshore Range: This wet meadow community occurs in seasonally flooded depressions or the floodplains of small streams. The two locations sampled at Pictured Rocks are located inland, away from the direct influence of Lake Superior in the eastern half of the park, although this community could potentially occur in saturated depressions throughout the park.
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.
Nations: CA, US
States/Provinces: CT, DE, MA, MD, 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

Pictured Rocks National Lakeshore Inventory Notes:
Pictured Rocks National Lakeshore Plots: PIRO.120, PIRO.122.
Pictured Rocks National Lakeshore Map Code: HCC
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., Fike 1999, Fortney 1975, Francl et al. 2004, Gawler 2002, Harris et al. 1996, Harrison 2004, NAP pers. comm. 1998, Rawinski 1984, Swain and Kearsley 2001, Thompson 1996, Thompson and Sorenson 2000, WNHIP unpubl. data, Walbridge 1982, Walbridge and Lang 1982

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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 America Freshwater Wet Meadow, Riparian & Marsh (2.C.5.a)
Macrogroup	Eastern & North-Central North American Marsh & Wet Meadow (MG069)
Group	Eastern North American Wet Meadow (G112)
Association (Common name)	Northern Sedge Wet Meadow
Ecological System(s):	Eastern Great Plains Wet Meadow, Prairie and Marsh (CES205.687)
	North-Central Interior Wet Meadow-Shrub Swamp (CES202.701)
	Northern Great Lakes Coastal Marsh (CES201.722)
	Western Great Plains Open Freshwater Depression Wetland (CES303.675)
	North-Central Interior Floodplain (CES202.694)
	Laurentian-Acadian Wet Meadow-Shrub Swamp (CES201.582)
	High Allegheny Wetland (CES202.069)

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

Pictured Rocks National Lakeshore Environment: This northern tall sedge community was sampled at four locations in the park in flat, seasonally to semipermanently flooded depressions. Soils range from poorly drained sandy loam to very poorly drained muck with the water table at or just below the surface to well-drained loamy sand over coarse sand, pebbles, and gravel. The unvegetated surface is made up almost entirely of leaf litter (97-99% cover) with some wood (0-1%) and bare soil (0-2%). At one site, the fluctuating water table has caused mortality to encroaching/receding hardwoods. This disturbance could be a result of past beaver activity, natural variation, culvert flow under road, and/or removal of beavers. Surrounding areas were probably selectively logged 70+ years ago.

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

Pictured Rocks National Lakeshore Vegetation: The graminoid herbaceous layer is dominant in this community. However, there is also a sparse (5-30% cover) short-shrub layer (0.5-2 m tall) that can include *Cornus sericea* (red-osier dogwood), *Myrica gale* (sweetgale), *Rubus idaeus* ssp. *strigosus* (grayleaf red raspberry), and *Salix petiolaris* (meadow willow), among others. The dense to total (80-100%) herbaceous layer (0.5-1 m) is dominated by *Carex* (sedge) spp., including *Carex buxbaumii* (Buxbaum's sedge), *Carex hystericina* (bottlebrush sedge), *Carex vesicaria* (blister sedge), and *Carex tuckermanii* (Tuckerman's sedge), as well as *Scirpus cyperinus* (woolgrass), *Eleocharis elliptica* (elliptic spikerush), *Glyceria striata* (fowl mannagrass), *Phalaris arundinacea* (reed canarygrass), and *Calamagrostis canadensis* (bluejoint).

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).

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MOST ABUNDANT SPECIES

Pictured Rocks National Lakeshore

Stratum	Lifeform	Species

Global

Stratum	Lifeform	Species

CHARACTERISTIC SPECIES

Pictured Rocks National Lakeshore: *Carex buxbaumii* (Buxbaum's sedge), *Carex tuckermanii* (Tuckerman's sedge), *Eleocharis elliptica* (elliptic spikerush), *Myrica gale* (sweetgale), *Salix petiolaris* (meadow willow), *Scirpus cyperinus* (woolgrass)
Global:

OTHER NOTEWORTHY SPECIES

Pictured Rocks National Lakeshore: Exotic/Invasive: *Cirsium palustre* (marsh thistle, exotic, Medium/Low)
Global:

CONSERVATION STATUS RANK

Global Rank & Reasons: G4G5 (17-Jun-1999).

CLASSIFICATION

Status: Standard
Classification Confidence: 2 - Moderate
Pictured Rocks National Lakeshore Comments:
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) =
- *Carex utriculata / Sphagnum* spp. fen (Byers et al. 2007) =
- *Polytrichum - Carex (rostrata, stricta)* hummock bog (Fortney 1975) =
- Meadow marsh: tall sedge (W12) (Harris et al. 1996) =
- Northern Sedge Meadow (Curtis 1959) =

OTHER COMMENTS

Other Comments:

ELEMENT DISTRIBUTION

Pictured Rocks National Lakeshore Range: This northern tall sedge community occurs in flat, seasonally to semipermanently flooded depressions. The two locations sampled at Pictured Rocks are located in the eastern half of the park, although this community could potentially occur in saturated depressions throughout the park.
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.

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Nations: CA, US
States/Provinces: IA, MB:SU, ME, MI, MN, ND:S2S3, ON, QC:S4?, SD, 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:?
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

Pictured Rocks National Lakeshore Inventory Notes:
Pictured Rocks National Lakeshore Plots: PIRO.045, PIRO.067, PIRO.083, PIRO.091.
Pictured Rocks National Lakeshore Map Code: HSG
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, Fortney 1975, Fortney and Rentch 2003, Francl et al. 2004, Gawler 2002, Gleason and Cronquist 1991, Greenall 1996, Harris et al. 1996, INAI unpubl. data, Midwestern Ecology Working Group n.d., Mohlenbrock and Ladd 1978, NDNHI unpubl. data, Ownbey and Morley 1991, Robinette 1966, Voss 1972, WNHIP unpubl. data

Dogwood - Willow Swamp

***Cornus sericea* - *Salix* spp. - (*Rosa palustris*) Shrubland**
Red-osier Dogwood - Willow species - (Swamp Rose) Shrubland
Identifier: CEGL002186

NVC CLASSIFICATION

Division	Eastern North America Freshwater Wet Meadow, Riparian & Marsh (2.C.5.a)
Macrogroup	Eastern & North-Central North American Marsh & Wet Meadow (MG069)
Group	Eastern North American Wet Meadow (G112)
Association (Common name)	Dogwood - Willow Swamp
Ecological System(s):	Boreal Ice-Scour Rivershore (CES103.589)
	Eastern Great Plains Wet Meadow, Prairie and Marsh (CES205.687)
	Eastern Boreal Floodplain (CES103.588)
	North-Central Interior Wet Meadow-Shrub Swamp (CES202.701)
	Laurentian-Acadian Wet Meadow-Shrub Swamp (CES201.582)

ELEMENT CONCEPT

Global Summary: This dogwood - willow shrub swamp community is found in the upper midwestern region of the United States and Canada. Stands are found along streams and lakes, or in upland depressions. Hydrology is variable but is typically seasonally flooded. Soils are wet, organic, and minerotrophic, with either highly decomposed peat or fine mineral soils. The vegetation is dominated by tall shrubs between 1 and 3 m tall, with at least 25% cover, and often very dense (>60% cover). More open stands may have high graminoid cover. Trees may be scattered but cover less than 25%. Composition of the shrub layer is quite diverse, primarily due to the diversity of *Salix* (willow) spp., which collectively share dominance with *Cornus sericea* (red-osier dogwood). Willow species include *Salix bebbiana* (Bebb willow), *Salix discolor* (pussy willow), *Salix eriocephala* (Missouri River willow), *Salix interior* (sandbar willow), *Salix fragilis* (crack willow), and *Salix petiolaris* (meadow willow). Other shrub associates include *Cephalanthus occidentalis* (common buttonbush) (southeastward), *Cornus amomum* (silky dogwood), *Ribes americanum* (American black currant), *Rosa palustris* (swamp rose) (more common eastward), *Rosa blanda* (smooth rose) and *Rosa woodsii* var. *woodsii* (Woods' rose) (more common westward), *Rubus pubescens* (dwarf red blackberry) (northward), *Rubus idaeus* ssp. *strigosus* (grayleaf red raspberry), *Sambucus canadensis* (common elderberry), *Spiraea alba* (white meadowsweet), and *Viburnum lentago* (nannyberry). Woody vines present include *Clematis virginiana* (devil's darning needles), *Parthenocissus quinquefolia* (Virginia creeper), and *Toxicodendron radicans* (eastern poison-ivy). Characteristic herbs include *Asclepias incarnata* (swamp milkweed), *Symphyotrichum lanceolatum* var. *lanceolatum* (white panicle aster), *Calamagrostis canadensis* (bluejoint), *Eupatorium maculatum* (spotted joepyeweed), *Glyceria striata* (fowl mannagrass), *Impatiens capensis* (jewelweed), *Lycopus americanus* (American water horehound), *Lycopus uniflorus* (northern bugleweed), *Phalaris arundinacea* (reed canarygrass), *Solidago gigantea* (giant goldenrod), and *Thalictrum dasycarpum* (purple meadowrue). A variety of sedges may dominate more open stands, including *Carex lacustris* (hairy sedge) and *Carex stricta* (upright sedge). Tree species include *Acer rubrum* (red maple), *Fraxinus pennsylvanica* (green ash), and *Ulmus americana* (American elm).

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ENVIRONMENTAL DESCRIPTION

Pictured Rocks National Lakeshore Environment: This dogwood - willow shrub swamp was sampled twice in the park. One site is a seasonally flooded depression perched 50-70 m above Lake Superior with well-drained sandy loam soil. Hydrology is linked to a wetland located to the northeast that drains into Lake Superior via a waterfall. The second site is an intermittently flooded streambed (dry at the time of sampling) with rapidly drained sand soil. The unvegetated surface is dominated by leaf litter (80-97% cover) with some wood (1-3%) and bare soil/sand (2-17%). The surrounding hardwoods at one site were undergoing timber harvest at the time of sampling and were logged 70 years ago at the other site.
Global Environment: Stands are found along streams and lakes, or in upland depressions. Hydrology is variable, but is typically seasonally flooded. Soils are wet, organic, and minerotrophic, with either highly decomposed peat or fine mineral soils (Curtis 1959, Harris et al. 1996).

VEGETATION DESCRIPTION

Pictured Rocks National Lakeshore Vegetation: This community is a dense (80-100% cover) monotypic stand of *Cornus sericea* (red-osier dogwood), 0.5-5 m tall. As a result of the dense shrub layer, the herbaceous layer is very sparse (5-20%) and may include *Carex cryptolepis* (northeastern sedge) (dominant in one plot), *Carex lasiocarpa* (woollyfruit sedge), *Carex tuckermanii* (Tuckerman's sedge), *Hypericum majus* (large St. Johnswort), *Iris versicolor* (harlequin blueflag), and *Potentilla norvegica* (Norwegian cinquefoil).
Global Vegetation: The vegetation is dominated by tall shrubs between 1 and 3 m tall, with at least 25% cover, and often very dense (>60% cover). More open stands may have high graminoid cover. Trees may be scattered, but cover less than 25%. Composition of the shrub layer is quite diverse, primarily due to the diversity of *Salix* (willow) spp., which collectively share dominance with *Cornus sericea* (red-osier dogwood). Willow species include *Salix bebbiana* (Bebb willow), *Salix discolor* (pussy willow), *Salix eriocephala* (Missouri River willow), *Salix exigua* (narrowleaf willow), *Salix fragilis* (crack willow), and *Salix petiolaris* (meadow willow). Other shrubs associates include *Cephalanthus occidentalis* (common buttonbush) (southeastward), *Cornus amomum* (silky dogwood), *Ribes americanum* (American black currant), *Rosa palustris* (swamp rose) (more common eastward), *Rosa blanda* (smooth rose) and *Rosa woodsii* var. *woodsii* (Woods' rose) (more common westward), *Rubus pubescens* (dwarf red blackberry) (northward), *Rubus idaeus* ssp. *strigosus* (grayleaf red raspberry), *Sambucus canadensis* (common elderberry), *Spiraea alba* (white meadowsweet), and *Viburnum lentago* (nannyberry). Woody vines present include *Clematis virginiana* (devil's darning needles), *Parthenocissus quinquefolia* (Virginia creeper), and *Toxicodendron radicans* (eastern poison-ivy). Characteristic herbs include *Asclepias incarnata* (swamp milkweed), *Symphyotrichum lanceolatum* var. *lanceolatum* (white panicle aster), *Calamagrostis canadensis* (bluejoint), *Eupatorium maculatum* (spotted joepyeweed), *Glyceria striata* (fowl mannagrass), *Impatiens capensis* (jewelweed), *Lycopus americanus* (American water horehound), *Lycopus uniflorus* (northern bugleweed), *Phalaris arundinacea* (reed canarygrass), *Solidago gigantea* (giant goldenrod), and *Thalictrum dasycarpum* (purple meadowrue). A variety of sedges may dominate more open stands, including *Carex lacustris* (hairy sedge) and *Carex stricta* (upright sedge). Tree species include *Acer rubrum* (red maple), *Fraxinus pennsylvanica* (green ash), and *Ulmus americana* (American elm) (Curtis 1959, White and Madany 1978, Chapman et al. 1989, Reschke 1990, MNNHP 1993, Harris et al. 1996).

MOST ABUNDANT SPECIES

Pictured Rocks National Lakeshore

Stratum	Lifeform	Species
Short shrub/sapling	Broad-leaved deciduous shrub	*Cornus sericea* (red-osier dogwood)

Global

Stratum	Lifeform	Species

CHARACTERISTIC SPECIES

Pictured Rocks National Lakeshore: *Cornus sericea* (red-osier dogwood)
Global:

OTHER NOTEWORTHY SPECIES

Pictured Rocks National Lakeshore:
Global:

CONSERVATION STATUS RANK

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

CLASSIFICATION

Status: Standard
Classification Confidence: 2 - Moderate
Pictured Rocks National Lakeshore Comments:
Global Comments: The closely related shrub meadow type is *Cornus sericea - Salix (bebbiana, discolor, petiolaris) / Calamagrostis stricta* Shrubland (CEGL002187), with which this type intergrades, and which generally has a more open shrub cover (25-50% cover). It's conceivable that the two types could be combined. It is also possible that a number of different *Salix* (willow) and *Cornus* (dogwood) shrub swamp types could be recognized with further study. A boreal/sub-boreal type may also be needed (e.g., Harris et al. 1996). Rich shrub fens, typically on a more peaty substrate or with calcareous indicators overlap to some degree with this type, but are a separate group (e.g., *Cornus amomum - Salix* spp. - *Toxicodendron vernix - Rhamnus lanceolata* Fen Shrubland (CEGL005087) and

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Cornus sericea - Cornus amomum - Photinia melanocarpa - Viburnum lentago Fen Shrubland (CEGL005088)). In Ontario, a coarsely defined type, Mixed Deciduous Thicket Swamp Shrubland (CEGL005086), covers a number of more locally dominant species recorded there, e.g., shrub swamps dominated by any of the following: *Acer spicatum* (mountain maple), *Lindera benzoin* (northern spicebush), *Viburnum dentatum* (southern arrow-wood), *Viburnum lentago* (nannyberry) (Bakowsky and Lee 1996, Lee et al. 1998). In New York, this type may occur on the Great Lakes plain.

Global Similar Associations:

- *Chamaedaphne calyculata - Myrica gale / Carex lasiocarpa* Dwarf-shrubland (CEGL005228)
- *Cornus (amomum, sericea) - Viburnum dentatum - Rosa multiflora* Shrubland (CEGL006576)
- *Cornus amomum - Salix* spp. - *Toxicodendron vernix - Rhamnus lanceolata* Fen Shrubland (CEGL005087)--is a tall shrub fen.
- *Cornus sericea - Cornus amomum - Photinia melanocarpa - Viburnum lentago* Fen Shrubland (CEGL005088)--is a tall shrub fen.
- *Cornus sericea - Salix (bebbiana, discolor, petiolaris) / Calamagrostis stricta* Shrubland (CEGL002187)--is somewhat drier, but grades into this type.
- Mixed Deciduous Thicket Swamp Shrubland (CEGL005086)--is a "collective" type, covering a number of different provincial types that contain dominant species that do not easily fit elsewhere.
- *Symplocarpus foetidus* Herbaceous Vegetation (CEGL002385)

Global Related Concepts:

- Shrub Carr (Curtis 1959) =
- Shrub Swamps (Anderson 1996) B
- Thicket swamp: tall willow (W36) (Harris et al. 1996) =

OTHER COMMENTS

Other Comments:

ELEMENT DISTRIBUTION

Pictured Rocks National Lakeshore Range: This dogwood - willow shrub swamp community is rare in the park. It is found in a desiccated wetland on a ridge high above Lake Superior, east of Miners Beach.

Global Range: This dogwood - willow shrubland swamp is found in the upper midwestern region of the United States and adjacent Canada, ranging from Minnesota east to western New York and Ontario, south to Illinois and Indiana.

Nations: CA, US

States/Provinces: IL, IN, MI, MN:S4, NY, OH, ON, PA, QC, WI:S4

TNC Ecoregions: 35:C, 36:C, 45:C, 46:C, 47:C, 48:C, 49:C, 64:P

USFS Ecoregions (1994/95): 212Hb:CCP, 212He:CC?, 212Hh:CC?, 212Hi:CCC, 212Hj:CC?, 212Hl:CC?, 212Hm:CC?, 212Ho:CCC, 212Hr:CC?, 212Hs:CC?, 212Ht:CCP, 212Hu:CCP, 212Hv:CC?, 212Hw:CCC, 212Hx:CC?, 212Ja:CPP, 212Jb:CPP, 212Jc:CPP, 212Je:CPP, 212Jf:CPP, 212Jj:CPP, 212Jl:CPP, 212Jm:CPP, 212Ka:CCP, 212Kb:CCC, 212La:CPP, 212Mb:CPP, 212Na:CCP, 212Nb:CCP, 212Nc:CCC, 221Ea:CCC, 221Fa:CCC, 222Ib:CCC, 222Ic:CCP, 222Id:CCP, 222Ja:CC?, 222Je:CCC, 222Ji:CCC, 222Jj:CCC, 222Ke:CCC, 222Kf:CCC, 222Lc:CCC, 222Mb:CCC, 222Mc:CCC, 222Md:CCC, 222Me:CCC, 222Na:CCC, 251Ba:CCC, 251Cf:CCC

Federal Lands: NPS (Indiana Dunes, Pictured Rocks, Sleeping Bear Dunes, Voyageurs); USFS (Chequamegon, Chequamegon-Nicolet, Chippewa, Hiawatha, Nicolet, Ottawa?, Superior?); USFWS (Erie, Iroquois)

ELEMENT SOURCES

Pictured Rocks National Lakeshore Inventory Notes:

Pictured Rocks National Lakeshore Plots: PIRO.084, PIRO.134.

Pictured Rocks National Lakeshore Map Code: SDW

Local Description Authors: M.J. Russo

Global Description Authors: D. Faber-Langendoen

References: Anderson 1996, Bakowsky and Lee 1996, Borowitz and Stephenson 1985, Chapman et al. 1989, Curtis 1959, Edinger et al. 2002, Harris et al. 1996, Lee et al. 1998, MNNHP 1993, Midwestern Ecology Working Group n.d., Reschke 1990, WNHIP unpubl. data, White and Madany 1978

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5. Hydromorphic Vegetation

5.B.1. Freshwater Aquatic Vegetation

5.B.1.a. North American Freshwater Aquatic Vegetation

MG108. Eastern North American Freshwater Aquatic Vegetation

G114. Eastern North American Freshwater Aquatic Vegetation [Placeholder]

Northern Water-lily Aquatic Wetland

***Nymphaea odorata - Nuphar (microphylla, variegata)* Herbaceous Vegetation**
American White Water-lily - (Yellow Pond-lily, Variegated Yellow Pond-lily) Herbaceous Vegetation
Identifier: CEGL002562

NVC CLASSIFICATION

Division	North American Freshwater Aquatic Vegetation (5.B.1.a)
Macrogroup	Eastern North American Freshwater Aquatic Vegetation (MG108)
Group	Eastern North American Freshwater Aquatic Vegetation [Placeholder] (G114)
Association (Common name)	Northern Water-lily Aquatic Wetland
Ecological System(s):	Laurentian-Acadian Freshwater Marsh (CES201.594)

ELEMENT CONCEPT

Global Summary: This water-lily aquatic wetland type occurs throughout the upper midwestern region of the United States and adjacent Canada. Stands occur in open, slow-moving water on lakes and streams, often less than 0.5 m deep. The substrate is variable, from muck to sedimentary peat. Emergent vegetation cover is less than 25% and floating-leaved aquatics cover at least 25% of the surface. Typical dominants vary from stand to stand but include *Nymphaea odorata* (American white waterlily), *Nuphar microphylla*, and *Nuphar variegata*. Other dominants may include *Brasenia schreberi* (watershield) and *Potamogeton amplifolius* (largeleaf pondweed). A variety of emergent species can occur in this community.

ENVIRONMENTAL DESCRIPTION

Pictured Rocks National Lakeshore Environment: This pond-lily aquatic community was sampled at three locations in the park. These permanently flooded shallow ponds are located along the backslope of a dune field, in a flat basin, and at the base of a somewhat steep southeast-facing kettle. Soils are very poorly drained muck. Standing water dominates (95-100% cover) the unvegetated surface which may include some leaf litter (0-5%). Beaver may be controlling water levels. Evidence of disturbance includes trails, seed tree and clear-cutting of surrounding areas, and potential slumping of slopes.
Global Environment: Stands occur in open, slow-moving water on lakes and streams, often less than 0.5 m deep. The substrate is variable, from muck to sedimentary peat (Harris et al. 1996)

VEGETATION DESCRIPTION

Pictured Rocks National Lakeshore Vegetation: This nearly monotypic pond community is dominated by the rooted-aquatic *Nuphar lutea* (yellow pond-lily) (30-70% cover). Other species that may be present include *Dulichium arundinaceum* (threeway sedge), *Eleocharis palustris* (common spikerush), *Glyceria canadensis* (rattlesnake mannagrass), *Typha latifolia* (broadleaf cattail), and *Potamogeton natans* (floating pondweed).
Global Vegetation: Emergent vegetation cover is less than 25% and floating-leaved aquatics cover at least 25% of the surface. Typical dominants vary from stand to stand but include *Nymphaea odorata* (American white waterlily), *Nuphar microphylla*, and *Nuphar variegata*. Other dominants may include *Brasenia schreberi* (watershield) and *Potamogeton amplifolius* (largeleaf pondweed). A variety of emergent species can occur within this type (Harris et al. 1996).

MOST ABUNDANT SPECIES

Pictured Rocks National Lakeshore

Stratum	Lifeform	Species
Floating aquatic	Aquatic herb (floating & submergent)	*Nuphar lutea* (yellow pond-lily)

Global

Stratum	Lifeform	Species
Floating aquatic	Aquatic herb (floating & submergent)	*Nuphar lutea* ssp. *pumila* (yellow pond-lily), *Nuphar lutea* ssp. *variegata* (variegated yellow pond-lily), *Nymphaea odorata* (American white waterlily)

CHARACTERISTIC SPECIES

Pictured Rocks National Lakeshore: *Dulichium arundinaceum* (threeway sedge), *Glyceria canadensis* (rattlesnake mannagrass), *Nuphar lutea* (yellow pond-lily)
Global: *Nuphar lutea* ssp. *pumila* (yellow pond-lily), *Nuphar lutea* ssp. *variegata* (variegated yellow pond-lily), *Nymphaea odorata* (American white waterlily)

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OTHER NOTEWORTHY SPECIES

Pictured Rocks National Lakeshore:
Global:

CONSERVATION STATUS RANK

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

CLASSIFICATION

Status: Standard
Classification Confidence: 3 - Weak
Pictured Rocks National Lakeshore Comments:
Global Comments: This type is not well-characterized across its range. Further review is needed in the United States. Depending on spatial scale, it conceptually overlaps both submergent and emergent aquatic types.
Global Related Concepts:
- Inland Emergent Marsh (Chapman et al. 1989) B
- Open water marsh: floating-leaved plants (W4) (Harris et al. 1996) =

OTHER COMMENTS

Other Comments:

ELEMENT DISTRIBUTION

Pictured Rocks National Lakeshore Range: This pond-lily aquatic community may occur in ponds or open water throughout the park.
Global Range: This water-lily aquatic wetland type occurs throughout the upper midwestern region of the United States and adjacent Canada.
Nations: CA, US
States/Provinces: MB:S2, MI, MN, NY, ON, QC:S5?, WI
TNC Ecoregions: 47:C, 48:C
USFS Ecoregions (1994/95): 212Hi:CCC, 212Hl:CCP, 212Hm:CCP, 212Hn:CCP, 212Ho:CCC, 212Hp:CCP, 212Hq:CCP, 212Hr:CCP, 212Hs:CCP, 212Ht:CCP, 212Hv:CCP, 212Hw:CCC, 212Hx:CCP, 212Hy:CCP, 212Ia:CCC, 212Ib:CCP, 212Ja:CPP, 212Jb:CPP, 212Jc:CPP, 212Jl:CPP, 212Jn:CPP, 212Jo:CPP, 212La:CPP, 212Mb:CPP, 212Na:CPP, 212Nb:CPP, 212Nc:CPP, 221B:CC, 222Jb:CCC, 222Je:CCC, M212:C
Federal Lands: NPS (Apostle Islands, Isle Royale, Pictured Rocks, Sleeping Bear Dunes, Voyageurs); USFS (Chippewa, Huron, Huron-Manistee, Manistee?, Ottawa, Superior?)

ELEMENT SOURCES

Pictured Rocks National Lakeshore Inventory Notes:
Pictured Rocks National Lakeshore Plots: PIRO.049, PIRO.087, PIRO.097.
Pictured Rocks National Lakeshore Map Code: HFA
Local Description Authors: M.J. Russo
Global Description Authors: D. Faber-Langendoen
References: Chapman et al. 1989, Edinger et al. 2002, Greenall 1996, Harris et al. 1996, Midwestern Ecology Working Group n.d., WNHIP unpubl. data

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.a)
Macrogroup	Eastern North American Freshwater Aquatic Vegetation (MG108)
Group	Eastern North American Freshwater Aquatic Vegetation [Placeholder] (G114)
Association (Common name)	Midwest Pondweed Submerged Aquatic Wetland
Ecological System(s):	Eastern Great Plains Wet Meadow, Prairie and Marsh (CES205.687)
	North-Central Interior Floodplain (CES202.694)
	Laurentian-Acadian Freshwater Marsh (CES201.594)
	North-Central Interior Freshwater Marsh (CES202.899)

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.

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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

Pictured Rocks National Lakeshore Environment: Information not available.

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

Pictured Rocks National Lakeshore Vegetation:

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 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

Pictured Rocks National Lakeshore

Stratum	Lifeform	Species

Global

Stratum	Lifeform	Species

CHARACTERISTIC SPECIES

Pictured Rocks National Lakeshore:

Global:

OTHER NOTEWORTHY SPECIES

Pictured Rocks National Lakeshore:

Global:

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CONSERVATION STATUS RANK

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

CLASSIFICATION

Status: Standard
Classification Confidence: 3 - Weak
Pictured Rocks National Lakeshore Comments:
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:
- Open water marsh: floating-leaved plants (W4) (Harris et al. 1996) I

OTHER COMMENTS

Other Comments:

ELEMENT DISTRIBUTION

Pictured Rocks National Lakeshore Range:
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, Indiana Dunes, Isle Royale, Pictured Rocks, Saint Croix, Sleeping Bear Dunes, Voyageurs); USFS (Chequamegon, Chequamegon-Nicolet, Nicolet, Shawnee, Superior?)

ELEMENT SOURCES

Pictured Rocks National Lakeshore Inventory Notes:
Pictured Rocks National Lakeshore Plots:
Pictured Rocks National Lakeshore Map Code: HSV
Local Description Authors:
Global Description Authors: D. Faber-Langendoen
References: Chapman et al. 1989, Curtis 1959, Harris et al. 1996, INAI unpubl. data, Keys et al. 1995, Midwestern Ecology Working Group n.d., NDNHI unpubl. data, Swindale and Curtis 1957

6. Lithomorphic Vegetation

6.B.2. Temperate & Boreal Cliff, Scree & Rock Vegetation

6.B.2.a. Eastern North American Temperate Cliff, Scree & Rock Vegetation

MG176. Eastern North American Beach, Shoreline & Flat

G342. Eastern North American Lake Flat & Beach

Inland Freshwater Strand Beach

Inland Freshwater Strand Beach Sparse Vegetation
Inland Freshwater Strand Beach Sparse Vegetation
Identifier: CEGL002310

NVC CLASSIFICATION

Division	Eastern North American Temperate Cliff, Scree & Rock Vegetation (6.B.2.a)
Macrogroup	Eastern North American Beach, Shoreline & Flat (MG176)
Group	Eastern North American Lake Flat & Beach (G342)
Association (Common name)	Inland Freshwater Strand Beach
Ecological System(s):	Laurentian-Acadian Lakeshore Beach (CES201.586)

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ELEMENT CONCEPT

Global Summary: This freshwater inland lake beach occurs throughout the upper midwestern and northeastern United States and adjacent Canada. Stands may be most common on sandy outwash plains, where lakes are large enough to be affected by wave action or annual fluctuations in water level. Stands are found in the lower beach zone, which has submergent and floating-leaved aquatics tolerant of stranding. Species composition of this type needs to be described.

ENVIRONMENTAL DESCRIPTION

Pictured Rocks National Lakeshore Environment: This shoreline community was sampled twice in the park at Beaver Lake and Little Beaver Lake. The sites are flat, intermittently flooded to saturated shorelines. Soils are rapidly drained (though with the water table just inches below the surface) to somewhat poorly drained sand. The unvegetated surface is made up of bare sand (74-85% cover), leaf litter (5-25%), wood (0-1%), and standing water (0-10%). Evidence of disturbance includes wave action and water level fluctuations, use by visitors to the park, and the presence of exotic plants.
Global Environment: Stands may be most common on sandy outwash plains (MNNHP 1993), presumably where lakes are large enough to be affected by wave action or annual fluctuations in water level.

VEGETATION DESCRIPTION

Pictured Rocks National Lakeshore Vegetation: Herbaceous species dominate this community. However, there is a sparse (5-10% cover) layer of short shrubs that may include *Acer rubrum* (red maple), *Betula papyrifera* (paper birch), *Myrica gale* (sweetgale), and *Populus balsamifera* (balsam poplar), among others. The moderate (40-70%) herbaceous layer is dominated by *Carex viridula* (little green sedge) and *Eleocharis elliptica* (elliptic spikerush) with lesser amounts of other *Carex* (sedge) spp., *Dichanthelium acuminatum* (tapered rosette grass), *Equisetum* (horsetail) spp., *Eupatorium* (thoroughwort) spp., *Euthamia graminifolia* (flat-top goldentop), *Fragaria virginiana* (Virginia strawberry), *Juncus* (rush) spp., and *Schoenoplectus americanus* (chairmaker's bulrush), among others.
Global Vegetation: The lower beach zone has submergent and floating-leaved aquatics tolerant of stranding (MNNHP 1993). The upper beach zone has both perennial graminoids tolerant of inundation and erosion and annual species. Species composition of this type needs to be described.

MOST ABUNDANT SPECIES

Pictured Rocks National Lakeshore

Stratum	Lifeform	Species
Tall shrub/sapling	Broad-leaved deciduous shrub	*Acer rubrum* (red maple), *Betula papyrifera* (paper birch)
Tall shrub/sapling	Broad-leaved evergreen shrub	*Myrica gale* (sweetgale)
Herb (field)	Forb	*Cirsium palustre*, *Euthamia graminifolia* (flat-top goldentop)
Herb (field)	Graminoid	*Carex viridula* (little green sedge), *Dichanthelium acuminatum* (tapered rosette grass), *Eleocharis elliptica* (elliptic spikerush), *Schoenoplectus americanus* (chairmaker's bulrush)

Global

Stratum	Lifeform	Species

CHARACTERISTIC SPECIES

Pictured Rocks National Lakeshore: *Carex viridula* (little green sedge), *Eleocharis elliptica* (elliptic spikerush), *Euthamia graminifolia* (flat-top goldentop), *Schoenoplectus americanus* (chairmaker's bulrush)
Global:

OTHER NOTEWORTHY SPECIES

Pictured Rocks National Lakeshore: Exotic/Invasive: *Cirsium palustre* (marsh thistle, exotic, Medium/Low)
Global:

CONSERVATION STATUS RANK

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

CLASSIFICATION

Status: Standard
Classification Confidence: 3 - Weak
Pictured Rocks National Lakeshore Comments:
Global Comments: Extent of this type in the region is not well known. Many inland lakes in the region do not have sparsely vegetated beaches.
Global Similar Associations:
- Lake Mudflats Sparse Vegetation (CEGL002313)

Global Related Concepts:
- Lacustrine, Littoral, Unconsolidated Cobble/Gravel Shore, Intermittently Flooded (L2US1) (Cowardin et al. 1979) ?
- Lacustrine, Littoral, Unconsolidated Sand Shore, Intermittently Flooded (L2US2) (Cowardin et al. 1979) ?
- Lake Sand Beach (Thompson 1996) B
- Lakeshore Dry Shale Cobble Community (Thompson 1996) ?

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OTHER COMMENTS

Other Comments:

ELEMENT DISTRIBUTION

Pictured Rocks National Lakeshore Range: This freshwater inland lake beach occurs on large inland lakes subject to minor wave and ice action. It is best developed at Beaver Lake and Kingston Lake.
Global Range: This freshwater inland lake beach occurs locally throughout the upper midwestern and northeastern United States and adjacent Canada, ranging from Minnesota and Saskatchewan southeastward to Indiana and northeastward to Vermont and Ontario.
Nations: CA, US
States/Provinces: IN?, MB:S3S4, ME, MI, MN:S3, NY, ON, SK, VT, WI:S2
TNC Ecoregions: 47:C, 48:C, 64:C
USFS Ecoregions (1994/95): 212Ha:CCP, 212Hb:CCP, 212He:CCP, 212Hh:CCP, 212Hi:CCC, 212Hj:CCP, 212Hk:CCP, 212Ho:CCC, 212Hq:CCP, 212Hw:CCC, 212Ja:CPP, 212Jb:CPP, 212Jc:CPP, 212Jk:CPP, 212Jl:CPP, 212Jm:CPP, 212Jn:CPP, 212Jo:CPP, 212Jr:CPP, 212Ka:CCC, 212Mb:C??, 212Na:CPP, 212Nb:CPP, 212Nc:CPP, 222:?
Federal Lands: NPS (Pictured Rocks, Sleeping Bear Dunes); USFS (Chequamegon, Chequamegon-Nicolet, Chippewa, Huron, Huron-Manistee, Manistee, Nicolet, Ottawa)

ELEMENT SOURCES

Pictured Rocks National Lakeshore Inventory Notes:
Pictured Rocks National Lakeshore Plots: PIRO.035, PIRO.127.
Pictured Rocks National Lakeshore Map Code: VAV
Local Description Authors: M.J. Russo
Global Description Authors: D. Faber-Langendoen
References: Cowardin et al. 1979, Gawler 2002, Greenall 1996, MNNHP 1993, Midwestern Ecology Working Group n.d., Thompson 1996, Thompson and Sorenson 2000, WNHIP unpubl. data

Lake Mudflats

Lake Mudflats Sparse Vegetation
Lake Mudflats Sparse Vegetation
Identifier: CEGL002313

NVC CLASSIFICATION

Division	Eastern North American Temperate Cliff, Scree & Rock Vegetation (6.B.2.a)
Macrogroup	Eastern North American Beach, Shoreline & Flat (MG176)
Group	Eastern North American Lake Flat & Beach (G342)
Association (Common name)	Lake Mudflats
Ecological System(s):	Laurentian-Acadian Lakeshore Beach (CES201.586)

ELEMENT CONCEPT

Global Summary: This lake mudflats community is found throughout the upper midwestern region of the United States and adjacent Canada, and probably more widely. Stands occur in shallow basins or lake margins that flood in the spring and draw down later in the season, exposing wet, muddy sediments on which plant species subsequently grow. Great Lakes shore mudflats are placed here as well. Substrates include silt and clay mixed with marl or sedimentary peats comprised of plant and animal residues precipitated from standing water. Rooted aquatics may grow during the flood stages, leaving organic debris on the surface during drawdowns. The composition and structure of the vegetation are influenced by the flooding regime. In general, the vegetation is composed of dryland forms of aquatic plants and seedlings originating from seeds dormant in the sediment or washed in from other communities. These aquatics include *Heteranthera* (mudplantain) spp., *Nuphar* (pond-lily) spp., *Nymphaea* (waterlily) spp., *Polygonum amphibium* (water knotweed), and *Potamogeton* (pondweed) spp. As the vegetation matures over the summer and early fall, graminoids or forbs may become dominant, including species of *Cyperus* (flatsedge), *Juncus* (rush), *Polygonum* (knotweed), and *Schoenoplectus* (bulrush).

ENVIRONMENTAL DESCRIPTION

Pictured Rocks National Lakeshore Environment: This lake mudflat community was sampled twice in the park. One site is the semipermanently flooded, flat floodplain of a creek, the other a seasonally flooded, flat shoreline. Soils are saturated poorly drained sand and very poorly drained muck. The unvegetated surface is made up of leaf litter (20-89% cover), standing water (0-10%) and bare soil (1-80%). Evidence of disturbance includes old beaver activity.
Global Environment: Stands occur in shallow basins or lake margins that flood in the spring and draw down later in the season, exposing wet, muddy sediments on which plant species subsequently grow. Substrates include silt and clay mixed with marl or sedimentary peats comprised of plant and animal residues precipitated from standing water (sometimes referred to as "gyttja") (MNNHP 1993).

VEGETATION DESCRIPTION

Pictured Rocks National Lakeshore Vegetation: One plot has a sparse (10% cover) short-shrub layer (0.5-1 m) of *Myrica gale* (sweetgale), *Vaccinium macrocarpon* (cranberry), and sapling *Thuja occidentalis* (northern white-cedar). The dominant (50-90%) herb

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layer may include *Carex sterilis* (dioecious sedge), *Cladium mariscoides* (smooth sawgrass), *Eleocharis palustris* (common spikerush), *Glyceria canadensis* (rattlesnake mannagrass), *Rhynchospora alba* (white beaksedge), *Rhynchospora fusca* (brown beaksedge) (60% cover in one plot), *Schoenoplectus americanus* (chairmaker's bulrush), *Sparganium americanum* (American bur-reed), and *Potamogeton natans* (floating pondweed), among others.

Global Vegetation: The composition and structure of the vegetation is influenced by the flooding regime. In general, the vegetation is composed of dryland forms of aquatic plants and seedlings originating from seeds dormant in the sediment or washed in from other communities. These aquatics include *Heteranthera* (mudplantain) spp., *Nuphar* (pond-lily) spp., *Nymphaea* (waterlily) spp., *Polygonum amphibium* (water knotweed), and *Potamogeton* (pondweed) spp. As the vegetation matures over the summer and early fall, graminoids or forbs may dominant, including species of *Cyperus* (flatsedge), *Juncus* (rush), *Polygonum* (knotweed), and *Scirpus* (bulrush) and/or *Schoenoplectus* (bulrush) (MNNHP 1993). Lake mudflats in the Great Lakes are exposed when high waters recede. They are often quickly colonized by *Schoenoplectus tabernaemontani* (softstem bulrush), *Rorippa palustris* (bog yellowcress), *Bidens cernua* (nodding beggarticks), and *Polygonum* (knotweed) spp. Over time these colonizing species decline and are replaced by wet meadow species, such as *Calamagrostis canadensis* (bluejoint) or *Carex* (sedge) spp. (Minc and Albert 1998).

MOST ABUNDANT SPECIES

Pictured Rocks National Lakeshore

Stratum	Lifeform	Species
Herb (field)	Graminoid	*Eleocharis palustris* (common spikerush)
Floating aquatic	Aquatic herb (floating & submergent)	*Potamogeton natans* (floating pondweed)

Global

Stratum	Lifeform	Species

CHARACTERISTIC SPECIES

Pictured Rocks National Lakeshore: *Carex sterilis* (dioecious sedge), *Cladium mariscoides* (smooth sawgrass), *Eleocharis palustris* (common spikerush), *Rhynchospora alba* (white beaksedge), *Rhynchospora fusca* (brown beaksedge), *Schoenoplectus americanus* (chairmaker's bulrush), *Sparganium americanum* (American bur-reed)

Global:

OTHER NOTEWORTHY SPECIES

Pictured Rocks National Lakeshore:

Global:

CONSERVATION STATUS RANK

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

CLASSIFICATION

Status: Standard

Classification Confidence: 3 - Weak

Pictured Rocks National Lakeshore Comments:

Global Comments: This description is based on information from lake mudflats in Minnesota (MNNHP 1993) and needs rangewide review and better circumscription. This type represents both the open, sparsely vegetated mudflats as well as the more vegetated phases. As such, the type may overlap in concept with *Polygonum amphibium* (water knotweed) Permanently Flooded Herbaceous Vegetation [Placeholder] (CEGL002002), *Polygonum* (knotweed) spp. - Mixed Forbs Herbaceous Vegetation (CEGL002430), and other herbaceous mudflat communities that occur on similar substrates, but are not regularly flooded. Lake mudflats are currently separated from riverine mudflats, River Mudflats Sparse Vegetation (CEGL002314). Lake mudflats on Great Lakes shorelines may be distinct from inland lakes (Minc and Albert 1998).

Global Similar Associations:

- Inland Freshwater Strand Beach Sparse Vegetation (CEGL002310)
- *Polygonum amphibium* Permanently Flooded Herbaceous Vegetation [Placeholder] (CEGL002002)
- *Polygonum* spp. - Mixed Forbs Herbaceous Vegetation (CEGL002430)
- River Mudflats Sparse Vegetation (CEGL002314)

Global Related Concepts:

- Cobble Beach (Chapman et al. 1989) B

OTHER COMMENTS

Other Comments:

ELEMENT DISTRIBUTION

Pictured Rocks National Lakeshore Range: This lake mudflat community is best developed at Beaver Lake and Kingston Lake.

Global Range: The lake mudflat community type is found throughout the upper midwestern region of the United States and adjacent Canada. It ranges from Minnesota and Manitoba east to Michigan and Ontario, and south to Indiana.

Nations: CA, US

States/Provinces: IN, MB:S3, MI, MN:S4, NY, ON, QC, WI

TNC Ecoregions: 47:C, 48:C, 64:C

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USFS Ecoregions (1994/95): 212Hi:CCC, 212Hj:CCP, 212Hl:CCP, 212Ia:CCC, 212Mb:C??, 212Na:CC?, 212Nb:CC?, 212Nc:CCC, 222Ha:PPP, 222Ji:PPP
Federal Lands: NPS (Apostle Islands, Pictured Rocks); USFS (Hiawatha)

ELEMENT SOURCES

Pictured Rocks National Lakeshore Inventory Notes:
Pictured Rocks National Lakeshore Plots: PIRO.121, PIRO.129.
Pictured Rocks National Lakeshore Map Code: VMF
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., Minc and Albert 1998, WNHIP unpubl. data

MG111. Eastern North American Cliff & Rock Vegetation

G340. Eastern North American Lake & River Bluff [Placeholder]

Eroding Clay Bank

Eroding Clay Bank Sparse Vegetation
Eroding Clay Bank Sparse Vegetation
Identifier: CEGL002584

NVC CLASSIFICATION

Division	Eastern North American Temperate Cliff, Scree & Rock Vegetation (6.B.2.a)
Macrogroup	Eastern North American Cliff & Rock Vegetation (MG111)
Group	Eastern North American Lake & River Bluff [Placeholder] (G340)
Association (Common name)	Eroding Clay Bank
Ecological System(s):	Laurentian-Acadian Lakeshore Beach (CES201.586)
	Northeastern Erosional Bluff (CES203.498)

ELEMENT CONCEPT

Global Summary: This eroding clay bank type is found localized along banks of rivers and lakes in the midwestern and northeastern United States and adjacent Canada. Stands occur on active steep and near-vertical exposures of unconsolidated clays and sands that are at least 3 m in height. Stands are subject to active erosional processes. They are typically found along lakes and rivers. Moisture and temperature fluctuations can be extreme. The vegetation is typically sparse to absent. Little information is available on species that persist in this habitat.

ENVIRONMENTAL DESCRIPTION

Pictured Rocks National Lakeshore Environment: Information not available.
Global Environment: This eroding clay bank type is found localized along banks of rivers and lakes in the midwestern and northeastern United States and adjacent Canada. Stands occur on active steep and near-vertical exposures of unconsolidated clays and sands that are at least 3 m in height. Moisture and temperature fluctuations can be extreme (Lee et al. 1998).

VEGETATION DESCRIPTION

Pictured Rocks National Lakeshore Vegetation:
Global Vegetation: The vegetation is typically sparse to absent. Little information is available on species that persist in this habitat; ruderal species tend to be common.

MOST ABUNDANT SPECIES

Pictured Rocks National Lakeshore

Stratum	Lifeform	Species

Global

Stratum	Lifeform	Species

CHARACTERISTIC SPECIES

Pictured Rocks National Lakeshore:
Global:

OTHER NOTEWORTHY SPECIES

Pictured Rocks National Lakeshore:
Global: Vulnerable: *Cicindela puritana* (puritan tiger beetle, G1G2)

CONSERVATION STATUS RANK

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

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CLASSIFICATION

Status: Standard
Classification Confidence: 3 - Weak
Pictured Rocks National Lakeshore Comments:
Global Comments: This type is found along lakes and rivers, but much more rangewide information is needed to characterize this type. Its status as a natural ecological community is considered by some to be rather dubious, not because it does not occur in natural settings, but because it has been poorly characterized as an association and may include more than one type.
Global Similar Associations:
- Small Eroding Bluffs Midwestern Sparse Vegetation (CEGL002315)

Global Related Concepts:

OTHER COMMENTS

Other Comments:

ELEMENT DISTRIBUTION

Pictured Rocks National Lakeshore Range:
Global Range: This eroding bank type is found localized along banks of rivers and lakes in the midwestern and northeastern United States and adjacent Canada.
Nations: CA, US
States/Provinces: IN?, MA, MB:SU, MD, ME, MI, NH:S2?, ON:S4, QC, VT:S2, WI
TNC Ecoregions: 48:C, 58:C, 61:C, 63:C, 64:C
USFS Ecoregions (1994/95): 212Ea:CCP, 212Ec:CCP, 212Ed:CCP, 212Ee:CCP, 212Hi:CCC, 212Ia:CCC, 222:?
Federal Lands: NPS (Apostle Islands, Pictured Rocks)

ELEMENT SOURCES

Pictured Rocks National Lakeshore Inventory Notes:
Pictured Rocks National Lakeshore Plots:
Pictured Rocks National Lakeshore Map Code: N/A
Local Description Authors:
Global Description Authors: D. Faber-Langendoen, mod. S.C. Gawler
References: Greenall 1996, Lee et al. 1998, Midwestern Ecology Working Group n.d., Rawinski 1984, Sperduto and Nichols 2004, Swain and Kearsley 2001, Thompson 1996, Thompson and Sorenson 2000

G341. Great Lakes Cliff & Shore [Placeholder]

Inland Limestone Pavement

Inland Limestone Pavement Sparse Vegetation
Inland Limestone Pavement Sparse Vegetation
Identifier: CEGL002570

NVC CLASSIFICATION

Division	Eastern North American Temperate Cliff, Scree & Rock Vegetation (6.B.2.a)
Macrogroup	Eastern North American Cliff & Rock Vegetation (MG111)
Group	Great Lakes Cliff & Shore [Placeholder] (G341)
Association (Common name)	Inland Limestone Pavement

Ecological System(s):

ELEMENT CONCEPT

Global Summary:

ENVIRONMENTAL DESCRIPTION

Pictured Rocks National Lakeshore Environment: Information not available.
Global Environment: Information not available.

VEGETATION DESCRIPTION

Pictured Rocks National Lakeshore Vegetation:
Global Vegetation:

MOST ABUNDANT SPECIES

Pictured Rocks National Lakeshore

Stratum	Lifeform	Species

Global

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Stratum **Lifeform** **Species**

CHARACTERISTIC SPECIES

Pictured Rocks National Lakeshore:
Global:

OTHER NOTEWORTHY SPECIES

Pictured Rocks National Lakeshore:
Global:

CONSERVATION STATUS RANK

Global Rank & Reasons: GNR (15-Dec-1994).

CLASSIFICATION

Status: Standard
Classification Confidence: 3 - Weak
Pictured Rocks National Lakeshore Comments:
Global Comments: Type concept is taken from Manitoba CDC classification by Greenall (1996) and needs rangewide review.
Global Related Concepts:

OTHER COMMENTS

Other Comments:

ELEMENT DISTRIBUTION

Pictured Rocks National Lakeshore Range:
Global Range:
Nations: CA, US
States/Provinces: MB:SU, MI
TNC Ecoregions: 48:C
USFS Ecoregions (1994/95): 212Hi:CCC
Federal Lands: NPS (Pictured Rocks)

ELEMENT SOURCES

Pictured Rocks National Lakeshore Inventory Notes:
Pictured Rocks National Lakeshore Plots:
Pictured Rocks National Lakeshore Map Code: N/A
Local Description Authors:
Global Description Authors:
References: Greenall 1996, Midwestern Ecology Working Group n.d.

Great Lakes Sandstone Bedrock Shore

Sandstone Bedrock Great Lakes Shore Sparse Vegetation
Sandstone Bedrock Great Lakes Shore Sparse Vegetation
Identifier: CEGL002507

NVC CLASSIFICATION

Division	Eastern North American Temperate Cliff, Scree & Rock Vegetation (6.B.2.a)
Macrogroup	Eastern North American Cliff & Rock Vegetation (MG111)
Group	Great Lakes Cliff & Shore [Placeholder] (G341)
Association (Common name)	Great Lakes Sandstone Bedrock Shore
Ecological System(s):	Great Lakes Acidic Rocky Shore and Cliff (CES201.025)

ELEMENT CONCEPT

Global Summary: This sparsely vegetated sandstone bedrock rocky shore community is found on the shores of Lake Superior in the United States and Canada. They occur as small inclusions within areas of the larger sandstone cliff communities. Narrow areas of pavement occur at less than a meter above the lake levels and are generally moist. Mosses, liverworts, and scattered vascular plants may be found. Vascular plants on the pavement are concentrated in cracks in the rock, whereas mosses and liverworts are found where seepages flow across the rock. Some of the more common vascular plants include *Achillea millefolium* (common yarrow), *Chamerion angustifolium* (fireweed), *Betula papyrifera* (paper birch), *Campanula rotundifolia* (bluebell bellflower), *Cystopteris fragilis* (brittle bladderfern), *Deschampsia caespitosa* (tufted hairgrass), *Phegopteris connectilis* (long beechfern), *Alnus incana* (gray alder), *Equisetum arvense* (field horsetail), and *Euthamia graminifolia* (flat-top goldentop). Less common, and more restricted to cracks in the pavement, are *Sibbaldiopsis tridentata* (shrubby fivefingers), *Lobelia kalmii* (Ontario lobelia), *Packera indecora* (elegant groundsel), *Packera paupercula* (balsam groundsel), *Physocarpus opulifolius* (common ninebark), *Primula mistassinica* (Mistassini primrose), *Trisetum spicatum* (spike trisetum), and *Rubus pubescens* (dwarf red blackberry).

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ENVIRONMENTAL DESCRIPTION

Pictured Rocks National Lakeshore Environment: This sparsely vegetated sandstone shoreline community was only sampled once in the park. The community forms a ring around Kettle Hole Lake (except for the southern side). The soil is rapidly drained sand. The unvegetated surface is made up of leaf litter (67% cover), large rocks (2%), small rocks (8%), bare sand (20%), and wood (3%). Evidence of disturbance includes a nearby trail system and seed- and clear-cutting of surrounding areas.
Global Environment: In Michigan, these bedrock shorelines occur as small inclusions within areas of the larger sandstone cliff communities. Narrow areas of pavement occur at less than a meter above the lake levels and are generally moist (Albert et al. 1995).

VEGETATION DESCRIPTION

Pictured Rocks National Lakeshore Vegetation: Nonvascular species (mosses and lichens) dominate this community with 70% cover. In addition, there are very sparse (5%) tree (5-10 m) and tall-shrub (2-5 m) layers of *Pinus banksiana* (jack pine). The very sparse (5%) short-shrub layer (0.5-1 m) includes *Acer rubrum* (red maple), *Pinus resinosa* (red pine), *Populus tremuloides* (quaking aspen), *Rubus* (blackberry) sp., and *Vaccinium angustifolium* (lowbush blueberry). *Epigaea repens* (trailing arbutus) forms a very sparse (5%) dwarf-shrub layer (<0.5 m). The sparse herbaceous layer (20%) includes *Dichanthelium acuminatum* (tapered rosette grass), *Fragaria virginiana* (Virginia strawberry), and *Pteridium aquilinum* (western brackenfern), among others.
Global Vegetation: This community is dominated by nonvascular species with open pavement. Mosses, liverworts, and scattered vascular plants may be found. Vascular plants on the pavement are concentrated in cracks in the rock, whereas mosses and liverworts are found where seepages flow across the rock. Some of the more common vascular plants include *Achillea millefolium* (common yarrow), *Chamerion angustifolium* (fireweed), *Betula papyrifera* (paper birch), *Campanula rotundifolia* (bluebell bellflower), *Cystopteris fragilis* (brittle bladderfern), *Deschampsia caespitosa* (tufted hairgrass), *Phegopteris connectilis* (long beechfern), *Alnus incana* (gray alder), *Equisetum arvense* (field horsetail), and *Euthamia graminifolia* (flat-top goldentop). Less common, and more restricted to cracks in the pavement, are *Sibbaldiopsis tridentata* (shrubby fivefingers), *Lobelia kalmii* (Ontario lobelia), *Packera indecora* (elegant groundsel), *Packera paupercula* (balsam groundsel), *Physocarpus opulifolius* (common ninebark), *Primula mistassinica* (Mistassini primrose), *Trisetum spicatum* (spike trisetum), and *Rubus pubescens* (dwarf red blackberry) (Albert et al. 1995).

MOST ABUNDANT SPECIES

Pictured Rocks National Lakeshore

Stratum	Lifeform	Species

Global

Stratum	Lifeform	Species

CHARACTERISTIC SPECIES

Pictured Rocks National Lakeshore: *Pinus banksiana* (jack pine)
Global:

OTHER NOTEWORTHY SPECIES

Pictured Rocks National Lakeshore: Exotic/Invasive: *Rumex acetosella* (common sheep sorrel, exotic, Medium/Low)
Global:

CONSERVATION STATUS RANK

Global Rank & Reasons: G3G4 (24-Oct-2002). This sandstone bedrock shore community is found in a relatively restricted distribution on the shores of Lake Superior in the United States and Canada. They occur as small inclusions within areas of the larger sandstone cliff communities. Narrow areas of pavement occur at less than a meter above the lake levels and are generally moist. States and provinces that contain this type have yet to provide much information on it. More information on the status of this type is needed.

CLASSIFICATION

Status: Standard
Classification Confidence: 2 - Moderate
Pictured Rocks National Lakeshore Comments:
Global Comments: Distribution in Minnesota is uncertain.
Global Similar Associations:
- Granite - Metamorphic Bedrock Great Lakes Shore Sparse Vegetation (CEGL005216)--This is also a non-alkaline shoreline type, but composed of granite/metamorphic bedrock.
- Non-alkaline Cobble - Gravel Great Lakes Shore Sparse Vegetation (CEGL002508)--cobble-gravel type.

Global Related Concepts:
- Bedrock Beach - Sandstone Cliff/Lakeshore (Chapman et al. 1989) B

OTHER COMMENTS

Other Comments:

ELEMENT DISTRIBUTION

Pictured Rocks National Lakeshore Range: This sparsely vegetated, sandstone bedrock, rocky shore community is found along the Lake Superior shoreline. It is best developed and exposed near the mouth of the Mosquito River.

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Global Range: This sparsely vegetated sandstone bedrock rocky shore community is found in the United States and Canada on the Michigan, Wisconsin (Apostle Islands only), and Ontario shores of Lake Superior, and possibly in Minnesota.
Nations: CA, US
States/Provinces: MI, MN, ON, WI:S1
TNC Ecoregions: 48:C
USFS Ecoregions (1994/95): 212Ha:CCP, 212Hi:CCC, 212Ia:CPP, 212Ja:CPP, 212Jb:CPP, 212Jn:CPP, 212Jr:CPP, 212Lb:C??
Federal Lands: NPS (Apostle Islands, Pictured Rocks); USFS (Hiawatha)

ELEMENT SOURCES

Pictured Rocks National Lakeshore Inventory Notes:
Pictured Rocks National Lakeshore Plots: PIRO.098.
Pictured Rocks National Lakeshore Map Code: VBS
Local Description Authors: M.J. Russo
Global Description Authors: D. Faber-Langendoen
References: Albert et al. 1995, Chapman et al. 1989, Midwestern Ecology Working Group n.d., WNHIP unpubl. data

Great Lakes Shore Sandstone Cliff

Sandstone Great Lakes Shore Cliff Sparse Vegetation
Sandstone Great Lakes Shore Cliff Sparse Vegetation
Identifier: CEGL002503

NVC CLASSIFICATION

Division	Eastern North American Temperate Cliff, Scree & Rock Vegetation (6.B.2.a)
Macrogroup	Eastern North American Cliff & Rock Vegetation (MG111)
Group	Great Lakes Cliff & Shore [Placeholder] (G341)
Association (Common name)	Great Lakes Shore Sandstone Cliff
Ecological System(s):	Great Lakes Acidic Rocky Shore and Cliff (CES201.025)

ELEMENT CONCEPT

Global Summary: This sandstone cliff community is found in the northern Great Lakes shorelines of the United States and Canada. The substrate is Precambrian sandstone, which in Michigan is exposed along the southern shoreline of Lake Superior. Cliffs rise up over 50 m in places. Species composition varies somewhat, depending on sandstone type, but sandstone cliffs are very low in botanical diversity for a variety of reasons, including lack of soil for rooting, droughtiness on much of the rock surface, exposure to waves and ice, and in some places, unstable surface prone to wave erosion. Some portions of the cliff are moist from small streams or seepages. Jacobsville sandstone has cliff faces that are largely unvegetated, with mosses, lichens, and herbs concentrated in seeps and streams. Two common herbs are *Sagina procumbens* (birdeye pearlwort) and *Stellaria calycantha* (northern starwort). *Pinguicula vulgaris* (common butterwort) also grows on moist cliffs.

ENVIRONMENTAL DESCRIPTION

Pictured Rocks National Lakeshore Environment: This sandstone cliff community was sampled twice in the park. One site is an overhanging, west-facing step-in-slope cliff of Precambrian sandstone (Jacobsville Formation). The other site is a moist, shaded, vertical cliff face on a sandstone outcropping perched 12-18 m (40-60 feet) above Miners River. The unvegetated surface is dominated by bedrock (90-100% cover) with some sand (0-5%). Evidence of disturbance includes trails and the presence of human litter due to heavy visitation of these areas.
Global Environment: The substrate is Precambrian sandstone, which in Michigan is exposed along the southern shoreline of Lake Superior. Cliffs rise up over 50 m in places. Fog and wavespray are important environmental influences (Albert et al. 1995).

VEGETATION DESCRIPTION

Pictured Rocks National Lakeshore Vegetation: This community is dominated by nonvascular species (mosses and lichens) covering 80% of the bedrock surface. In addition, one site has a sparse (0-5%) tree layer (5-10 m tall) of *Tsuga canadensis* (eastern hemlock). Both sites have a sparse (5%) short-shrub layer (1-2 m) that may include *Betula alleghaniensis* (yellow birch), *Betula papyrifera* (paper birch), and *Thuja occidentalis* (northern white-cedar). The sparse (20-30%) herbaceous layer may include *Circaea alpina* (small enchanter's nightshade), *Cryptogramma stelleri* (fragile rockbrake), *Cystopteris bulbifera* (bulblet bladderfern), *Impatiens capensis* (jewelweed), *Phegopteris connectilis* (long beechfern), and *Polypodium virginianum* (rock polypody), among others.
Global Vegetation: Species composition varies somewhat, depending on sandstone type, but sandstone cliffs are very low in botanical diversity for a variety of reasons, including lack of soil for rooting, droughtiness on much of the rock surface, exposure to waves and ice, and in some places, unstable surface prone to wave erosion. Some portions of the cliff are moist from small streams or seepages. Jacobsville sandstone has cliff faces that are largely unvegetated, with mosses, lichens, and herbs concentrated in seeps and streams. Two common herbs are *Sagina procumbens* (birdeye pearlwort) and *Stellaria calycantha* (northern starwort). *Pinguicula vulgaris* (common butterwort) also grows on moist cliffs (Albert et al. 1995).

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MOST ABUNDANT SPECIES

Pictured Rocks National Lakeshore

Stratum	Lifeform	Species

Global

Stratum	Lifeform	Species

CHARACTERISTIC SPECIES

Pictured Rocks National Lakeshore: *Cryptogramma stelleri* (fragile rockbrake), *Cystopteris bulbifera* (bulblet bladderfern)
Global:

OTHER NOTEWORTHY SPECIES

Pictured Rocks National Lakeshore: Exotic/Invasive: *Poa pratensis* (Kentucky bluegrass, exotic, Medium), *Taraxacum officinale* (common dandelion, exotic)
Global:

CONSERVATION STATUS RANK

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

CLASSIFICATION

Status: Standard
Classification Confidence: 2 - Moderate
Pictured Rocks National Lakeshore Comments:
Global Comments: Categories of moist versus dry are difficult to apply due to variability on the rock surface and the Great Lakes shoreline context. Instead, substrate type is used, with the granite - metamorphic cliffs placed in Granite - Metamorphic Great Lakes Shore Cliff Sparse Vegetation (CEGL005244).
Global Similar Associations:
- Granite - Metamorphic Great Lakes Shore Cliff Sparse Vegetation (CEGL005244)

Global Related Concepts:
- Moist Acid Cliff (Chapman et al. 1989) B

OTHER COMMENTS

Other Comments:

ELEMENT DISTRIBUTION

Pictured Rocks National Lakeshore Range: This sandstone cliff community is found along the Lake Superior shoreline and is best developed near Miners Beach and Chapel Beach. This formation also extends for about six miles inland from Miners Beach.
Global Range: This sandstone cliff community type is found in the northern Great Lakes shorelines of the United States and Canada, from Michigan and Wisconsin (Apostle Islands, northern Bayfield County along Lake Superior) to Ontario, possibly eastward to Pennsylvania.
Nations: CA, US
States/Provinces: MI, ON, PA?, WI
TNC Ecoregions: 48:C
USFS Ecoregions (1994/95): 212Ha:CCC, 212He:CCP, 212Hi:CCC, 212Hl:CCC, 212Ia:CCC, 212Ib:CCC, 212Ja:CCC, 212Jb:CCP, 212Jn:CCC, 212Jr:CCC, 212Lb:C??, 222:?
Federal Lands: NPS (Apostle Islands, Pictured Rocks); USFS (Hiawatha)

ELEMENT SOURCES

Pictured Rocks National Lakeshore Inventory Notes:
Pictured Rocks National Lakeshore Plots: PIRO.105, PIRO.140.
Pictured Rocks National Lakeshore Map Code: VSC
Local Description Authors: M.J. Russo
Global Description Authors: D. Faber-Langendoen
References: Albert et al. 1995, Chapman et al. 1989, Midwestern Ecology Working Group n.d., WNHIP unpubl. data

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.a)
Macrogroup	Eastern North American Cliff & Rock Vegetation (MG111)
Group	Great Lakes Cliff & Shore [Placeholder] (G341)
Association (Common name)	Midwest Moist Sandstone Cliff

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Ecological System(s): Central Interior Acidic Cliff and Talus (CES202.689)
Laurentian-Acadian Acidic Cliff and Talus (CES201.569)
North-Central Appalachian Acidic Cliff and Talus (CES202.601)

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 spleewort). 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

Pictured Rocks National Lakeshore Environment: Information not available.

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

Pictured Rocks National Lakeshore Vegetation:

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 virginianum* (rock polypody), and the rare *Asplenium bradleyi* (Bradley's spleewort). 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).

MOST ABUNDANT SPECIES

Pictured Rocks National Lakeshore

Stratum	Lifeform	Species

Global

Stratum	Lifeform	Species

CHARACTERISTIC SPECIES

Pictured Rocks National Lakeshore:

Global:

OTHER NOTEWORTHY SPECIES

Pictured Rocks National Lakeshore:

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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
Pictured Rocks National Lakeshore Comments:
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) B
- Moist Acid Cliff (Chapman et al. 1989) B
- Shaded Rock Cliffs (Curtis 1959) B

OTHER COMMENTS

Other Comments:

ELEMENT DISTRIBUTION

Pictured Rocks National Lakeshore Range:
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, 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

Pictured Rocks National Lakeshore Inventory Notes:
Pictured Rocks National Lakeshore Plots:
Pictured Rocks National Lakeshore Map Code: N/A
Local Description Authors:
Global Description Authors: D. Faber-Langendoen

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References: Anderson 1996, Chapman et al. 1989, Curtis 1959, Homoya et al. 1985, 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 Pictured Rocks National Lakeshore (PIRO). The vegetation types are based on the National Vegetation Classification Standard (NVCS) and were derived from field data collected during the PIRO 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 Community Global Element code is given, followed by the association name. A few association names have an additional name listed in parenthesis following it. These correlate to map-class phases.

For best results, all assessments of vegetation types in the field should be done on an area of 5,000 m^2 (i.e., 40-m radius around point) 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 60% cover 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 refers to 25% of the 40% total cover.

GENERAL KEY

1A. Upland soils and vegetation prevalent. Wetlands absent or limited in extent to occasional vernal pools. **2**

1B. Wetland soils and vegetation prevalent. Presence of standing water or saturated mineral or organic soils. **39**

UPLANDS

2A. Total tree canopy >25%. **3**

2B. Total tree canopy <25%. **27**

3A. Total tree canopy cover <60%. Sparse, open tree canopy of scattered jack pine (*Pinus banksiana*), red pine (*Pinus resinosa*) and/or eastern white pine (*Pinus strobus*) without an oak component. Occurs on dune fields or outwash plains of excessively drained sands.
[CEGL005125] *Pinus banksiana* - (*Pinus resinosa*) - *Pinus strobus* / *Juniperus horizontalis* Wooded Herbaceous Vegetation

Note: Tree canopy cover of 10–25% is barrens phase, and cover of 25–60% is woodland phase.

3B. Total tree canopy cover >60%. **4**

4A. Tree canopy <25% conifers. **5**

4B. Tree canopy >25% conifers. **7**

5A. Tree canopy dominated by sugar maple (*Acer saccharum*), yellow birch (*Betula alleghaniensis*), and/or American basswood (*Tilia americana*). **[CEGL002457] *Acer saccharum* - *Betula alleghaniensis* - (*Tilia americana*) Forest**

Note: Several phases exist for CEGL002457 (classic phase, yew phase, balsam fir shrub phase, and sugar maple phase).

5B. Tree canopy dominated by paper birch (*Betula papyrifera*), quaking aspen (*Populus tremuloides*), or balsam poplar (*Populus balsamifera*). **6**

6A. Tree canopy dominated by paper birch (*Betula papyrifera*), may contain <10% balsam fir (*Abies balsamea*) or other deciduous hardwoods. Rare, along Lake Superior shoreline. **[CEGL002463] *Betula papyrifera* / *Diervilla lonicera* - (*Abies balsamea*) Forest**

6B. Tree canopy dominated by balsam poplar (*Populus balsamifera*); stand possibly containing low levels of paper birch (*Betula papyrifera*) or quaking aspen (*Populus tremuloides*) growing on sand dunes. **[CEGL005119] *Populus deltoides* - (*Juniperus virginiana*) Dune Woodland**

7A. Tree canopy >75% conifers. **8**

7B. Tree canopy <75% conifers. **17**

8A. Tree canopy dominated by pines, including jack pine (*Pinus banksiana*), red pine (*Pinus resinosa*), and eastern white pine (*Pinus strobus*). **9**

8B. Tree canopy dominated by conifers other than pines, including eastern hemlock (*Tsuga canadensis*), northern white-cedar (*Thuja occidentalis*), white spruce (*Picea glauca*), black spruce (*Picea mariana*), and balsam fir (*Abies balsamea*). **14**

9A. Tree canopy cover and basal area codominated by a mixture of pine species. Occurs on dunes. **[CEGL002589] *Pinus banksiana* - *Pinus resinosa* - *Pinus strobus* Dune Forest**

9B. Tree canopy cover and basal area dominated by a single pine species, either red pine (*Pinus resinosa*), jack pine (*Pinus banksiana*), or eastern white pine (*Pinus strobus*). Tree canopy may also include balsam fir (*Abies balsamea*) and/or eastern hemlock (*Tsuga canadensis*). Occurs on dunes, kames, or outwash plains with well- to excessively well-drained soils. **10**

10A. Among all pines (*Pinus* spp.) in the tree canopy, red pine (*Pinus resinosa*) >75% cover. **[CEGL002443] *Pinus resinosa* / *Vaccinium* spp. Forest**

Note: Compare with *Pinus strobus* / *Vaccinium* spp. Forest (CEGL002444) and *Pinus banksiana* - *Pinus resinosa* - *Pinus strobus* Dune Forest (CEGL002589).

10B. Among all pines (*Pinus* spp.) in the tree canopy, red pine (*Pinus resinosa*) <75% cover. **11**

11A. Tree canopy cover and basal area dominated or codominated by jack pine (*Pinus banksiana*). **12**

11B. Tree canopy cover and basal area dominated or codominated by eastern white pine (*Pinus strobus*). **13**

12A. Tree canopy and subcanopy include a significant balsam fir (*Abies balsamea*) component. (3–10% overstory, >20% understory). Uncommon. **[CEGL002437] *Pinus banksiana /Abies balsamea* Forest**

12B. Tree canopy and subcanopy without a significant balsam fir (*Abies balsamea*) component (<3% overstory, <20% understory). **[CEGL002441] *Pinus banksiana* / *Vaccinium* spp. / *Pleurozium schreberi* Forest**

13A. Tree canopy and subcanopy >10% eastern hemlock (*Tsuga canadensis*). **[CEGL002590] *Pinus strobus* - *Tsuga canadensis* Great Lakes Forest**

13B. Tree canopy and subcanopy <10% eastern hemlock (*Tsuga canadensis*). **[CEGL002444] *Pinus strobus* / *Vaccinium* spp. Forest**

Note: Compare with *Pinus resinosa* / *Vaccinium* spp. Forest Forest (CEGL002443) and *Pinus banksiana* - *Pinus resinosa* - *Pinus strobus* Dune Forest (CEGL002589).

14A. Northern white-cedar (*Thuja occidentalis*) or black spruce (*Picea mariana*) dominant. **15**

14B. Balsam fir (*Abies balsamea*) and/or white spruce (*Picea glauca*) dominant. **16**

15A. Northern white-cedar (*Thuja occidentalis*) dominant. **[CEGL002449] *Thuja occidentalis* / *Abies balsamea* - *Acer spicatum* Forest (conifer phase)**

15B. Black spruce (*Picea mariana*) dominates canopy, typically with a ground cover of feathermoss. **[CEGL002447] *Picea mariana* / *Pleurozium schreberi* Forest**

16A. Balsam fir (*Abies balsamea*) and white spruce (*Picea glauca*) codominants. **[CEGL002446] *Picea glauca* - *Abies balsamea* / *Acer spicatum* / *Rubus pubescens* Forest**

16B. Balsam fir (*Abies balsamea*) and paper birch (*Betula papyrifera*) codominants. **[CEGL002474] *Abies balsamea* - *Betula papyrifera* / *Diervilla lonicera* Forest**

17A. Conifer tree canopy dominants include red pine (*Pinus resinosa*) and eastern white pine (*Pinus strobus*), along with deciduous trees. **18**

17B. Conifer tree canopy dominants include northern white-cedar (*Thuja occidentalis*), balsam fir (*Abies balsamea*), white spruce (*Picea glauca*), and/or eastern hemlock (*Tsuga canadensis*).**23**

18A. Deciduous component of canopy dominated by northern red oak (*Quercus rubra*). **[CEGL002480] *Pinus strobus* - (*Pinus resinosa*) - *Quercus rubra* Forest**

18B. Deciduous component of canopy dominated by aspen (*Populus* spp.) and birch (*Betula* spp.). May be the result of forest management. **19**

19A. Eastern white pine (*Pinus strobus*) <25% of conifer component of canopy. **20**

19B. Eastern white pine (*Pinus strobus*) >25% of conifer component of canopy. **21**

20A. Tree canopy and subcanopy dominated by red pine (*Pinus resinosa*) and quaking aspen (*Populus tremuloides*). **[CEGL002520] *Pinus resinosa* - *Populus tremuloides* / *Diervilla lonicera* - *Vaccinium* spp. Forest**

Note: Compare with *Pinus resinosa* / *Vaccinium* spp. Forest (CEGL002443).

20B. Tree canopy and subcanopy dominated by jack pine (*Pinus banksiana*) and quaking aspen (*Populus tremuloides*). **[CEGL002518] *Pinus banksiana* - *Populus tremuloides* / *Diervilla lonicera* Forest**

21A. Open pine forest, with overstory coverage as low as 25%, in heavily burnt pinery of the Kingston Plains. Forest a mix of deciduous species, and there is typically a scrub-shrub layer. **[CEGL005563] *Pinus strobus* - *Populus tremuloides* - (*Acer rubrum*) / *Pteridium aquilinum* Forest (forest phase)**

21B. More closed canopy with supra-canopy of eastern white pine (*Pinus strobus*) common, and fewer signs of severe fire disturbance. **22**

22A. Tree canopy and subcanopy dominated by eastern white pine (*Pinus strobus*), bigtooth aspen (*Populus grandidentata*), quaking aspen (*Populus tremuloides*), and/or paper birch (*Betula papyrifera*). May result from forest management. **[CEGL002479] Pinus strobus - Populus tremuloides / *Corylus cornuta* Forest**

22B. Tree canopy dominated by eastern white pine (*Pinus strobus*) and northern red oak (*Quercus rubra*). Other northern hardwoods sometimes present. **[CEGL002480] *Pinus strobus* - (*Pinus resinosa*) - *Quercus rubra* Forest**

23A. Eastern hemlock (*Tsuga canadensis*) a major conifer dominant or codominant. **24**

23B. Northern white-cedar (*Thuja occidentalis*), balsam fir (*Abies balsamea*), or white spruce (*Picea glauca*) are major conifer dominants. **26**

24A. Tree canopy dominated by eastern hemlock (*Tsuga canadensis*), yellow birch (*Betula alleghaniensis*) and includes a significant American beech (*Fagus grandifolia*) component. **[CEGL005042] *Tsuga canadensis* - *Fagus grandifolia* - (*Acer saccharum*) Great Lakes Forest**

24B. Tree canopy dominated by eastern hemlock (*Tsuga canadensis*), yellow birch (*Betula alleghaniensis*), and/or sugar maple (*Acer saccharum*), but lacks a significant American beech (*Fagus grandifolia*) component. **25**

25A. Tree canopy and/or subcanopy includes a significant red maple (*Acer rubrum*) or sugar maple (*Acer saccharum*) component. **[CEGL005044] *Tsuga canadensis* - *Acer saccharum* - *Betula alleghaniensis* Forest**

25B. Tree canopy and/or subcanopy lacks a significant red maple or sugar maple component. Tree canopy may be pure hemlock. **[CEGL002598] *Tsuga canadensis* - (*Betula alleghaniensis*) Forest**

26A. Northern white-cedar (*Thuja occidentalis*) is codominant with yellow birch (*Betula alleghaniensis*), growing on slope, not in wetland basin. **[CEGL002449] *Thuja occidentalis* / Abies balsamea - *Acer spicatum* Forest (conifer - hardwood phase)**

26B. Balsam fir (*Abies balsamea*) and/or white spruce (*Picea glauca*) codominant with quaking aspen (*Populus tremuloides*) or other northern hardwoods. Not known from PIRO, but common elsewhere along western Lake Superior. **[CEGL002475] *Picea glauca* - *Abies balsamea* - *Populus tremuloides* / Mixed Herbs Forest**

27A. Tall, short, or dwarf-shrubs >25% total canopy cover. **28**

27B. Tall, short, or dwarf-shrubs <25% total canopy cover. **32**

28A. Tall or short shrubs < 25% absolute canopy cover. Shrub stratum is dominated by creeping or matted dwarf-shrubs (typically <50 cm tall) such as creeping juniper (*Juniperus horizontalis*), bearberry (*Arctostaphylos uva-ursi*), woolly beach-heather (*Hudsonia tomentosa*) and/or ground juniper (*Juniperus communis*). **29**

28B. Tall or short shrubs (typically >50 cm tall) >25% absolute canopy cover. **30**

29A. Dominated by woolly beach-heather (*Hudsonia tomentosa*) on open sand dunes. **[CEGL004024] *Hudsonia tomentosa* Dune Dwarf-shrubland**

29B. Dominated by a mix of dwarf-shrubs, including creeping juniper (*Juniperus horizontalis*), bearberry (*Arctostaphylos uva-ursi*), and/or ground juniper (*Juniperus communis*). **[CEGL005064] *Juniperus horizontalis* - *Arctostaphylos uva-ursi* - *Juniperus communis* Dune Dwarf-shrubland**

Note: Compare with *Prunus pumila* - (*Ptelea trifoliata*) Dune Shrubland (CEGL005075) and *Ammophila breviligulata* - (*Schizachyrium scoparium*) Herbaceous Vegetation (CEGL005098).

30A. Shrubland dominated by sand cherry (*Prunus pumila*) and/or willows (*Salix* spp.). Occurs on dunes. [**CEGL005075] *Prunus pumila* - (*Ptelea trifoliata*) Dune Shrubland**

Note: Compare with *Juniperus horizontalis - Arctostaphylos uva-ursi - Juniperus communis* Dune Dwarf-shrubland (CEGL005064) and *Ammophila breviligulata* - (*Schizachyrium scoparium*) Herbaceous Vegetation (CEGL005098).

30B. Shrubland dominated by other tall shrubs, and site shows signs of intense human disturbance. **31**

31A. Shrubland dominated by thimbleberry (*Rubus parviflorus*). May be the result of anthropogenic or natural disturbance. **[CEGL005248] *Rubus parviflorus* Shrubland [Provisional]**

31B. Shrubland dominated by diversity of shrubs and small trees growing with bracken fern (*Pteridium aquilinum*) and lichens. Concentrated on burnt, logged pinery of Kingston Plains. **[CEGL005563] *Pinus strobus - Populus tremuloides* - (*Acer rubrum*) / *Pteridium aquilinum* Forest (scrub phase)**

32A. Dominated by herbaceous vegetation, >10% total vegetation cover. **33**

32B. Sparsely vegetated, <10% total vegetation cover. **34**

33A. Vegetation dominated by American beachgrass (*Ammophila breviligulata*) and little bluestem (*Schizachyrium scoparium*). Occurs on dunes. **[CEGL005098] *Ammophila breviligulata* - (*Schizachyrium scoparium*) Herbaceous Vegetation**

Note: Compare with *Juniperus horizontalis - Arctostaphylos uva-ursi - Juniperus communis* Dune Dwarf-shrubland (CEGL005064) and *Prunus pumila* - (*Ptelea trifoliata*) Dune Shrubland (CEGL005075)

33B. Vegetation dominated by bracken fern with occasional sedges and grasses. Occurs on level plains or rolling uplands and in depressions in pitted outwash. **[CEGL005142] *Pteridium aquilinum - Bromus kalmii* Herbaceous Vegetation**

34A. Occurs on sand beach or clay bluffs. **35**

34B. Occurs on bedrock cliffs or pavement. Occurs on sandstone or limestone bedrock. **36**

35A. Occurs on clay bluffs along Lake Superior. **[CEGL002584] Eroding Clay Bank Sparse Vegetation**

35B. Occurs along sandy shores of inland freshwater lakes such as Beaver Lake and Little Beaver Lake. **[CEGL002310] Inland Freshwater Strand Beach Sparse Vegetation**

36A. Occurs on inland limestone bedrock. **[CEGL002570] Inland Limestone Pavement Sparse Vegetation**

36B. Occurs on sandstone bedrock. **37**

37A. Occurs on sandstone pavement, low rock shelves (<3 meters high) along the Lake Superior shore. **[CEGL002507] Sandstone Bedrock Great Lakes Shore Sparse Vegetation**

37B. Occurs on sandstone bedrock cliff. **38**

38A. Occurs on dry sandstone bedrock cliffs (>3 meters high). **[CEGL002503] Sandstone Great Lakes Shore Cliff Sparse Vegetation**

38B. Occurs on moist sandstone bedrock cliffs (>3 meters high), vegetation in cracks and on ledges. **[CEGL002287] Sandstone Midwest Moist Cliff Sparse Vegetation**

WETLANDS

39A. Total tree canopy >25%. Forest or woodland. **40**

39B. Total tree canopy <25%. Dominated by shrubs, herbaceous vegetation, or sparsely vegetated. **47**

40A. Tree canopy <25% deciduous species. Pines (*Pinus* spp.) not major dominants of these wetland forests. **41**

40B. Tree canopy >25% deciduous species. Eastern white pine (*Pinus strobes*) and red pine (*Pinus resinosa*) may be a major component of these wetland forests. **43**

41A. Tree canopy dominated by northern white-cedar (Thuja occidentalis). **42**

41B. Tree canopy dominated by tamarack (*Larix laricina*) and/or black spruce (*Picea mariana*). Trees may be short (2–5 m). Soils seasonally flooded/saturated well-decomposed woody peat. **[CEGL005271] *Picea mariana* - (*Larix laricina*) / *Ledum groenlandicum* / *Sphagnum* spp. Forest**

Note: tamarack >75% relative dominance to black spruce is tamarack phase, <75% is black spruce phase.

42A. Sites in seeps, typically small (<0.5 ha), may have canopy/subcanopy associates of red maple (*Acer rubrum*), balsam poplar (*Populus balsamifera*), and/or yellow birch (*Betula alleghaniensis*) often associated with upland *Thuja occidentalis / Abies balsamea – Acer spicatum* Forest. **[CEGL002455] *Thuja occidentalis – (Larix laricina)* Seepage Forest**

42B. Sites not in seeps, may have canopy/subcanopy associates of balsam fir (*Abies balsamea*) and black spruce (*Picea mariana*). **[CEGL002456] *Thuja occidentalis* - (*Picea mariana, Abies balsamea*) / *Alnus incana* Forest**

43A. Tree canopy cover and basal area dominated by eastern white pine (*Pinus strobus*), red pine (*Pinus resinosa*), and/or red maple (*Acer rubrum*). Occurs on a thin layer of organics or sandy loam over sand. May occur as part of a wooded dune and swale complex. **[CEGL002482] *Pinus strobus* - (*Acer rubrum*) / *Osmunda* spp. Forest**

43B. Tree canopy cover and basal area dominated by deciduous hardwoods, or a mix of northern white-cedar (*Thuja occidentalis*) or eastern hemlock (*Tsuga canadensis*) with deciduous hardwoods. **43**

44A. Tree canopy dominated by black ash (*Fraxinus nigra*), often with other deciduous hardwoods or conifers, in either drainage ways or depressions. **[CEGL002105] *Fraxinus nigra* - Mixed hardwoods - Conifers / *Cornus sericea* / *Carex* spp. Forest**

Note: Black ash >50% relative dominance to other hardwood trees is the black ash phase. Hardwood lowlands having <50% black ash is the lowland phase, and are ecotone to wet-mesic scenarios of the *Acer saccharum - Betula alleghaniensis* - (*Tilia americana*) Forest (CEGL002457).

44B. Tree canopy not dominated by black ash (*Fraxinus nigra*). **44**

45A. Tree canopy co-dominated by tamarack (*Larix laricina*), red maple (*Acer rubrum*), and/or black ash (*Fraxinus nigra*). **[CEGL005271] *Picea mariana* - (*Larix laricina*) / *Ledum groenlandicum* / *Sphagnum* spp. Forest (tamarack phase)**

45B. Tree canopy not co-dominated by tamarack (*Larix laricina*) 45

46A. Tree canopy dominated by hemlock (*Tsuga canadensis*) and yellow birch (*Betula alleghaniensis*). Soils poorly drained, saturated loamy sand, sandy loam, or loam. **[CEGL005003] *Tsuga canadensis - Betula alleghaniensis* Saturated Forest**

46B. Tree canopy dominated by northern white-cedar (*Thuja occidentalis*) and deciduous hardwoods. **46**

47A. Tree canopy cover and basal area codominated by northern white-cedar (*Thuja occidentalis*) and black ash (*Fraxinus nigra*). Saturated soils are mineral or well-decomposed peat. **[CEGL005165] *Thuja occidentalis - Fraxinus nigra* Forest**

47B. Tree canopy and basal area codominated by northern white-cedar (*Thuja occidentalis*) and yellow birch (*Betula alleghaniensis*). Occurs on poorly drained seepages near base of slope. Uncommon. **[CEGL002449] *Thuja occidentalis* / *Abies balsamea - Acer spicatum* Forest (conifer - hardwood phase)**

48A. Tall shrubs, short shrubs, or dwarf-shrubs have >25% absolute canopy cover. **48**

48B. Tall shrubs, short shrubs, or dwarf-shrubs have <25% absolute canopy cover. **53**

49A. Shrubland dominated by gray alder (*Alnus incana*). **[CEGL002381] *Alnus incana* Swamp Shrubland**

49B. Shrubland not dominated by gray alder (*Alnus incana*). **49**

50A. Shrubland dominated by red-osier dogwood (*Cornus sericea*) and/or willows (*Salix* spp.). **[CEGL002186] *Cornus sericea* - *Salix* spp. - (*Rosa palustris*) Shrubland**

50B. Shrubland not dominated by red-osier dogwood (*Cornus sericea*) and/or willows (*Salix* spp.). **50**

51A. Shrubland dominated by sweet gale (*Myrica gale*) and/or bog birch (*Betula pumila*), not in shore fen settings. **51**

51B. Fens dominated by short shrubs such as leatherleaf (*Chamaedaphne calyculata*), sometimes with sweet gale (*Myrica gale*) co-dominant in shore fens, with or without scattered canopy of tamarack (*Larix laricina*) and/or black spruce (*Picea mariana*). **52**

52A. Shrub canopy >10% bog birch (*Betula pumila*). **[A.1021] *Betula pumila* - (*Salix* spp.) Saturated Shrubland Alliance**

52B. Shrub canopy <10% bog birch (*Betula pumila*), dominated by sweet gale (*Myrica gale*). **[CEGL005141] *Myrica gale* Fen Shrubland**

53A. Minerotrophic fen dominated by sweet gale (*Myrica gale*) or white meadowsweet (*Spiraea alba*), with low levels of leatherleaf (*Chamaedaphne calyculata*) and only local peat accumulation. **[CEGL005228] *Chamaedaphne calyculata* - *Myrica gale* / *Carex lasiocarpa* Dwarf-shrubland**

53B. Poor fen or bog dominated by leatherleaf (*Chamaedaphne calyculata*) with thick accumulations of *Sphagnum* peat. **[CEGL005277] *Chamaedaphne calyculata* / *Carex oligosperma* / *Sphagnum* spp. Poor Fen Dwarf-shrubland**

54A. Seasonally flooded or saturated herbaceous wetland or open, wet soils (<5% vegetation). **54**

54B. Permanently or semipermanently flooded wetland. **59**

55A. Open, wet soils with <5% vegetation. **[CEGL002313] Lake Mudflats Sparse Vegetation**

55B. Wetland dominated by herbaceous vegetation (>5% cover). **53**

56A. Wetland primarily dominated by grasses such as bluejoint (*Calamagrostis canadensis*) and/or reed canarygrass (*Phalaris arundinacea*). Occurs in flat, seasonally flooded basins or in floodplains of small streams. **[CEGL005174] *Calamagrostis canadensis* - *Eupatorium maculatum* Herbaceous Vegetation**

56B. No clear dominant herbaceous species. Obvious indication of beaver or anthropogenic disturbance. **Wet Meadow Mixed Herbaceous (Map Class; Macrogroup G112)**

56C. Wetland primarily dominated by sedges (*Carex* spp.), cattails (*Typha* spp.), or bulrushes (*Schoenoplectus* spp.). Grasses common to occasional but not dominant. **56**

57A. Dominated by cattails (*Typha* spp.) and/or hardstem bulrush (*Schoenoplectus acutus*). Occurs in basin depressions, river and pond margins, and on lakeplains. Typically characterized by continuous inundation and saturated soils. **[CEGL002229] *Typha* spp. - *Schoenoplectus acutus* - Mixed Herbs Midwest Herbaceous Vegetation**

57B. Dominated by sedges (*Carex* spp.). **57**

58A. Wetland primarily dominated by tall, wide-leaved sedges such as Tuckerman's sedge (*Carex tuckermanii*), beaked sedge (*Carex rostrata*), Northwest Territory sedge (*Carex utriculata*) and/or woolgrass bulrush (*Scirpus cyperinus*), and green bulrush (*Scirpus atrovirens*). Shrub cover up to 25% and open-water pools may be present. **[CEGL002257] *Carex* (*rostrata, utriculata*) - *Carex lacustris* - (*Carex vesicaria*) Herbaceous Vegetation**

58B. Wetland primarily dominated by tall, narrow-leaved sedges, particularly woollyfruit sedge (*Carex lasiocarpa*). **58**

59A. Soils very strongly acidic, low exposure to mineral-rich groundwater. Poor fen dominated by sedges such as woollyfruit sedge (*Carex lasiocarpa*) with fewseed sedge (*Carex oligosperma*), mud sedge (*Carex limosa*), and/or white beaksedge (*Rhynchospora alba*). **[CEGL002265] *Carex lasiocarpa* - *Carex oligosperma* / *Sphagnum* spp. Herbaceous Vegetation**

59B. Soils circumneutral to mildly alkaline. Moderate exposure to mineral-rich groundwater. Rich fen dominated by woollyfruit sedge (*Carex lasiocarpa*). Semipermanently flooded to seasonally inundated, often found on a floating mat at the margins of lakes and streams. Pools of open water and/or unvegetated patches common. **[CEGL005229] *Carex lasiocarpa* - (*Carex rostrata*) - *Equisetum fluviatile* Herbaceous Vegetation**

60A. Semipermanently or intermittently flooded herbaceous wetland occurring along shorelines dominated by water horsetail (*Equisetum fluviatile*) and marsh spikerush (*Eleocharis palustris*). **[CEGL005258] *Equisetum fluviatile* - (*Eleocharis palustris*) Herbaceous Vegetation**

60B. Pond or open water community dominated by floating and/or submergent aquatic macrophytes. **60**

61A. Dominants are floating aquatic plants, with large leaves (>10 cm long) and flowers. **[CEGL002562]** ***Nymphaea odorata* - *Nuphar lutea* (ssp. *pumila*, ssp. *variegata*) Herbaceous Vegetation**

61B. Dominant plants are submergent, with only small floating leaves (<10 cm long) or flowers at the surface. **[CEGL002282]** ***Potamogeton* spp. - *Ceratophyllum* spp. Midwest Herbaceous Vegetation**

Appendix D: List of Plant Species

Explanation of the Species List

Plant species were identified and documented from vegetation sample plots and accuracy assessment sites collected for the Pictured Rocks National Lakeshore (PIRO) vegetation mapping project. Plant species, along with other sample data, were entered into the National Park Service PLOTS Database Version 2 (NatureServe 2005b) for subsequent analyses (plant community descriptions and map assessment). Table D-1 is an export of all plant species generated from the PLOTS Database for this project. This list is not intended to be comprehensive of every species at the PIRO. The plant species list is organized alphabetically, first by family name and then by scientific name. Nomenclature follows the PLANTS database (U.S. Department of Agriculture 2004).

Table D-1. Plant species list of Pictured Rocks National Lakeshore.

Scientific Name	Common Name	Family
Acer pensylvanicum	striped maple	Aceraceae
Acer rubrum	red maple	Aceraceae
Acer saccharinum	silver maple	Aceraceae
Acer saccharum	sugar maple	Aceraceae
Acer spicatum	mountain maple	Aceraceae
Sagittaria latifolia	broadleaf arrowhead	Alismataceae
Sanionia uncinata	sanionia moss	Amblystegiaceae
Rhus hirta	staghorn sumac	Anacardiaceae
Toxicodendron radicans	eastern poison ivy	Anacardiaceae
Cicuta bulbifera	bulblet-bearing water hemlock	Apiaceae
Osmorhiza	sweetroot	Apiaceae
Osmorhiza berteroi	sweetcicely	Apiaceae
Osmorhiza claytonii	Clayton's sweetroot	Apiaceae
Osmorhiza longistylis	longstyle sweetroot	Apiaceae
Sanicula marilandica	Maryland sanicle	Apiaceae
Sium suave	hemlock waterparsnip	Apiaceae
Apocynum androsaemifolium	spreading dogbane	Apocynaceae
Ilex verticillata	common winterberry	Aquifoliaceae
Nemopanthus	nemopanthus	Aquifoliaceae
Nemopanthus mucronatus	catberry	Aquifoliaceae
Arisaema triphyllum	Jack in the pulpit	Araceae
Aralia hispida	bristly sarsaparilla	Araliaceae
Aralia nudicaulis	wild sarsaparilla	Araliaceae
Asclepias	milkweed	Asclepiadaceae
Asclepias syriaca	common milkweed	Asclepiadaceae
Achillea millefolium	common yarrow	Asteraceae
Antennaria	pussytoes	Asteraceae
Artemisia	sagebrush	Asteraceae
Artemisia absinthium	absinthium	Asteraceae
Artemisia campestris	field sagewort	Asteraceae
Artemisia campestris ssp. *caudata*	field sagewort	Asteraceae
Aster	aster	Asteraceae
Centaurea biebersteinii	spotted knapweed	Asteraceae
Cirsium	thistle	Asteraceae
Cirsium palustre	marsh thistle	Asteraceae

Scientific Name	Common Name	Family
Cirsium pitcheri	sand dune thistle	Asteraceae
Cirsium vulgare	bull thistle	Asteraceae
Eupatorium	thoroughwort	Asteraceae
Eupatorium maculatum	spotted joepyeweed	Asteraceae
Eupatorium perfoliatum	common boneset	Asteraceae
Eupatorium purpureum	sweetscented joepyeweed	Asteraceae
Eurybia macrophylla	bigleaf aster	Asteraceae
Euthamia graminifolia	flat-top goldentop	Asteraceae
Euthamia tenuifolia var. *tenuifolia*	slender goldentop	Asteraceae
Hieracium	hawkweed	Asteraceae
Hieracium aurantiacum	orange hawkweed	Asteraceae
Hieracium piloselloides	tall hawkweed	Asteraceae
Lactuca	lettuce	Asteraceae
Leucanthemum vulgare	oxeye daisy	Asteraceae
Petasites frigidus	arctic sweet coltsfoot	Asteraceae
Prenanthes serpentaria	cankerweed	Asteraceae
Solidago	goldenrod	Asteraceae
Solidago canadensis	Canada goldenrod	Asteraceae
Solidago hispida	hairy goldenrod	Asteraceae
Solidago rugosa	wrinkleleaf goldenrod	Asteraceae
Symphyotrichum lateriflorum var. *lateriflorum*	calico aster	Asteraceae
Tanacetum bipinnatum ssp. *huronense*	Lake Huron tansy	Asteraceae
Taraxacum officinale	common dandelion	Asteraceae
Tragopogon	goatsbeard	Asteraceae
Aulacomnium androgynum	aulacomnium moss	Aulacomniaceae
Impatiens	touch-me-not	Balsaminaceae
Impatiens capensis	jewelweed	Balsaminaceae
Impatiens pallida	pale touch-me-not	Balsaminaceae
Caulophyllum thalictroides	blue cohosh	Berberidaceae
Podophyllum peltatum	mayapple	Berberidaceae
Alnus incana	gray alder	Betulaceae
Alnus incana ssp. *rugosa*	speckled alder	Betulaceae
Betula alleghaniensis	yellow birch	Betulaceae
Betula papyrifera	paper birch	Betulaceae
Betula pumila	bog birch	Betulaceae
Corylus cornuta	beaked hazelnut	Betulaceae
Ostrya virginiana	hophornbeam	Betulaceae
Cynoglossum virginianum var. *boreale*	wild comfrey	Boraginaceae
Lithospermum canescens	hoary puccoon	Boraginaceae
Lithospermum caroliniense	Carolina puccoon	Boraginaceae
Myosotis	forget-me-not	Boraginaceae
Myosotis scorpioides	true forget-me-not	Boraginaceae
Myosotis sylvatica	woodland forget-me-not	Boraginaceae
Arabis lyrata	lyrate rockcress	Brassicaceae
Cardamine	bittercress	Brassicaceae
Cardamine diphylla	crinkleroot	Brassicaceae
Campanula aparinoides	marsh bellflower	Campanulaceae
Diervilla lonicera	northern bush honeysuckle	Caprifoliaceae

Scientific Name	Common Name	Family
Linnaea borealis	twinflower	Caprifoliaceae
Lonicera	honeysuckle	Caprifoliaceae
Lonicera canadensis	American fly honeysuckle	Caprifoliaceae
Lonicera dioica	limber honeysuckle	Caprifoliaceae
Lonicera hirsuta	hairy honeysuckle	Caprifoliaceae
Lonicera oblongifolia	swamp fly honeysuckle	Caprifoliaceae
Sambucus	elderberry	Caprifoliaceae
Sambucus nigra ssp. canadensis	common elderberry	Caprifoliaceae
Sambucus racemosa	red elderberry	Caprifoliaceae
Viburnum	viburnum	Caprifoliaceae
Viburnum lentago	nannyberry	Caprifoliaceae
Viburnum nudum var. *cassinoides*	withe-rod	Caprifoliaceae
Viburnum opulus var. *americanum*	American cranberrybush	Caprifoliaceae
Stellaria longipes	longstalk starwort	Caryophyllaceae
Hudsonia tomentosa	woolly beachheather	Cistaceae
Cladina	reindeer lichen	Cladoniaceae
Cladina rangiferina	greygreen reindeer lichen	Cladoniaceae
Cladonia	cup lichen	Cladoniaceae
Cladonia chlorophaea	cup lichen	Cladoniaceae
Cladonia cristatella	cup lichen	Cladoniaceae
Hypericum	St. Johnswort	Clusiaceae
Hypericum boreale	northern St. Johnswort	Clusiaceae
Hypericum canadense	lesser Canadian St. Johnswort	Clusiaceae
Hypericum majus	large St. Johnswort	Clusiaceae
Hypericum perforatum	common St. Johnswort	Clusiaceae
Hypericum punctatum	spotted St. Johnswort	Clusiaceae
Triadenum fraseri	Fraser's marsh St. Johnswort	Clusiaceae
Cornus	dogwood	Cornaceae
Cornus alternifolia	alternateleaf dogwood	Cornaceae
Cornus canadensis	bunchberry dogwood	Cornaceae
Cornus rugosa	roundleaf dogwood	Cornaceae
Cornus sericea	redosier dogwood	Cornaceae
Cornus sericea ssp. *sericea*	redosier dogwood	Cornaceae
Juniperus communis	common juniper	Cupressaceae
Thuja occidentalis	arborvitae	Cupressaceae
Carex	sedge	Cyperaceae
Carex arctata	drooping woodland sedge	Cyperaceae
Carex aurea	golden sedge	Cyperaceae
Carex bebbii	Bebb's sedge	Cyperaceae
Carex brunnescens	brownish sedge	Cyperaceae
Carex buxbaumii	Buxbaum's sedge	Cyperaceae
Carex canescens	silvery sedge	Cyperaceae
Carex comosa	longhair sedge	Cyperaceae
Carex cryptolepis	northeastern sedge	Cyperaceae
Carex deweyana	Dewey sedge	Cyperaceae
Carex diandra	lesser panicled sedge	Cyperaceae
Carex disperma	softleaf sedge	Cyperaceae
Carex flava	yellow sedge	Cyperaceae

Scientific Name	Common Name	Family
Carex folliculata	northern long sedge	Cyperaceae
Carex hystericina	bottlebrush sedge	Cyperaceae
Carex interior	inland sedge	Cyperaceae
Carex intumescens	greater bladder sedge	Cyperaceae
Carex lacustris	hairy sedge	Cyperaceae
Carex lasiocarpa	woollyfruit sedge	Cyperaceae
Carex leptalea	bristlystalked sedge	Cyperaceae
Carex leptonervia	nerveless woodland sedge	Cyperaceae
Carex limosa	mud sedge	Cyperaceae
Carex oligosperma	fewseed sedge	Cyperaceae
Carex pauciflora	fewflower sedge	Cyperaceae
Carex pedunculata	longstalk sedge	Cyperaceae
Carex pensylvanica	Pennsylvania sedge	Cyperaceae
Carex retrorsa	knotsheath sedge	Cyperaceae
Carex rostrata	beaked sedge	Cyperaceae
Carex scoparia	broom sedge	Cyperaceae
Carex sterilis	dioecious sedge	Cyperaceae
Carex stipata	owlfruit sedge	Cyperaceae
Carex stricta	upright sedge	Cyperaceae
Carex trisperma	threeseeded sedge	Cyperaceae
Carex tuckermanii	Tuckerman's sedge	Cyperaceae
Carex utriculata	Northwest Territory sedge	Cyperaceae
Carex vesicaria	blister sedge	Cyperaceae
Carex viridula	little green sedge	Cyperaceae
Cladium mariscoides	smooth sawgrass	Cyperaceae
Dulichium arundinaceum	threeway sedge	Cyperaceae
Eleocharis	spikerush	Cyperaceae
Eleocharis elliptica	elliptic spikerush	Cyperaceae
Eleocharis intermedia	matted spikerush	Cyperaceae
Eleocharis palustris	common spikerush	Cyperaceae
Eriophorum	cottongrass	Cyperaceae
Eriophorum angustifolium	tall cottongrass	Cyperaceae
Eriophorum vaginatum var. *spissum*	tussock cottongrass	Cyperaceae
Eriophorum virginicum	tawny cottongrass	Cyperaceae
Rhynchospora alba	white beaksedge	Cyperaceae
Rhynchospora fusca	brown beaksedge	Cyperaceae
Rhynchospora rugosa	claybank beaksedge	Cyperaceae
Schoenoplectus	bulrush	Cyperaceae
Schoenoplectus acutus var. *acutus*	hardstem bulrush	Cyperaceae
Schoenoplectus americanus	chairmaker's bulrush	Cyperaceae
Schoenoplectus pungens	common threesquare	Cyperaceae
Schoenoplectus subterminalis	swaying bulrush	Cyperaceae
Schoenoplectus tabernaemontani	softstem bulrush	Cyperaceae
Scirpus	bulrush	Cyperaceae
Scirpus atrovirens	green bulrush	Cyperaceae
Scirpus cyperinus	woolgrass	Cyperaceae
Trichophorum caespitosum	tufted bulrush	Cyperaceae
Dacampia	dacampia	Dacampiaceae

Scientific Name	Common Name	Family
Pteridium aquilinum	western brackenfern	Dennstaedtiaceae
Dicranum polysetum	dicranum moss	Dicranaceae
Dicranum scoparium	dicranum moss	Dicranaceae
Dicranum viride	dicranum moss	Dicranaceae
Ceratodon purpureus	ceratodon moss	Ditrichaceae
Drosera	sundew	Droseraceae
Drosera intermedia	spoonleaf sundew	Droseraceae
Drosera rotundifolia	roundleaf sundew	Droseraceae
Athyrium filix-femina	common ladyfern	Dryopteridaceae
Cystopteris bulbifera	bulblet bladderfern	Dryopteridaceae
Deparia acrostichoides	silver false spleenwort	Dryopteridaceae
Dryopteris	woodfern	Dryopteridaceae
Dryopteris carthusiana	spinulose woodfern	Dryopteridaceae
Dryopteris cristata	crested woodfern	Dryopteridaceae
Dryopteris filix-mas	male fern	Dryopteridaceae
Dryopteris intermedia	intermediate woodfern	Dryopteridaceae
Gymnocarpium ×intermedium		Dryopteridaceae
Gymnocarpium dryopteris	western oakfern	Dryopteridaceae
Matteuccia struthiopteris	ostrich fern	Dryopteridaceae
Onoclea	sensitive fern	Dryopteridaceae
Onoclea sensibilis	sensitive fern	Dryopteridaceae
Polystichum braunii	Braun's hollyfern	Dryopteridaceae
Equisetum	horsetail	Equisetaceae
Equisetum ×ferrissii		Equisetaceae
Equisetum arvense	field horsetail	Equisetaceae
Equisetum fluviatile	water horsetail	Equisetaceae
Equisetum hyemale	scouringrush horsetail	Equisetaceae
Equisetum palustre	marsh horsetail	Equisetaceae
Equisetum pratense	meadow horsetail	Equisetaceae
Equisetum scirpoides	dwarf scouringrush	Equisetaceae
Equisetum sylvaticum	woodland horsetail	Equisetaceae
Andromeda polifolia	bog rosemary	Ericaceae
Andromeda polifolia var. *glaucophylla*	bog rosemary	Ericaceae
Arctostaphylos uva-ursi	kinnikinnick	Ericaceae
Chamaedaphne	leatherleaf	Ericaceae
Chamaedaphne calyculata	leatherleaf	Ericaceae
Epigaea repens	trailing arbutus	Ericaceae
Gaultheria	snowberry	Ericaceae
Gaultheria hispidula	creeping snowberry	Ericaceae
Gaultheria procumbens	eastern teaberry	Ericaceae
Gaylussacia baccata	black huckleberry	Ericaceae
Kalmia polifolia	bog laurel	Ericaceae
Ledum groenlandicum	bog Labrador tea	Ericaceae
Vaccinium	blueberry	Ericaceae
Vaccinium angustifolium	lowbush blueberry	Ericaceae
Vaccinium macrocarpon	cranberry	Ericaceae
Vaccinium membranaceum	thinleaf huckleberry	Ericaceae
Vaccinium myrtilloides	velvetleaf huckleberry	Ericaceae

Scientific Name	Common Name	Family
Vaccinium ovalifolium	oval-leaf blueberry	Ericaceae
Vaccinium oxycoccos	small cranberry	Ericaceae
Eriocaulon aquaticum	sevenangle pipewort	Eriocaulaceae
Lathyrus japonicus	beach pea	Fabaceae
Medicago	alfalfa	Fabaceae
Melilotus alba	white sweetclover	Fabaceae
Trifolium pratense	red clover	Fabaceae
Vicia	vetch	Fabaceae
Fagus grandifolia	American beech	Fagaceae
Quercus alba	white oak	Fagaceae
Quercus rubra	northern red oak	Fagaceae
Dicentra	bleeding heart	Fumariaceae
Gentiana rubricaulis	closed gentian	Gentianaceae
Geranium	geranium	Geraniaceae
Grimmia	grimmia dry rock moss	Grimmiaceae
Ribes	currant	Grossulariaceae
Ribes cynosbati	eastern prickly gooseberry	Grossulariaceae
Ribes hirtellum	hairystem gooseberry	Grossulariaceae
Ribes triste	red currant	Grossulariaceae
Myriophyllum sibiricum	shortspike watermilfoil	Haloragaceae
Proserpinaca palustris	marsh mermaidweed	Haloragaceae
Hedwigia ciliata	ciliate hedwigia moss	Hedwigiaceae
Hylocomiastrum pyrenaicum	hylocomiastrum moss	Hylocomiaceae
Hylocomium	Hylocomium feather moss	Hylocomiaceae
Hylocomium splendens	splendid feather moss	Hylocomiaceae
Pleurozium schreberi	Schreber's big red stem moss	Hylocomiaceae
Callicladium haldanianum	callicladium moss	Hypnaceae
Hypnum imponens	hypnum moss	Hypnaceae
Ptilium crista-castrensis	knights plume moss	Hypnaceae
Iris	iris	Iridaceae
Iris lacustris	dwarf lake iris	Iridaceae
Iris versicolor	harlequin blueflag	Iridaceae
Juncus	rush	Juncaceae
Juncus balticus	Baltic rush	Juncaceae
Juncus brevicaudatus	narrowpanicle rush	Juncaceae
Juncus canadensis	Canadian rush	Juncaceae
Juncus effusus	common rush	Juncaceae
Juncus nodosus	knotted rush	Juncaceae
Juncus pelocarpus	brownfruit rush	Juncaceae
Juncus tenuis	poverty rush	Juncaceae
Triglochin maritimum	seaside arrowgrass	Juncaginaceae
Lycopus	waterhorehound	Lamiaceae
Lycopus americanus	American water horehound	Lamiaceae
Lycopus uniflorus	northern bugleweed	Lamiaceae
Mentha arvensis	wild mint	Lamiaceae
Prunella vulgaris	common selfheal	Lamiaceae
Scutellaria	skullcap	Lamiaceae
Scutellaria galericulata	marsh skullcap	Lamiaceae

Scientific Name	Common Name	Family
Lemna	duckweed	Lemnaceae
Lemna minor	common duckweed	Lemnaceae
Spirodela polyrrhiza	common duckmeat	Lemnaceae
Utricularia	bladderwort	Lentibulariaceae
Utricularia cornuta	horned bladderwort	Lentibulariaceae
Utricularia intermedia	flatleaf bladderwort	Lentibulariaceae
Lepidozia reptans		Lepidoziaceae
Leucobryum glaucum	leucobryum moss	Leucobryaceae
Allium tricoccum	wild leek	Liliaceae
Clintonia borealis	bluebead	Liliaceae
Erythronium americanum	dogtooth violet	Liliaceae
Erythronium americanum ssp. *americanum*	dogtooth violet	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
Polygonatum pubescens	hairy Solomon's seal	Liliaceae
Streptopus	twistedstalk	Liliaceae
Streptopus amplexifolius	claspleaf twistedstalk	Liliaceae
Streptopus lanceolatus	twistedstalk	Liliaceae
Streptopus lanceolatus var. *curvipes*	twistedstalk	Liliaceae
Streptopus lanceolatus var. *roseus*	twistedstalk	Liliaceae
Trillium	trillium	Liliaceae
Trillium cernuum	whip-poor-will flower	Liliaceae
Trillium grandiflorum	snow trillium	Liliaceae
Uvularia grandiflora	largeflower bellwort	Liliaceae
Huperzia lucidula	shining clubmoss	Lycopodiaceae
Lycopodiella inundata	inundated clubmoss	Lycopodiaceae
Lycopodium	clubmoss	Lycopodiaceae
Lycopodium annotinum	stiff clubmoss	Lycopodiaceae
Lycopodium clavatum	running clubmoss	Lycopodiaceae
Lycopodium dendroideum	tree groundpine	Lycopodiaceae
Lycopodium digitatum	fan clubmoss	Lycopodiaceae
Lycopodium obscurum	rare clubmoss	Lycopodiaceae
Menyanthes	buckbean	Menyanthaceae
Menyanthes trifoliata	buckbean	Menyanthaceae
Plagiomnium ciliare	plagiomnium moss	Mniaceae
Monotropa uniflora	Indianpipe	Monotropaceae
Myrica gale	sweetgale	Myricaceae
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
Fraxinus americana	white ash	Oleaceae
Fraxinus nigra	black ash	Oleaceae
Chamerion angustifolium	fireweed	Onagraceae

Scientific Name	Common Name	Family
Circaea alpina	small enchanter's nightshade	Onagraceae
Epilobium	willowherb	Onagraceae
Oenothera	evening-primrose	Onagraceae
Oenothera oakesiana	Oakes' evening-primrose	Onagraceae
Botrychium	grapefern	Ophioglossaceae
Botrychium virginianum	rattlesnake fern	Ophioglossaceae
Calopogon tuberosus	tuberous grasspink	Orchidaceae
Corallorrhiza maculata	summer coralroot	Orchidaceae
Cypripedium	lady's slipper	Orchidaceae
Cypripedium acaule	moccasin flower	Orchidaceae
Cypripedium arietinum	ram's head lady's slipper	Orchidaceae
Cypripedium parviflorum	lesser yellow lady's slipper	Orchidaceae
Epipactis helleborine	broadleaf helleborine	Orchidaceae
Goodyera	rattlesnake plantain	Orchidaceae
Goodyera oblongifolia	western rattlesnake plantain	Orchidaceae
Habenaria	bog orchid	Orchidaceae
Listera convallarioides	broadlipped twayblade	Orchidaceae
Listera cordata	heartleaf twayblade	Orchidaceae
Platanthera	fringed orchid	Orchidaceae
Platanthera clavellata	small green wood orchid	Orchidaceae
Spiranthes lacera	northern slender ladies'-tresses	Orchidaceae
Spiranthes lacera var. *gracilis*	northern slender ladies'-tresses	Orchidaceae
Osmunda	osmunda	Osmundaceae
Osmunda cinnamomea	cinnamon fern	Osmundaceae
Osmunda claytoniana	interrupted fern	Osmundaceae
Osmunda regalis	royal fern	Osmundaceae
Oxalis montana	mountain woodsorrel	Oxalidaceae
Sanguinaria canadensis	bloodroot	Papaveraceae
Abies balsamea	balsam fir	Pinaceae
Larix laricina	tamarack	Pinaceae
Picea	spruce	Pinaceae
Picea glauca	white spruce	Pinaceae
Picea mariana	black spruce	Pinaceae
Pinus banksiana	jack pine	Pinaceae
Pinus resinosa	red pine	Pinaceae
Pinus strobus	eastern white pine	Pinaceae
Tsuga canadensis	eastern hemlock	Pinaceae
Agrostis gigantea	redtop	Poaceae
Agrostis hyemalis	winter bentgrass	Poaceae
Ammophila breviligulata	American beachgrass	Poaceae
Andropogon gerardii	big bluestem	Poaceae
Brachyelytrum erectum	bearded shorthusk	Poaceae
Bromus inermis	smooth brome	Poaceae
Calamagrostis	reedgrass	Poaceae
Calamagrostis canadensis	bluejoint	Poaceae
Cinna latifolia	drooping woodreed	Poaceae
Dactylis glomerata	orchardgrass	Poaceae
Danthonia spicata	poverty oatgrass	Poaceae

Scientific Name	Common Name	Family
Deschampsia	hairgrass	Poaceae
Deschampsia caespitosa	tufted hairgrass	Poaceae
Deschampsia flexuosa	wavy hairgrass	Poaceae
Dichanthelium acuminatum var. *acuminatum*	tapered rosette grass	Poaceae
Dichanthelium acuminatum var. *fasciculatum*	western panicgrass	Poaceae
Elymus repens	quackgrass	Poaceae
Elymus trachycaulus	slender wheatgrass	Poaceae
Festuca	fescue	Poaceae
Festuca saximontana	Rocky Mountain fescue	Poaceae
Glyceria	mannagrass	Poaceae
Glyceria canadensis	rattlesnake mannagrass	Poaceae
Glyceria grandis	American mannagrass	Poaceae
Glyceria striata	fowl mannagrass	Poaceae
Koeleria macrantha	prairie Junegrass	Poaceae
Leersia	cutgrass	Poaceae
Leymus mollis	American dunegrass	Poaceae
Melica smithii	Smith's melicgrass	Poaceae
Milium effusum	American milletgrass	Poaceae
Oryzopsis	ricegrass	Poaceae
Oryzopsis asperifolia	roughleaf ricegrass	Poaceae
Panicum	panicgrass	Poaceae
Phalaris	canarygrass	Poaceae
Phalaris arundinacea	reed canarygrass	Poaceae
Phleum pratense	timothy	Poaceae
Poa	bluegrass	Poaceae
Poa compressa	Canada bluegrass	Poaceae
Poa pratensis	Kentucky bluegrass	Poaceae
Schizachyrium scoparium	little bluestem	Poaceae
Schizachyrium scoparium var. *scoparium*	little bluestem	Poaceae
Polygala paucifolia	gaywings	Polygalaceae
Polygonum	knotweed	Polygonaceae
Polygonum amphibium	water knotweed	Polygonaceae
Polygonum amphibium var. *emersum*	longroot smartweed	Polygonaceae
Polygonum hydropiper	marshpepper knotweed	Polygonaceae
Rumex	dock	Polygonaceae
Rumex acetosa	garden sorrel	Polygonaceae
Rumex acetosella	common sheep sorrel	Polygonaceae
Polypodium virginianum	rock polypody	Polypodiaceae
Polytrichum piliferum	polytrichum moss	Polytrichaceae
Claytonia	springbeauty	Portulacaceae
Potamogeton	pondweed	Potamogetonaceae
Potamogeton amplifolius	largeleaf pondweed	Potamogetonaceae
Potamogeton confervoides	Tuckerman's pondweed	Potamogetonaceae
Potamogeton natans	floating pondweed	Potamogetonaceae
Potamogeton zosteriformis	flatstem pondweed	Potamogetonaceae
Lysimachia thyrsiflora	tufted loosestrife	Primulaceae
Trientalis borealis	starflower	Primulaceae
Cryptogramma stelleri	fragile rockbrake	Pteridaceae

Scientific Name	Common Name	Family
Chimaphila	prince's pine	Pyrolaceae
Chimaphila umbellata	pipsissewa	Pyrolaceae
Moneses uniflora	single delight	Pyrolaceae
Orthilia secunda	sidebells wintergreen	Pyrolaceae
Pyrola	wintergreen	Pyrolaceae
Pyrola americana	American wintergreen	Pyrolaceae
Pyrola asarifolia	liverleaf wintergreen	Pyrolaceae
Pyrola chlorantha	greenflowered wintergreen	Pyrolaceae
Pyrola elliptica	waxflower shinleaf	Pyrolaceae
Pyrola minor	snowline wintergreen	Pyrolaceae
Actaea	baneberry	Ranunculaceae
Actaea pachypoda	white baneberry	Ranunculaceae
Actaea rubra	red baneberry	Ranunculaceae
Anemone	anemone	Ranunculaceae
Anemone canadensis	Canadian anemone	Ranunculaceae
Anemone multifida	Pacific anemone	Ranunculaceae
Anemone virginiana	tall thimbleweed	Ranunculaceae
Caltha palustris	yellow marsh marigold	Ranunculaceae
Clematis	leather flower	Ranunculaceae
Clematis occidentalis	western blue virginsbower	Ranunculaceae
Clematis virginiana	devil's darning needles	Ranunculaceae
Coptis	goldthread	Ranunculaceae
Coptis trifolia	threeleaf goldthread	Ranunculaceae
Enemion biternatum	eastern false rue anemone	Ranunculaceae
Hepatica nobilis var. *obtusa*	roundlobe hepatica	Ranunculaceae
Ranunculus	buttercup	Ranunculaceae
Ranunculus hispidus	bristly buttercup	Ranunculaceae
Ranunculus recurvatus	blisterwort	Ranunculaceae
Thalictrum dasycarpum	purple meadow-rue	Ranunculaceae
Rhamnus alnifolia	alderleaf buckthorn	Rhamnaceae
Rhytidium rugosum	rhytidium moss	Rhytidiaceae
Agrimonia striata	roadside agrimony	Rosaceae
Amelanchier	serviceberry	Rosaceae
Amelanchier arborea	common serviceberry	Rosaceae
Amelanchier laevis	Allegheny serviceberry	Rosaceae
Argentina anserina	silverweed cinquefoil	Rosaceae
Comarum palustre	purple marshlocks	Rosaceae
Crataegus	hawthorn	Rosaceae
Fragaria vesca	woodland strawberry	Rosaceae
Fragaria virginiana	Virginia strawberry	Rosaceae
Geum	avens	Rosaceae
Geum canadense	white avens	Rosaceae
Geum rivale	purple avens	Rosaceae
Malus pumila	paradise apple	Rosaceae
Photinia floribunda	purple chokeberry	Rosaceae
Potentilla	cinquefoil	Rosaceae
Potentilla norvegica	Norwegian cinquefoil	Rosaceae
Prunus	plum	Rosaceae

Scientific Name	Common Name	Family
Prunus pensylvanica	pin cherry	Rosaceae
Prunus pumila	sandcherry	Rosaceae
Prunus serotina	black cherry	Rosaceae
Prunus virginiana	chokecherry	Rosaceae
Rosa	rose	Rosaceae
Rosa acicularis	prickly rose	Rosaceae
Rosa blanda	smooth rose	Rosaceae
Rosa palustris	swamp rose	Rosaceae
Rubus	blackberry	Rosaceae
Rubus hispidus	bristly dewberry	Rosaceae
Rubus idaeus	American red raspberry	Rosaceae
Rubus idaeus ssp. *strigosus*	grayleaf red raspberry	Rosaceae
Rubus parviflorus	thimbleberry	Rosaceae
Rubus pubescens	dwarf red blackberry	Rosaceae
Sorbus	mountain ash	Rosaceae
Sorbus americana	American mountain ash	Rosaceae
Sorbus decora	northern mountain ash	Rosaceae
Spiraea alba	white meadowsweet	Rosaceae
Galium	bedstraw	Rubiaceae
Galium hispidulum	coastal bedstraw	Rubiaceae
Galium trifidum	threepetal bedstraw	Rubiaceae
Galium triflorum	fragrant bedstraw	Rubiaceae
Gaultheria hispidula	creeping snowberry	Rubiaceae
Mitchella repens	partridgeberry	Rubiaceae
Populus balsamifera	balsam poplar	Salicaceae
Populus grandidentata	bigtooth aspen	Salicaceae
Populus tremuloides	quaking aspen	Salicaceae
Salix	willow	Salicaceae
Salix candida	sageleaf willow	Salicaceae
Salix cordata	heartleaf willow	Salicaceae
Salix eriocephala	Missouri River willow	Salicaceae
Salix exigua	narrowleaf willow	Salicaceae
Salix interior	sandbar willow	Salicaceae
Salix lucida	shining willow	Salicaceae
Salix pedicellaris	bog willow	Salicaceae
Salix petiolaris	meadow willow	Salicaceae
Comandra umbellata	bastard toadflax	Santalaceae
Sarracenia	pitcherplant	Sarraceniaceae
Sarracenia purpurea	purple pitcherplant	Sarraceniaceae
Mitella diphylla	twoleaf miterwort	Saxifragaceae
Mitella nuda	naked miterwort	Saxifragaceae
Tiarella cordifolia	heartleaf foamflower	Saxifragaceae
Melampyrum lineare	narrowleaf cowwheat	Scrophulariaceae
Mimulus ringens	Allegheny monkeyflower	Scrophulariaceae
Veronica beccabunga	European speedwell	Scrophulariaceae
Veronica officinalis	common gypsyweed	Scrophulariaceae
Veronica serpyllifolia	thymeleaf speedwell	Scrophulariaceae
Sparganium	bur-reed	Sparganiaceae

Scientific Name	Common Name	Family
Sparganium americanum	American bur-reed	Sparganiaceae
Sparganium natans	small bur-reed	Sparganiaceae
Sphagnum	sphagnum	Sphagnaceae
Sphagnum papillosum	papillose sphagnum	Sphagnaceae
Taxus canadensis	Canada yew	Taxaceae
Phegopteris	beechfern	Thelypteridaceae
Phegopteris connectilis	long beechfern	Thelypteridaceae
Thelypteris	maiden fern	Thelypteridaceae
Thelypteris noveboracensis	New York fern	Thelypteridaceae
Thelypteris palustris	eastern marsh fern	Thelypteridaceae
Abietinella abietina	abietinella moss	Thuidiaceae
Tilia americana	American basswood	Tiliaceae
Typha	cattail	Typhaceae
Typha latifolia	broadleaf cattail	Typhaceae
Ulmus americana	American elm	Ulmaceae
Viola	violet	Violaceae
Viola canadensis	Canadian white violet	Violaceae
Viola macloskeyi	small white violet	Violaceae
Viola sororia	common blue violet	Violaceae
Xyris montana	northern yelloweyed grass	Xyridaceae

Appendix E: Descriptions of Map Classes

Explanation of Map-class Descriptions

This appendix to the Main Report of the Pictured Rocks National Lakeshore (PIRO) vegetation mapping project provides descriptions to the 74 map classes we used to map the PIRO and environs for the National Park Service (NPS) Vegetation Inventory Program (VIP). Of these 74 map classes, 70 represent vegetation types within the National Vegetation Classification Standard (NVCS) (FGDC 2008), where another four represent non-vegetated units (open water, barren land). 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 these map-class descriptions.

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 as provided by NatureServe. (For map-class phases, the phase portion 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-vegetated features, we derived succinct names to describe the feature.

Commencing each map-class description, we provide the official classification name and code that the map class represents, whether in the NVCS or, if non-vegetated, to the classification in the National Land Cover Database (NLCD) 2001 (Homer et al. 2004). The map class is described with a focus to the PIRO and immediate environs and not necessarily to the region beyond. Also, descriptions are from a mapping perspective more than from an ecologic perspective; however, some ecologic concepts are inherent to the descriptions, as one would expect when describing the mapping of types in the NVCS. We also discuss how map classes relate to other map classes, because many vegetation types transition into each other. We finally provide a brief explanation of how map classes were analyzed during the accuracy assessment.

Throughout the map-class descriptions, “RD” refers to relative density and “AA” refers to accuracy assessment. Also, when speaking of tree species (e.g., sugar maple, northern white-cedar), it is assumed these are of heights >5 m unless otherwise specified (e.g., shrub-height trees). This includes general references to trees as conifers and hardwoods.

Along with describing the map classes via text, representative ground pictures are also provided to give visual concepts of what the map classes represent. It is worth noting that the representative pictures are a partial representation; to capture all variations within a map class would become daunting.

We organized map classes representing vegetation types by the hierarchy in the NVCS (FGDC 2008). We organized map classes representing non-vegetated features (e.g., open water) with 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).

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Table E-1. Map classification with crosswalk to the National Vegetation Classification Standard (Version 2) for the Pictured Rocks National Lakeshore vegetation mapping project.

[NVCS, National Vegetation Classification Standard; NLCD, National Land Cover Database; MMU, minimum mapping unit]

Map-class Code	Map-class Name
1. FOREST & WOODLAND CLASS	
1.C.2.a. Eastern North American Cool Temperate Forest Division	
MG014. Northern Hardwood & Conifer Forest Macrogroup	
G163. Northern Hardwood - Hemlock - White Pine Forest Group	
Acer saccharum - *Betula alleghaniensis* - (*Tilia americana*) Forest Association (CEGL002457)	
FMB	Maple - Yellow Birch Northern Hardwoods Forest (classic phase)
FMY	Maple - Yellow Birch Northern Hardwoods Forest (yew phase)
FMF	Maple - Yellow Birch Northern Hardwoods Forest (balsam fir shrub phase)
FMM	Maple - Yellow Birch Northern Hardwoods Forest (sugar maple phase)
Pinus strobus - *Tsuga canadensis* Great Lakes Forest Association (CEGL002590)	
FWH	Great Lakes White Pine - Hemlock Forest
Thuja occidentalis / *Abies balsamea* - *Acer spicatum* Forest Association (CEGL002449)	
FCC	White-cedar - Boreal Conifer Mesic Forest (conifer phase)
FCM	White-cedar - Boreal Conifer Mesic Forest (conifer - hardwood phase)
Tsuga canadensis - (*Betula alleghaniensis*) Forest Association (CEGL002598)	
FHC	Hemlock Mesic Forest
Tsuga canadensis - *Acer saccharum* - *Betula alleghaniensis* Forest Association (CEGL005044)	
FHM	North-Central Hemlock - Hardwood Forest
Tsuga canadensis - *Fagus grandifolia* - (*Acer saccharum*) Great Lakes Forest Association (CEGL005042)	
FHB	Great Lakes Hemlock - Beech - Hardwood Forest
G025. White Pine - Red Pine - Jack Pine - Oak Forest & Woodland Group	
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)	
FWO	White Pine - Red Oak Forest

Map-class Code	Map-class Name
	Pinus strobus - *Populus tremuloides* - (*Acer rubrum*) / *Pteridium aquilinum* Forest Association (CEGL005563)
FPB	White Pine - Mixed Deciduous / Bracken Barren Forest and Scrub (forest phase)
SSS	White Pine - Mixed Deciduous / Bracken Barren Forest and Scrub (scrub phase)
	Pinus strobus - *Populus tremuloides* / *Corylus cornuta* Forest Association (CEGL002479)
FWA	White Pine - Aspen - Birch Forest
	Pinus strobus / *Vaccinium* spp. Forest Association (CEGL002444)
FWP	White Pine / Blueberry Dry-Mesic Forest
	MG159. Northern Pine - Oak Woodland & Barrens Macrogroup
	G160. Great Lakes Pine Barrens Group
	Pinus banksiana - *Pinus resinosa* - *Pinus strobus* Dune Forest Association (CEGL002589)
FPD	Great Lakes Dune Pine Forest
	MG013. Eastern North American Ruderal Forest & Plantation Macrogroup
	G030. Northern & Central Hardwood & Conifer Ruderal Forest Group
FCX	Conifer Ruderal Forest
FDX	Hardwood Ruderal Forest
FMX	Conifer - Hardwood Ruderal Forest
	G032. Northern & Central Conifer & Hardwood Plantation Group
FPE	Conifer Plantation
	1.C.3.a. Northeastern & Central North American Flooded & Swamp Forest Division
	MG030. Northern & Central Swamp Forest Macrogroup
	G046. Northern & Central Alkaline Conifer & Hardwood Swamp Group
	Fraxinus nigra - Mixed Hardwoods - Conifers / *Cornus sericea* / *Carex* spp. Forest Association (CEGL002105)
FBA	Black Ash - Mixed Hardwood Swamp (black ash phase)
FLD	Black Ash - Mixed Hardwood Swamp (lowland phase)
	Pinus strobus - (*Acer rubrum*) / *Osmunda* spp. Forest Association (CEGL002482)
FWM	White Pine - Red Maple Swamp (swamp phase)
FWW	White Pine - Red Maple Swamp (swamp - dune mosaic phase)
	Thuja occidentalis - (*Larix laricina*) Seepage Forest Association (CEGL002455)
N/A	White-cedar Seepage Swamp
	Thuja occidentalis - *Fraxinus nigra* Forest Association (CEGL005165)
FCA	White-cedar - Black Ash Swamp

Map-class Code	Map-class Name
	Tsuga canadensis - *Betula alleghaniensis* Saturated Forest Association (CEGL005003)
FHS	Hemlock - Yellow Birch Swamp Wet-Mesic Forest
	MG160. Northern & Central Tall Shrub Wetland Macrogroup
	G167. Northern & Central Shrub Swamp Group
	Alnus incana Swamp Shrubland Association (CEGL002381)
SAS	Gray Alder Swamp Shrubland
	1.D.1.a. North American Lowland Boreal Forest Division
	MG037. Eastern & Central North American Boreal Conifer & Hardwood Forest Macrogroup
	G047. Jack Pine - Black Spruce Forest Group
	Picea mariana / *Pleurozium schreberi* Forest Association (CEGL002447)
FBS	Black Spruce / Feathermoss Forest
	Pinus banksiana - *Populus tremuloides* / *Diervilla lonicera* Forest Association (CEGL002518)
FJM	Jack Pine - Aspen / Bush-honeysuckle Forest
	Pinus banksiana / *Abies balsamea* Forest Association (CEGL002437)
FJF	Jack Pine / Balsam Fir Forest
	Pinus banksiana / *Vaccinium* spp. / *Pleurozium schreberi* Forest Association (CEGL002441)
FJB	Jack Pine / Blueberry / Feathermoss Forest
	G048. White Spruce - Balsam Fir Forest Group
	Abies balsamea - *Betula papyrifera* / *Diervilla lonicera* Forest Association (CEGL002474)
FFB	Balsam Fir - Paper Birch Forest
	Betula papyrifera / *Diervilla lonicera* - (*Abies balsamea*) Forest Association (CEGL002463)
FGF	Paper Birch / Fir Forest
	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
	1.D.2.a. North American Boreal Flooded & Swamp Forest Division

Map-class Code	Map-class Name
	MG038. Central & Eastern Boreal Flooded & Swamp Forest Macrogroup
	G050. Black Spruce - Tamarack Acidic Swamp Group
	Picea mariana - (*Larix laricina*) / *Ledum groenlandicum* / *Sphagnum* spp. Forest Association (CEGL005271)
FSS	Black Spruce - Tamarack / Labrador-tea Poor Swamp (black spruce phase)
FTS	Black Spruce - Tamarack / Labrador-tea Poor Swamp (tamarack phase)
	G051. Tamarack - Conifer Alkaline Swamp Group
	Thuja occidentalis - (*Picea mariana*, *Abies balsamea*) / *Alnus incana* Forest Association (CEGL002456)
FCS	White-cedar - (Mixed Conifer) / Alder Swamp
2. SHRUBLAND & GRASSLAND CLASS	
	2.C.1.c. Eastern North American Grassland, Meadow & Shrubland Division
	MG164. Eastern Temperate Forest Region Savanna & Barrens Macrogroup
	G063. Eastern Shrub-Herb Sand Barrens Group
	Pteridium aquilinum - *Bromus kalmii* Herbaceous Vegetation Association (CEGL005142)
HBF	Bracken Grassland
	MG123. Eastern Ruderal Shrubland & Grassland Macrogroup
	G059. Eastern Ruderal Shrubland & Grassland Group [Placeholder]
SMX	Ruderal Shrubland
HMX	Ruderal Grassland
	2.C.2.a. North American Boreal Grassland, Meadow & Shrubland Division
	MG055. North American Boreal Shrubland & Grassland Macrogroup
	G339. Eastern North American Boreal Shrubland Group
	Rubus parviflorus Shrubland [Provisional] Association (CEGL005248)
N/A	Thimbleberry Shrubland
	2.C.3.a. Eastern North American Coastal Grassland & Shrubland Division
	MG057. Eastern North American Coastal Grassland & Shrubland Macrogroup
	G089. Great Lakes Coast Grassland & Shrubland Group
	Ammophila breviligulata - (*Schizachyrium scoparium*) Herbaceous Vegetation (CEGL005098)
HAB	Great Lakes Beachgrass Dune
	Hudsonia tomentosa Dune Dwarf-shrubland Association (CEGL004024)
DBH	Great Lakes Beach-heather Dune Dwarf-shrubland

Map-class Code	Map-class Name
	Juniperus horizontalis - *Arctostaphylos uva-ursi* - *Juniperus communis* Dune Dwarf-shrubland Association (CEGL005064)
DJD	Great Lakes Juniper Dune Shrubland
	Pinus banksiana - (*Pinus resinosa*) - *Pinus strobus* / *Juniperus horizontalis* Wooded Herbaceous Vegetation Association (CEGL005125)
HPB	Great Lakes Coast Pine Barrens (barrens phase)
HPW	Great Lakes Coast Pine Barrens (woodland phase)
	Populus deltoides - (*Juniperus virginiana*) Dune Woodland Association (CEGL005119)
WCD	Cottonwood Dune Open Woodland
	Prunus pumila - (*Ptelea trifoliata*) Dune Shrubland Association (CEGL005075)
SCW	Sand Cherry Dune Shrubland
2.C.4.a. North American Bog & Fen Division	
MG062. North American Boreal Bog & Fen Macrogroup	
G185. Boreal Alkaline Peatland Group	
	Betula pumila - (*Salix* spp.) Saturated Shrubland Alliance (A.1021)
SBB	Bog Birch - (Willow species) Saturated Shrubland
	Carex lasiocarpa - (*Carex rostrata*) - *Equisetum fluviatile* Herbaceous Vegetation Association (CEGL005229)
HSS	Wiregrass Sedge Shore Fen
	Myrica gale Fen Shrubland Association (CEGL005141)
SSF	Sweet Gale Shrub Fen
G053. North American Boreal Acidic Peatland Group	
	Carex lasiocarpa - *Carex oligosperma* / *Sphagnum* spp. Herbaceous Vegetation Association (CEGL002265)
HSP	Northern Sedge Poor Fen
	Chamaedaphne calyculata - *Myrica gale* / *Carex lasiocarpa* Dwarf-shrubland Association (CEGL005228)
DLS	Leatherleaf - Sweetgale Shore Fen
	Chamaedaphne calyculata / *Carex oligosperma* / *Sphagnum* spp. Poor Fen Dwarf-shrubland Association (CEGL005277)
DLF	Leatherleaf Poor Fen
2.C.5.a. Eastern North America Freshwater Wet Meadow, Riparian & Marsh Division	
MG069. Eastern & North-Central North American Marsh & Wet Meadow Macrogroup	
G125. Eastern North American Freshwater Marsh Group	
	Equisetum fluviatile - (*Eleocharis palustris*) Herbaceous Vegetation Association (CEGL005258)
HHT	Water Horsetail - Spikerush Marsh

Map-class Code	Map-class Name

Typha spp. - *Schoenoplectus acutus* - Mixed Herbs Midwest Herbaceous Vegetation Association (CEGL002229)
HCM Midwest Mixed Emergent Deep Marsh

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)
HSG Northern Sedge Wet Meadow

Cornus sericea - *Salix* spp. - (*Rosa palustris*) Shrubland Association (CEGL002186)
SDW Dogwood - Willow Swamp

5. AQUATIC VEGETATION CLASS

5.B.1.a. North American Freshwater Aquatic Vegetation Division

MG108. Eastern North American Freshwater Aquatic Vegetation Macrogroup

G114. Eastern North American Freshwater Aquatic Vegetation Group [Placeholder]

Nymphaea odorata - *Nuphar* (*microphylla*, *variegata*) Herbaceous Vegetation Association (CEGL002562)
HFA Northern Water-lily Aquatic Wetland

Potamogeton spp. - *Ceratophyllum* spp. Midwest Herbaceous Vegetation Association (CEGL002282)
HSV Midwest Pondweed Submerged Aquatic Wetland

6. NONVASCULAR & SPARSE VASCULAR ROCK VEGETATION CLASS

6.B.2.a. Eastern North American Temperate Cliff, Scree & Rock Vegetation Division

MG176. Eastern North American Beach, Shoreline & Flat Macrogroup

G342. Eastern North American Lake Flat & Beach Group

Inland Freshwater Strand Beach Sparse Vegetation Association (CEGL002310)
VAV Inland Freshwater Strand Beach

Lake Mudflats Sparse Vegetation Association (CEGL002313)
VMF Lake Mudflats

MG111. Eastern North American Cliff & Rock Vegetation Macrogroup

G340. Eastern North American Lake & River Bluff Group [Placeholder]

Eroding Clay Bank Sparse Vegetation Association (CEGL002584)
N/A Eroding Clay Bank

Map-class Code	Map-class Name
	G341. Great Lakes Cliff & Shore Group [Placeholder]
	Inland Limestone Pavement Sparse Vegetation Association (CEGL002570)
N/A	Inland Limestone Pavement
	Sandstone Bedrock Great Lakes Shore Sparse Vegetation Association (CEGL002507)
VBS	Great Lakes Sandstone Bedrock Shore
	Sandstone Great Lakes Shore Cliff Sparse Vegetation Association (CEGL002503)
VSC	Great Lakes Shore 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)
	Orchard (tree) Subformation (L4)
	Fruit - Orchards Subgroup (L6)
FOD	Deciduous Orchard
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)
NDV	Developed Area
NON-NVCS UNITS	
	Non-Vegetated Water & Land (<1% vegetated)
	Non-Vegetated Water
	Open Water (NLCD 2001; 11)
NSR	Stream & River
NWP	Open Water Pond
NWL	Open Water Lake
	Non-Vegetated Land
	Barren Land (NLCD 2001; 31)
NSB	Sand & Cobble Beach

Maple - Yellow Birch Northern Hardwoods Forest (FMB, FMY, FMF, and FMM)

The Maple - Yellow Birch Northern Hardwoods Forest map class represents the *Acer saccharum* - *Betula alleghaniensis* - (*Tilia americana*) Forest Association (CEGL002457) in the NVCS. This map class captures the most extensive hardwood forest of PIRO, found throughout most of the landscape, in a broad range of environmental settings having a wide range of vegetation characteristics. As the matrix forest, sugar maple is dominant but usually mixed with various other hardwoods. This forest type is found mostly within mesic settings, yet it can also be in both wet-mesic and dry-mesic settings. Canada yew can be of high density in the shrub layer, depending on past land use and deer populations. The Maple - Yellow Birch Northern Hardwoods Forest map class consists of four phases, including classic (FMB), yew (FMY), balsam fir shrub (FMF), and sugar maple (FMM). Each map-class phase will be discussed in further detail.

Because the Maple - Yellow Birch Northern Hardwoods Forest spans a wide spectrum of environments, it easily transitions toward and closely resembles other forest associations. Common within these northern hardwood forests are conifers, including northern white-cedar, eastern hemlock, and balsam fir; white spruce is found less commonly. When the RD of conifers to hardwoods was >25% and the RD of white-cedar to hemlock was >50%, the White-cedar - Boreal Conifer Mesic Forest map class (two phases, including FCC and FCM) was considered. In turn, when the RD of hemlock to white-cedar was >50%, the North-Central Hemlock - Hardwood Forest (FHM) map class was considered. Balsam fir was a factor only when the RD of canopy fir to hardwoods was >50%, in which cases the Spruce - Fir - Aspen Forest (FCP) map class was considered. Balsam fir was also given attention when the hardwoods were primarily of paper birch, lacking significant sugar maple and yellow birch. For these scenarios, the Balsam Fir - Paper Birch Forest (FFB) map class was considered. Eastern white pine and red pine can also be present within FMB, and when their collective RD to hardwoods was >25%, either the White Pine - Aspen - Birch Forest (FWA) map class or the Red Pine - Aspen - Birch Forest (FRA) map class was considered.

For AA, the four map-class phases (FMB, FMY, FMF, and FMM) were combined because they collectively represent one association type. They were left, however, as separate entities in the vegetation map layer. Furthermore, initial AA results showed that the lowland (FLD) phase of the Black Ash - Mixed Hardwood Swamp map class was confused with Maple - Yellow Birch Northern Hardwoods Forest. Thus for AA, the Black Ash - Mixed Hardwood Swamp map class (including both phases, black ash [FBA] and lowland FLD]) was assessed with the Maple - Yellow Birch Northern Hardwoods Forest map class in order to reach confidence standards. The Black Ash - Mixed Hardwood Swamp map class and phases were left, however, as separate entities in the vegetation map layer.

Maple - Yellow Birch Northern Hardwoods Forest (classic phase)–FMB

The classic (FMB) map-class phase represents the Maple - Yellow Birch Northern Hardwoods Forest map class (as described above) when there is a mix of hardwoods, usually with sugar maple being dominant and mixed with various hardwoods including red maple, paper birch, yellow birch American basswood, American beech, bigtooth aspen, and balsam poplar. It is noteworthy that the yellow birch can be less prominent because of various natural or anthropogenic events (wind throws, logging) and are often replaced with paper birch. Environments where FMB are found are highly variable, from the tall (>100 m), dense stands on rich mesic soils of the Beaver Basin to the short, shrub-like (<5 m), open stands on the Grand Sable Dunes. Physiognomic modifiers applied to map attributes capture these variations.

When forest stands were monotypically sugar maple, the maple (FMM) phase of this same map class was considered; however, when balsam fir and/or Canada yew were primary in the shrub understory, the balsam fir shrub (FMF) or the yew (FMY) phases were considered.









Maple - Yellow Birch Northern Hardwoods Forest (yew phase)–FMY

The yew (FMY) map-class phase represents the Maple - Yellow Birch Northern Hardwoods Forest map class (as described above) when Canada yew is the primary understory shrub. Given the dense canopies of these hardwood forests, viewing of spring, leaf-off aerial photographs was necessary to determine the understory components. Even with that, discerning yew from young, broad-shaped balsam fir shrubs can be difficult. When the RD of balsam fir shrubs to all shrubs was >60%, the balsam fir shrub (FMF) phase of this same map class was considered. When neither fir nor yew was the dominant shrub component, the classic (FMB) phase was considered.







Maple - Yellow Birch Northern Hardwoods Forest (balsam fir shrub phase)–FMF

The balsam fir shrub (FMF) map-class phase represents the Maple - Yellow Birch Northern Hardwoods Forest map class (as described above) when there is a shrub understory of balsam fir having a RD to other shrubs (including Canada yew) of >60%. Given the dense canopies of these hardwood forests, viewing of aerial photographs obtained during spring, leaf-off conditions was necessary to determine the understory components. Even using that strategy, discerning balsam fir shrubs from yew can be difficult, particularly when fir shrubs are young and broad-shaped. When the RD of balsam fir shrubs to all shrubs was <60%, the classic (FMB) phase of this same map class was considered, unless Canada yew was the primary shrub component, in which case the yew (FMY) phase was considered.







Maple - Yellow Birch Northern Hardwoods Forest (maple phase)–FMM

The maple (FMM) map-class phase represents the Maple - Yellow Birch Northern Hardwoods Forest map class (as described above) when sugar maple is monotypic or predominant. When other hardwoods were prominent within the forest stand, the classic (FMB) phase of this same map class was considered, unless balsam fir or Canada yew were primary in the shrub understory, in which case the balsam fir shrub (FMF) or the yew (FMY) phases were considered.





Great Lakes White Pine - Hemlock Forest (FWH)

The Great Lakes White Pine - Hemlock Forest (FWH) map class represents the *Pinus strobus* - *Tsuga canadensis* Great Lakes Forest Association (CEGL002590) in the NVCS. This map class captures mesic conifer forests wherein eastern white pine and eastern hemlock are co-dominant, with a mutual RD >25%. Hemlock is often greater in dominance, whereas white pine often forms a supracanopy over the hemlock. Hardwoods are a minor component at best, with a RD to conifers and red pine of <25%. When the RD of white pine to hemlock was <25%, the Hemlock Mesic Forest (FHC) was considered; however, when the RD of hardwoods to conifers was >25%, either the North-Central Hemlock - Hardwood Forest (FHM) map class or the Great Lakes Hemlock - Beech - Hardwood Forest (FHB) map class was considered, depending on the amount of American beech present.

For AA, the FWH map class was assessed independently of all other map classes.





White-cedar - Boreal Conifer Mesic Forest (FCC and FCM)

The White-cedar - Boreal Conifer Mesic Forest map class represents the *Thuja occidentalis* / *Abies balsamea - Acer spicatum* Forest Association (CEGL002449) in the NVCS. This map class consists of two phases, including conifer (FCC) and conifer - hardwood (FCM). The White-cedar - Boreal Conifer Mesic Forest map class captures mesic to wet-mesic forests typically located on slopes (not basins), wherein the RD of northern white-cedar - mixed conifers to hardwoods is >25%. The RD of white-cedar to balsam fir and white spruce is >25%, to eastern hemlock is >50%, and to black spruce is >60%. Balsam fir can be a primary component. Hardwoods typically consist of yellow birch, with elements of paper birch and red maple, and may even include some sugar maple and balsam poplar. Eastern white pine can be scattered, but its RD to all conifer trees should be <25%. Small inclusions of White-cedar Seepage Swamp Association (CEGL002455) may occur on steep slopes, when forests are located below perched water tables.

When the RD of conifers to hardwoods was <25%, the Maple - Yellow Birch Northern Hardwoods Forest map class (four phases, including FMB, FMY, FMF, and FMM) was considered. When the RD of hemlock to white-cedar was >50%, the North-Central Hemlock - Hardwood Forest (FHM) map class was considered when the RD of hardwoods to conifers was >25%, and the Hemlock Mesic Forest (FHC) map class was considered when the RD of hardwoods to conifers was <25%). When the RD of black spruce to white-cedar was >40%, either the Black Spruce / Feathermoss Forest (FBS) map class was considered (within uplands sites) or the two phases (FSS and FTS) of the Black Spruce - Tamarack / Labrador-tea Poor Swamp map class were considered (within wetland sites). When in wetland sites dominated by white-cedar, the White-cedar - (Mixed Conifer) / Alder Swamp (FCS) map class or the White-cedar - Black Ash Swamp (FCA) map class was considered, depending on the RDs of conifers and hardwoods to each other. Although the White-cedar - Boreal Conifer Mesic Forest can easily grade into these wetland forests, they lack peatland swamp characteristics.

The conifer (FCC) phase captures mesic white-cedar forests wherein the RD of conifers to hardwoods is >75%. The conifer - hardwood (FCM) phase captures forests wherein the mutual RD of conifers and hardwoods is >25%.

For AA, the two map-class phases (FCC and FCM) were combined because they collectively represent one association type. They were left, however, as separate entities in the vegetation map layer.

White-cedar - Boreal Conifer Mesic Forest (conifer phase)–FCC

The conifer (FCC) map-class phase represents the White-cedar - Boreal Conifer Mesic Forest map class (as described above) when the RD of the conifer component to hardwoods is >75%. When the RD of hardwoods RD to conifers was >25%, the conifer - hardwood (FCM) phase of this same map class was considered. A significant amount of balsam fir may be present, but its RD to northern white-cedar should be < 75%. Eastern hemlock may also be present, but its RD to white-cedar should be <50%. These forests are often dense, with a shaded understory and sparse vegetation ground layer. The few hardwoods present are mostly yellow birch and paper birch.





White-cedar - Boreal Conifer Mesic Forest (conifer - hardwood phase)–FCM

The conifer - hardwood (FCM) map-class phase represents the White-cedar - Boreal Conifer Mesic Forest map class (as described above) when the mutual RD of conifers and hardwoods is >25%. When the RD of hardwoods to conifers was <25%, the conifer (FCC) phase of this same map class was considered. These forests are often less dense and more open than FCC and, thus, have richer understory vegetation.

Hardwood trees consist primarily of yellow birch and paper birch, although yellow birch can be less prominent because of various natural or human events (e.g., wind throws and logging) and is often replaced with paper birch. The hardwood tree canopy typically covers and obscures the conifer trees. To determine the correct forest type during the mapping of the FCM phase, it was necessary to refer to aerial photographs obtained during spring, leaf-off conditions to determine not merely the conifer component, but also the RDs among conifer species (e.g., the RD of northern white-cedar to balsam fir).



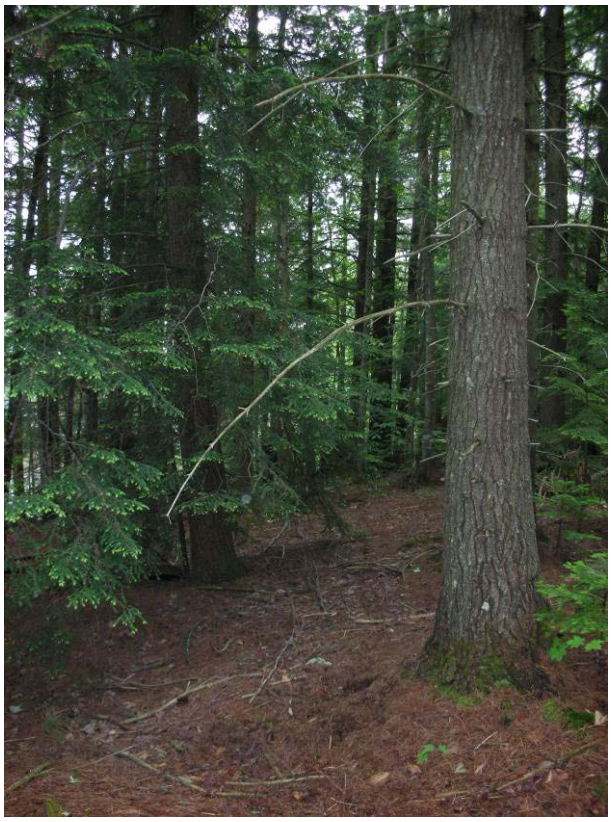


Hemlock Mesic Forest (FHC)

The Hemlock Mesic Forest (FHC) map class represents the *Tsuga canadensis* - (*Betula alleghaniensis*) Forest Association (CEGL002598) in the NVCS. This map class captures mesic to wet-mesic conifer forests wherein the RD of eastern hemlock to northern white-cedar is >50%; the RD of eastern white pine to other conifers is <25%; and the RD of hardwoods to all conifers is <25%. Although a rare occurrence, when the RD of white pine to conifers (although, with little or no red pine) was >25%, the Great Lakes White Pine - Hemlock Forest (FWH) map class was considered. When the RD of white-cedar to hemlock was >50%, the conifer (FCC) phase of the White-cedar - Boreal Conifer Mesic Forest map class was considered.

Hardwoods consist of yellow birch, red maple, and paper birch. When the collective RD of those hardwoods to conifers was >25% and when American beech was present in the forest canopy layer (even at low density), the Great Lakes Hemlock - Beech - Hardwood Forest (FHB) map class was considered. Otherwise, when American beech was essentially absent in the forest canopy layer, the North-Central Hemlock - Hardwood Forest (FHM) map class was considered. Small pocket inclusions of the Hemlock - Yellow Birch Swamp Wet-Mesic Forest (FHS) are most probable within the FHC than any other forest type..

For AA, the FHC map class was assessed independently of all other map classes.





North-Central Hemlock - Hardwood Forest (FHM)

The North-Central Hemlock - Hardwood Forest (FHM) map class represents the *Tsuga canadensis - Acer saccharum - Betula alleghaniensis* Forest Association (CEGL005044) in the NVCS. This map class captures mesic to wet-mesic conifer - hardwood forests wherein the RD of eastern hemlock to northern white-cedar is >50%; the RD of eastern white pine to other conifers is <25%; and the RD of hardwoods to all conifers is >25%. Hardwoods consist mostly of yellow birch, red maple, and paper birch, yet these forests lack American beech in the forest canopy layer. When beech was present in the canopy, even at low density, the Great Lakes Hemlock - Beech - Hardwood Forest (FHB) map class was considered. When the collective RD of hardwoods to conifers was <25%, the Hemlock Mesic Forest (FHC) map class was considered.

When the RD of hardwoods to conifers was >75%, the Maple - Yellow Birch Northern Hardwoods Forest (FMB) map class was considered. When the RD of white pine to conifers was >25%, the White Pine - Aspen - Birch Forest (FWA) map class was considered, even when the aspen component was nominal. When the RD of white-cedar to hemlock was >50%, the conifer - hardwood (FCM) phase of the White-cedar - Boreal Conifer Mesic Forest map class was considered.

For AA, the FHM and FHB map classes were assessed together. Initial AA results showed confusion between these two map classes, and thus, they were combined in order to reach confidence standards. These map classes were, however, left as separate entities in the vegetation map layer.





Great Lakes Hemlock - Beech - Hardwood Forest (FHB)

The Great Lakes Hemlock - Beech - Hardwood Forest (FHB) map class represents the *Tsuga canadensis - Fagus grandifolia* - (*Acer saccharum*) Great Lakes Forest Association (CEGL005042) in the NVCS. This map class captures mesic to wet-mesic conifer-hardwood forests much like those classified as North-Central Hemlock - Hardwood Forest (FHM), yet with American beech present in the forest canopy layer, even at low densities. In these forests, the RD of eastern hemlock to northern white-cedar is >50%; the RD of eastern white pine to other conifers is <25%; and the RD of hardwoods to all conifers is >25%. Along with American beech in the forest canopy layer (characteristic of this forest type), hardwoods consist mostly of yellow birch, red maple, and paper birch. When American beech was not present in the canopy, the North-Central Hemlock - Hardwood Forest (FHM) map class was considered. When the collective RD of hardwoods to conifers was <25%, the Hemlock Mesic Forest (FHC) map class was considered.

When the RD of hardwoods to conifers was >75%, the Maple - Yellow Birch Northern Hardwoods Forest (FMB) map class was considered. When the RD of white pine to conifers was >25%, the White Pine - Aspen - Birch Forest (FWA) map class was considered, even when the aspen component was nominal. When the RD of white-cedar to hemlock was >50%, the conifer - hardwood (FCM) phase of the White-cedar - Boreal Conifer Mesic Forest map class was considered.

For AA, the FHB and FHM map classes were assessed together. Initial AA results showed confusion between these two map classes, and thus, they were combined in order to reach confidence standards. These map classes were, however, left as separate entities in the vegetation map layer.





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. This map class captures dry-mesic, mixed conifer and hardwood forests wherein the RD of red pine to other conifers (particularly, white pine and jack pine) is >75%. The RD of hardwoods (consisting of varying amounts of red maple, bigtooth aspen, paper birch, and some northern red oak) to conifers is >25%.

When the RD of hardwoods to conifers was >75%, the Maple - Yellow Birch Northern Hardwoods Forest (four phases, including FMB, FMY, FMF, and FMM) was considered. Conversely, when the RD of hardwoods to conifer trees was <25%, other map classes were considered as follows: (1) when the RD of red pine to other conifers was >75%, the Red Pine / Blueberry Dry Forest (FRP) map class was considered, and (2) when the RD of red pine to other conifers was <75%, other mixed conifer-hardwood map classes were considered, such as White Pine - Aspen - Birch Forest (FWA) or Jack Pine - Aspen / Bush-honeysuckle Forest (FJM).

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. This map class captures dry to dry-mesic forests common to sandplains and occasional to sand dunes wherein red pine is strongly dominant. The RD of Red pine to other conifers is >75% (>50% RD when on sand dunes), and the RD of hardwoods to conifers is <25%. An element of paper birch is often part of the subcanopy. Sites of FRP are often in close proximity to White Pine / Blueberry Dry-Mesic Forest (FWP), yet FRP are found at slightly dryer sites. Canopy openings are common, where reindeer lichens often cover the ground layer. The FRP map class also captures red pine stands within the IBZ (in the Kingston Plains area) that are heavily managed and selectively cut (silvaculture) toward red pine dominance and may resemble pine plantations.

When the RD of hardwoods to conifers was >25%, with a RD of red pine to other conifers of >75%, the Red Pine - Aspen - Birch Forest (FRA) map class was considered. Yet, when the RD of red pine to all conifers was <75%, then other conifer forest map classes were considered as follows: (1) when the RD of eastern white pine to red pine and jack pine was >25%, the White Pine / Blueberry Dry-Mesic Forest (FWP) map class was considered; (2) when jack pine was dominant, the Jack Pine / Blueberry / Feathermoss Forest (FJB) map class was considered; and (3) when the RD of black spruce to red pine was >25%, the Black Spruce / Feathermoss Forest (FBS) map class was considered. Furthermore, when red-pine dominant forests were on active sand dunes, the Great Lakes Dune Pine Forest (FPD) was considered, particularly when the RD of red pine to other pines and other conifers was <50%.

For AA, the FRP map class was assessed independently of all other map classes.





White Pine - Red Oak Forest (FWO)

The White Pine - Red Oak Forest (FWO) map class represents the *Pinus strobus* - (*Pinus resinosa*) - *Quercus rubra* Forest Association (CEGL002480) of the NVCS. This map class captures mesic to dry-mesic white pine - hardwood forests wherein red oak is the primary hardwood. The mutual RD of conifers and hardwoods is >25%, with a RD of white pine to conifers of >25%. Red pine often complements white pine, more often in dry-mesic settings. White pine can form a supracanopy above the hardwoods.

When the RD of hardwoods to conifers was <25%, and the RD of white pine to all other conifers was >25%, the White Pine / Blueberry Dry-Mesic Forest (FWP) map class was considered. Also, when red oak was less dominant and other hardwoods (including sugar maple, red maple, paper birch, yellow birch, American basswood, and aspens [quaking and/or trembling]) were more prominent, the Maple - Yellow Birch Northern Hardwoods Forest (four phases, including FMB, FMY, FMF, and FMM) was considered.

For AA, the FWO map class was assessed independently of all other map classes.



White Pine - Mixed Deciduous / Bracken Barren Forest and Scrub (FPB and SSS)

The White Pine - Mixed Deciduous / Bracken Barren Forest and Scrub map class represents the *Pinus strobus - Populus tremuloides* - (*Acer rubrum*) / *Pteridium aquilinum* Forest Association (CEGL005563) in the NVCS. This map class consists of two phases, including forest (FPB) and scrub (SSS). The White Pine - Mixed Deciduous / Bracken Barren Forest and Scrub map class captures open, dry forests and scrublands consisting of mixed conifer-hardwoods, located on the sandplains of the Kingston Plains. This map class was restricted to the Kingston Plains, capturing a disturbance regime of forest cutover and fire within the IBZ. The mutual RD of conifers and hardwoods is >25%. Mixed conifers consist of white pine and red pine, with components of jack pine, white spruce, and balsam fir. Hardwoods are mixed as well, consisting of red maple, quaking aspen, and paper birch, with components of bigtooth aspen. Conifer and hardwoods can be tall or of short-tree and shrub heights and are depicted separately via the two map-class phases and the physiognomic modifiers applied to the map attribute. Reindeer lichen and bracken fern are dominant in the open and driest locations.

The forest (FPB) phase captures this map class when, in open forest, taller than shrub-height trees contribute >25% cover over a scrub-shrub understory. The scrub (SSS) phase captures this map class in open scrub areas, but the shrub-height trees are essentially the same species as those in the FPB phase.

For AA, the two map-class phases (FPB and SSS) were combined because they collectively represent one association type. They were left, however, as separate entities in the vegetation map layer.

White Pine - Mixed Deciduous / Bracken Barren Forest and Scrub (forest phase)–FPB

The forest (FPB) map-class phase represents the White Pine - Mixed Deciduous / Bracken Barren Forest and Scrub map class (as described above) in open canopy forests wherein trees taller than shrub-height contribute >25% cover. The understory essentially consists of shrub-height trees of the same species as the overstory canopy, as well as other scrub-shrub species. When tall trees contributed <25% cover, the scrub (SSS) phase of this same map class was considered.

When the RD of hardwoods to pine-mixed conifers was <25%, the appropriate pine map class was applied as follows: (1) when the RD of red pine to all other pines and conifers was >75%, the Red Pine / Blueberry Dry Forest (FRP) map class was considered; (2) when the RD of white pine to all other conifers was >25%, the White Pine / Blueberry Dry-Mesic Forest (FWP) map class was considered; and (3) when the RD of jack pine to red pine was >25%, yet the RD of white pine to all conifers was <25%, the Jack Pine / Blueberry / Feathermoss Forest (FJB) map class was considered. Furthermore, when the RD of white spruce and balsam fir to pines was >25%, either the Spruce - Fir - Aspen Forest (FCP) map class or Spruce - Fir / Mountain Maple Forest (FSF) map class was considered, depending on RDs of hardwoods present.

Once off the Kingston Plains, then other mixed pine-hardwood mesic forest map classes were considered, including White Pine - Aspen - Birch Forest (FWA) and Red Pine - Aspen - Birch Forest (FRA), depending on RDs of pines





White Pine - Mixed Deciduous / Bracken Barren Forest and Scrub (scrub phase)–SSS

The scrub (SSS) map-class phase represents the White Pine - Mixed Deciduous / Bracken Barren Forest and Scrub class (as described above) in open scrub areas wherein shrub-height trees are dominant (tree types are essentially the same as in the forest (FPB) phase of this same map class). Short quaking aspen trees are common to SSS. Dwarf-shrubs are those common to the Bracken Grassland (HBF) map class, including lowbush blueberry and velvetleaf huckleberry. Bracken fern and reindeer lichen dominate the floor layer of these open, dry sandplain sites. When trees taller than shrub-height contributed >25% cover, the FPB map-class phase was considered.

When the scrub-shrub layer—as well as tall tree layer—contributed <25% cover, the HBF map class was considered.





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. This map class captures mesic to dry-mesic, mixed conifer and hardwood forests wherein the RD of eastern white pine to other conifers is >25%. The RD of hardwoods (consisting of paper birch, with varying amounts of red maple, sugar maple, yellow birch, American basswood, American beech, and aspens, (quaking and/or bigtooth)] to conifers is >25% . Northern red oak is only nominally present or absent. White pine often forms a supracanopy above the hardwood forest canopy. A significant amount of red pine can be present, particularly in the dry-mesic sites. FWA forests often include an element of balsam fir, white spruce, and northern white-cedar.

When red oak was the more prominent hardwood present, the White Pine - Red Oak Forest (FWO) map class was considered. Likewise, when the RD of red pine to other conifers was >75%, the Red Pine - Aspen - Birch Forest (FRA) map class was considered. When the RD of hardwoods to conifers was >75%, the Maple - Yellow Birch Northern Hardwoods Forest (four phases, including FMB, FMY, FMF, and FMM) was considered. Conversely, when the RD of hardwoods to conifers was <25% RD, the White Pine / Blueberry Dry-Mesic Forest (FWP) map class was considered.

For AA, the FWA map class was assessed independently of all other map classes.



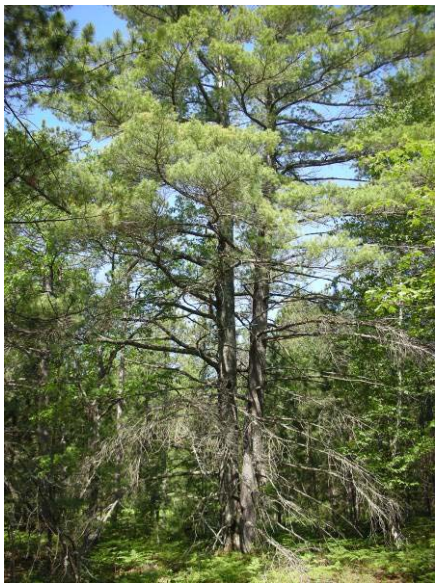
White Pine / Blueberry Dry-Mesic Forest (FWP)

The White Pine / Blueberry Dry-Mesic Forest (FWP) map class represents the *Pinus strobus* / *Vaccinium* spp. Forest Association (CEGL002444) NVCS. This map class captures dry-mesic to dry forests of eastern white pine, located on sandplain, sandscape, and sand dune locations. The FWP can be both open and closed canopy and lack a tall-shrub understory. A significant amount of red pine can be present, yet northern red oak is essentially absent. The RD of hardwoods to conifers is <25%, and the RD of white pine to all conifers (particularly other pines) is >25%; however, when on sand dunes, the RD of white pine to all conifers is >50%. The FWP map class also captures white pine stands within the IBZ (in the Kingston Plains area) that are heavily managed and selectively cut (silvaculture) toward white pine dominance and may resemble pine plantations.

When the RD of white pine to red pine and/or jack pine was <25% and when the RD of red pine to all other conifers was > 75%, the Red Pine / Blueberry Dry Forest (FRP) map class was considered. When the RD of jack pine to other conifers, primarily pines, was >25%, the Jack Pine / Blueberry / Feathermoss Forest (FJB) map class was considered. Furthermore, when the RD of hardwoods to conifers was >25%, the White Pine - Aspen - Birch Forest (FWA) map class was considered.

The Great Lakes Dune Pine Forest (FPD) map class was considered when forests were on active sand dunes near Lake Superior, when tree canopy contributed >60% cover, and when the RD of white pine to other pines and conifers was <50%. Likewise, when tree canopy contributed <60% cover and the RD of white pine to other pines and conifers was <50%, either the woodland (HPW) phase or the barrens (HPB) phase of the Great Lakes Coast Pine Barrens map class was considered, depending on density of canopy cover.

For AA, the FWP map class was assessed independently of all other map classes.





Great Lakes Dune Pine Forest (FPD)

The Great Lakes Dune Pine Forest (FPD) map class represents the *Pinus banksiana - Pinus resinosa - Pinus strobus* Dune Forest Association (CEGL002589) in the NVCS. This map class captures dry forests wherein there is a mixture of red pine, eastern white pine, and/or jack pine and tree canopy contributes >60% cover, located in the interdunal zones of the Grand Sable Dunes. The Great Lakes Coast Pine Barrens map class (two phases, including HPB and HPW) captures similar stands wherein tree canopy contributes <60% cover. The understory vegetation in FPD includes typical sandscape species, such as American beachgrass, sand cherry, common juniper, bearberry, and woolly beach-heather. The RD of the hardwood tree component to conifer trees is <25%.

When pine forests were strongly dominated by one pine species rather than a mix of pine species, then other pine-dominant map classes common to Grand Sable Dunes were considered, including White Pine / Blueberry Dry-Mesic Forest (FWP), Jack Pine / Blueberry / Feathermoss Forest (FJB), Red Pine / Blueberry Dry Forest (FRP), and Jack Pine / Balsam Fir Forest (FJF), depending on RDs of pines and the location of forest units. Furthermore, when pine forests on these sand dunes were mixed and the RD of hardwoods was >25%, various mixed pine - hardwoods map classes were considered, including Jack Pine - Aspen / Bush-honeysuckle Forest (FJM), White Pine - Aspen - Birch Forest (FWA), and Red Pine - Aspen - Birch Forest (FRA).

For AA, the FPD map class was assessed independently of all other map classes.





Conifer Ruderal Forest (FCX)

The Conifer Ruderal Forest (FDX) map class represents, in part, the Northern & Central Hardwood & Conifer Ruderal Forest Group (G030) in the NVCS. Because of disturbance from anthropogenic activity and the inherent variability of floristic vegetation in these early successional forests, an association type could not be determined. This map class captures ruderal forests with >25% tree cover and wherein the RD of conifers to hardwoods is >75%. Conifers consist of tree species both common and unique to the PIRO area. These ruderal forests can be open or with closed canopy.

When the RD of hardwoods to conifers was >25%, the Conifer - Hardwood Ruderal Forest (FMX) map class was considered, which also represents, in part, the Northern & Central Hardwood & Conifer Ruderal Forest Group (G030). Also, when tree cover was <25%, the Ruderal Shrubland (SMX) map class was considered. Furthermore, when shrub cover was <25%, the Ruderal Grassland (HMX) 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 anthropogenic activity and the inherent variability of floristic vegetation in these early successional forests, an association type could not be determined. This map class captures ruderal forests with >25% tree cover wherein the RD of hardwoods to conifers is >75%. Hardwoods consist of deciduous tree species both common and unique to the PIRO area. These ruderal forests can be open or with closed canopy.

When the RD of conifers to hardwoods was >25%, the Conifer - Hardwood Ruderal Forest (FMX) map class was considered, which also represents, in part, the Northern & Central Hardwood & Conifer Ruderal Forest Group (G030). Also, when trees contributed <25% cover, the Ruderal Shrubland (SMX) map class was considered. Furthermore, when trees and shrubs both contributed <25% cover, the Ruderal Grassland (HMX) map class was considered.

Because of the disturbance regime inherent to ruderal forests, the FDX map class was not assessed for accuracy.

No representative pictures are available.

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) NVCS. Because of disturbance from anthropogenic activity and the inherent variability of floristic vegetation in these early successional forests, an association type could not be determined. This map class captures ruderal forests having >25% tree cover wherein the mutual RD of conifers and hardwoods is >25%. Conifers and hardwoods consist of tree species both common and unique to the PIRO area. These ruderal forests can be open or with closed canopy.

When the RD of conifers to hardwoods was <25%, the Hardwood Ruderal Forest (FDX) map class was considered, which also represents, in part, the Northern & Central Hardwood & Conifer Ruderal Forest Group (G030). Also, when trees contributed <25% cover, the Ruderal Shrubland (SMX) map class was considered. Furthermore, when trees and shrubs both contributed <25% cover, the Ruderal Grassland (HMX) map class was considered.

Because of the disturbance regime inherent to ruderal forests, the FMX map class was not assessed for accuracy.



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 captures conifers that have been planted, consisting of any conifer species, including red pine, white pine, spruce, and even northern white-cedar.

Because of the cultivated disposition of being a plantation, The FPP map class was not assessed for accuracy.

No representative pictures are available.

Black Ash - Mixed Hardwood Swamp (FBA and FLD)

The Black Ash - Mixed Hardwood Swamp map class represents the *Fraxinus nigra* - Mixed Hardwoods - Conifers / *Cornus sericea* / *Carex* spp. Forest Association (CEGL002105) in the NVCS. This map class consists of two phases, including black ash (FBA) and lowland (FLD). The Black Ash - Mixed Hardwood Swamp map class captures wet-mesic and swamp forests in basins and drainages wherein the RD of black ash to other hardwoods is >25% and the RD of conifers to hardwoods is <25%. Other hardwoods may consist of red maple, yellow birch, paper birch, and American elm, along with some aspens (quaking and bigtooth), sugar maple, and balsam poplar. Conifers are often of short stature and may consist of northern white-cedar, white spruce, and balsam fir, yet the RD of all conifer trees to hardwoods is <25%. The forest canopy can be open, with a significant understory of gray alder shrub. Typical settings range from wet-mesic drainages to wetland margins of peatland basins.

When in wet-mesic settings and the RD of black ash to other hardwoods was <25%, the Maple - Yellow Birch Northern Hardwoods Forest (four phases, including FMB, FMY, FMF, and FMM) map class was considered; however, when hardwoods collectively contributed <25% canopy cover and alder shrubs contributed >25% cover, the Gray Alder Swamp Shrubland (SAS) map class was considered. When the RD of conifers to hardwoods was >25% and the RD of white-cedar to conifers was >25%, the White-cedar - Black Ash Swamp (FCA) map class was considered.

The black ash (FBA) phase captures wetland forests wherein the RD of black ash to hardwoods is >50%. The lowland (FLD) phase captures wet-mesic forests wherein the RD of black ash to a diverse mix of hardwoods ranges 25–50%.

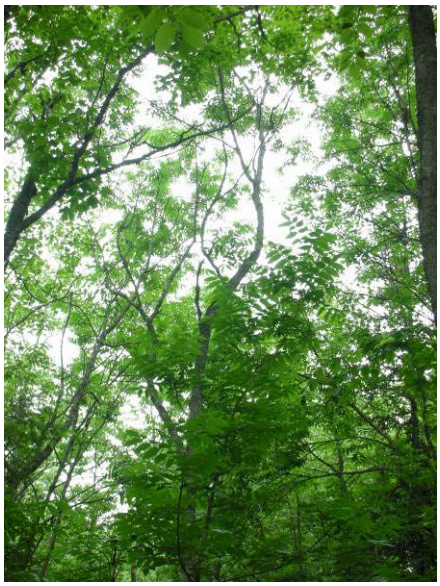
For AA, the two map-class phases (FBA and FLD) were combined because they collectively represent one association type. They were, however, left as separate entities in the vegetation map layer. Furthermore, initial AA results showed that the FLD phase was confused with the Maple - Yellow Birch Northern Hardwoods Forest map class (four phases, including FMB, FMY, FMF, and FMM). Thus, for purposes of AA the Black Ash - Mixed Hardwood Swamp map class (including both phases) was assessed with the Maple - Yellow Birch Northern Hardwoods Forest map class in order to reach confidence standards. The Black Ash - Mixed Hardwood Swamp map class and phases were, however, left as separate entities in the vegetation map layer.

Black Ash - Mixed Hardwood Swamp (black ash phase)–FBA

The black ash (FBA) map-class phase represents the Black Ash - Mixed Hardwood Swamp map class (as described above) within wetland forests wherein the RD of black ash to other hardwoods is >50%. Tree canopy is usually open, more so than in units classified as the lowland (FLD) phase of this same map class. Other hardwoods mostly consist of red maple, commonly with some American elm and yellow birch. A significant amount of gray alder shrub can be present (it is normally absent within FLD).

The lowland (FLD) phase of this map class was considered when sites were located in wet-mesic settings and when the RD of black ash to other hardwoods (consisting of mostly red maple and yellow birch, but also of paper birch, balsam poplar, and even some sugar maple) ranged 25–50%.





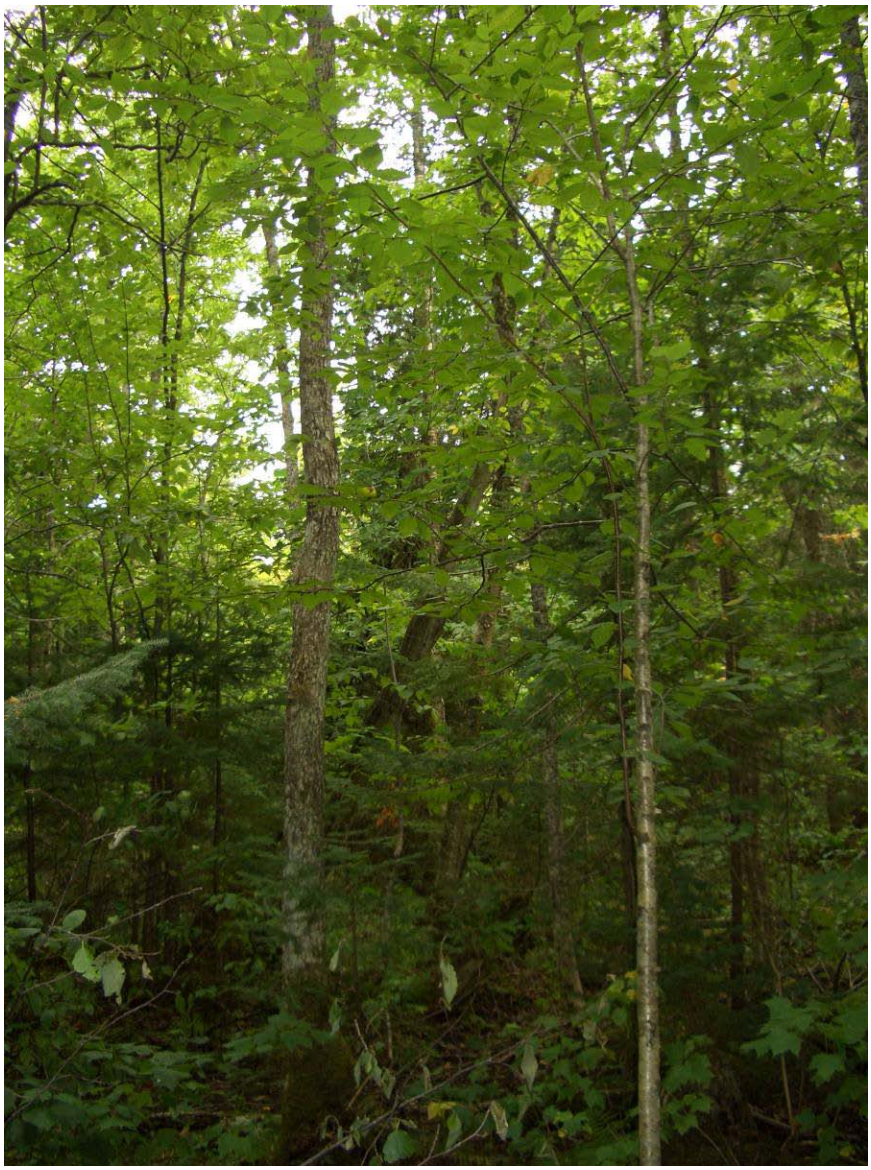




Black Ash - Mixed Hardwood Swamp (lowland phase)–FLD

The lowland (FLD) map-class phase represents the Black Ash - Mixed Hardwood Swamp map class (as described above) in wet-mesic forests wherein the RD of black ash to a diverse mix of hardwoods ranges 25–50%. The FLD phase can have a seepage element to it, but not swamp-like. The tree canopy is usually closed with a diverse herbaceous layer, more than sites of the black ash (FBA) phase of this same map class. Other hardwoods are a diverse mix of red maple, yellow birch, paper birch, balsam poplar, and even some sugar maple. Gray alder shrub is typically absent (it is often present within FBA).

The black ash (FBA) phase was considered for sites located in wetland swamp settings wherein the RD of black ash to other hardwoods (consisting mainly of red maple, yellow birch, and American elm) was >50%.



White Pine - Red Maple Swamp (FWM and FWW)

The White Pine - Red Maple Swamp map class represents the *Pinus strobus* - (*Acer rubrum*) / *Osmunda* spp. Forest Association (CEGL002482) of the NVCS. This map class consists of two phases, including swamp (FWM) and swamp - dune mosaic (FWW). The White Pine - Red Maple Swamp map class captures mixed conifer and hardwood swamp forests within sandscapes near Lake Superior or wetland basins further inland. The mutual RD of conifers and hardwoods is >25%, and the RD of white pine to conifers and hardwoods (consisting most typically of red maple) is >25%. At least a thin organic layer is established, but is not necessarily of peat. Labrador-tea and leatherleaf are common dwarf-shrubs.

When the RD of black spruce and/or tamarack to conifers was >25%, the Black Spruce - Tamarack / Labrador-tea Poor Swamp (two phases, including FSS and FTS) was considered.

The swamp (FWM) phase captures this map class when within wetland basins further inland from Lake Superior. The swamp - dune mosaic (FWW) phase captures this map class when the site was of a dune and swale mosaic on Lake Superior sandscapes consisting of the Great Lakes Beach-heather Dune Dwarf-shrubland (DBH) and the White Pine - Red Maple Swamp.

For AA, the two map-class phases (FWM and FWW) were combined because, for the most part, they collectively represent one association type (although inclusions of DBH are recognized within FWW). They were, however, left as separate entities in the vegetation map layer.

White Pine - Red Maple Swamp (swamp phase)–FWM

The swamp (FWM) map-class phase represents the White Pine - Red Maple Swamp map class (as described above) within wetland basins further inland from Lake Superior. Hardwoods consist of yellow birch, hemlock, and American elm; tamarack and black ash are essentially absent. Other conifers typically consist of black spruce; however, when the RD of black spruce to conifers was >25%, the black spruce (FSS) phase of the Black Spruce - Tamarack / Labrador-tea Poor Swamp map class was considered.

When sites of the White Pine - Red Maple Swamp were on sandscapes adjacent to Lake Superior and part of a dune and swale mosaic, the swamp - dune mosaic (FWW) phase of the same map class was used.





White Pine - Red Maple Swamp (swamp - dune mosaic phase)–FWW

The swamp - dune mosaic (FWW) map-class phase represents the swamp (FWM) phase of the White Pine - Red Maple Swamp map class (as described above) and the Great Lakes Beach-heather Dune Dwarf-shrubland (DBH) map class when sites are located on sandscape settings near Lake Superior. This map class captures a mosaic of beach ridges and wetland swales to accommodate a mapping-scale limitation. Long, linear, wet swales are dominant, with an open canopy of white pine, surrounded by beach ridges of DBH. (See the DBH map-class description for further details.) FWW on these sandscapes receive high winds, snow, and ice from Lake Superior.

When the White Pine - Red Maple Swamp was further inland, within wetland basins, the swamp (FWM) phase of the same map class was used. It is noteworthy that the FWW phase can also have inclusions of the White Pine / Blueberry Dry-Mesic Forest (FWP), a common sandscape forest. Likewise, small pockets of FWM and DBH that are less than the size of a MMU are likely left as inclusions within FWP.



White-cedar Seepage Swamp (N/A)

Because they are too small to map (well below the size of a MMU), no map class was derived for the White-cedar Seepage Swamp vegetation type, which is the *Thuja occidentalis* - (*Larix laricina*) Seepage Forest Association (CEGL002455) in the NVCS. Thus, where sites of this vegetation type exist, other map classes would have captured them as inclusions. Sites of White-cedar Seepage Swamp were likely mapped as an inclusion within the conifer - hardwood (FCM) phase of the White-cedar - Boreal Conifer Mesic Forest map class.

The White-cedar Seepage Swamp is found on slopes receiving seepage from perched water tables above it. Northern white-cedar is the dominant conifer, with hardwoods consisting of red maple, balsam poplar, and yellow birch.

Because of the lack of a map class, the White-cedar Seepage Swamp map class was not assessed for accuracy.

No representative pictures are available.

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. This map class captures mixed conifer and hardwood wetland forests wherein the RD of northern white-cedar to other conifers is >25%, and the RD of black ash to other hardwoods is >25%; however the black ash is sometimes diminished and the site is dominant with red maple. Typical settings range from wet-mesic drainages to wetland margins of peatland basins. Red maple, yellow birch, paper birch, and balsam fir are common component trees, with gray alder a common shrub, particularly when forest canopy is open. The white-cedar can often be obscured by a slightly taller black ash canopy; therefore, the use of aerial photographs obtained during spring, leaf-off conditions was helpful in distinguishing FCA and Black Ash - Mixed Hardwood Swamp (FBA) during mapping.

When the RD of hardwoods to conifers was <25%, the White-cedar - (Mixed Conifer) / Alder Swamp (FCS) map class was considered. Likewise, when the RD of conifers to hardwoods was <25%, the Black Ash - Mixed Hardwood Swamp (FBA) map class was considered. Also, within mesic-wet sites, when black ash diminished and was replaced with yellow birch and paper birch, the conifer - hardwood (FCM) phase of the White-cedar - Boreal Conifer Mesic Forest map class was considered.

For AA, the FCA map class was assessed independently of all other map classes.



Hemlock - Yellow Birch Swamp Wet-Mesic Forest (FHS)

The Hemlock - Yellow Birch Swamp Wet-Mesic Forest (FHS) represents the *Tsuga canadensis - Betula alleghaniensis* Saturated Forest Association (CEGL005003) in the NVCS. This map class captures eastern hemlock wetland forests wherein the RD of hemlock cover to that of all other trees is >25%; the RD of northern white-cedar to hemlock is <50%; and the RD of black spruce to hemlock is <25%. Other trees in addition to white-cedar are typically present, including red maple, white pine, black spruce, and yellow birch. Typical settings range from saturated wet drainages to small wetland basins. Sphagnum and other peatland vegetation, such as Labrador-tea, can be a common component of the ground layer.

When the RD of white-cedar to hemlock was >50%, the White-cedar - (Mixed Conifer) / Alder Swamp (FCS) map class was considered. Likewise, when the RD of black spruce to all other conifers within these wetland settings was >25%, the Black Spruce - Tamarack / Labrador-tea Poor Swamp map class (two phases, including FSS and FTS) was considered. Particularly within wet-mesic settings, there is a subtle transition between FHS and upland hemlock forests, such that when mapping FHS, both the Hemlock Mesic Forest (FHC) and the map North-Central Hemlock - Hardwood Forest (FHM) classes were kept in mind, depending on the amount of hardwoods present. Pockets of FHS that are less than the size of a standard MMU are likely included in the mapping of FHM.

For AA, the FHS map class was assessed independently of all other map classes.



Gray Alder Swamp Shrubland (SAS)

The Gray Alder Swamp Shrubland (SAS) represents the *Alnus incana* Swamp Shrubland Association (CEGL002381) in the NVCS. It is worth pointing out that although SAS is a shrubland, it is located within the Forest & Woodland Class hierarchy of the NVCS. This map class captures wetland shrublands having >25% shrub cover wherein the RD of gray alder to other shrubs is >25%. These alder shrub wetlands are common to saturated drainages and margins of peatland basins.

The typical expression of these shrub wetlands includes tall, dense stands where alder is monotypic, with few other shrub species (such as willows) present. When willows and/or dogwoods were dominant, the Dogwood - Willow Swamp (SDW) map class was considered. Hardwoods, such as red maple and black ash, can be present, along with yellow birch and paper birch; however, when hardwoods contributed >25% cover, particularly when the RD of black ash to other hardwoods was >50%, the black ash (FBA) phase of the Black Ash - Mixed Hardwood Swamp map class was considered. Likewise, when conifers contributed >25% cover and the RD of northern white-cedar to other conifers was >25%, the White-cedar - (Mixed Conifer) / Alder Swamp (FCS) map class was considered. Also, when conifers and hardwoods combined contributed >25% cover, and black ash and white-cedar each met their density criteria for the White-cedar - Black Ash Swamp (FCA), the FCA map class was considered.

For AA, the SAS map class was assessed independently of all other map classes.





Black Spruce / Feathermoss Forest (FBS)

The Black Spruce / Feathermoss Forest (FBS) map class represents the *Picea mariana* / *Pleurozium schreberi* Forest Association (CEGL002447) in the NVCS. This map class captures black spruce forests in upland settings wherein there is a prominent feathermoss ground layer. The RD of eastern white pine to all other conifers is <25%, and the RD of black spruce to other conifers is >25%. Red pine and jack pine can be common associates; however, when the RD of red pine to other conifers was >75%, the Red Pine / Blueberry Dry Forest (FRP) map class was considered. Likewise, when the RD of jack pine to other conifers was >50%, the Jack Pine / Blueberry / Feathermoss Forest (FJB) map class was considered.

When sites included floristics common to peatlands (e.g., sphagnum, ericads), the Black Spruce - Tamarack / Labrador-tea Poor Swamp map class (two phases, including FSS and FTS, with FSS most probable in this scenario) was considered.

For AA, the FBS map class was assessed independently of all other map classes.



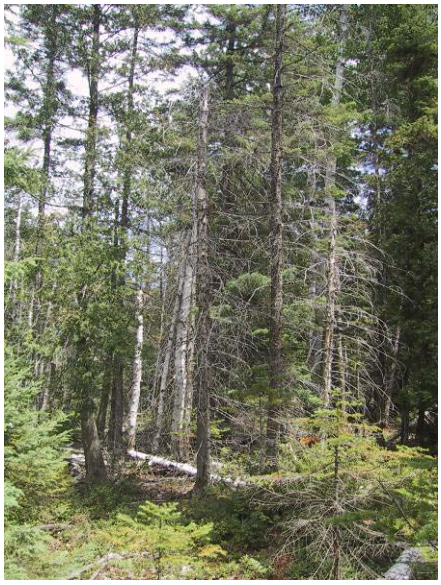


Jack Pine - Aspen / Bush-honeysuckle Forest (FJM)

The Jack Pine - Aspen / Bush-honeysuckle Forest (FJM) map class represents the *Pinus banksiana - Populus tremuloides* / *Diervilla lonicera* Forest Association (CEGL002518) n the NVCS. This map class captures mesic-rich forests of jack pine-mixed hardwoods, located at interdunal sites and occasionally on sandplains. The FJM map class is most common to the Grand Sable Dunes, typically on east-facing slopes and within valleys. These forests are closed canopy, often with >80% cover, and have a dense balsam fir subcanopy. The mutual RD of conifers and hardwoods is >25%; the RD of jack pine to eastern white pine and red pine is >50%; and the RD of white pine to all other pines is <25%. Hardwoods consist mostly of balsam poplar, paper birch, and red maple.

When the RD of hardwoods to conifers was <25%, the Jack Pine / Balsam Fir Forest (FJF) map class was considered, particularly in forests remaining within a mesic-rich, closed canopy of jack pine over a dense subcanopy of balsam fir. Alternatively, when forests were more dry, with open canopy and whether on sand dunes or sandplains having typical sandscape vegetation (e.g., American beachgrass, sand cherry, common juniper, bearberry, and woolly beach-heather), the Jack Pine / Blueberry / Feathermoss Forest (FJB) was considered.

For AA, the FJM map class was assessed independently of all other map classes.





Jack Pine / Balsam Fir Forest (FJF)

The Jack Pine / Balsam Fir Forest (FJF) map class represents the *Pinus banksiana* / *Abies balsamea* Forest Association (CEGL002437) in the NVCS. This map class captures mesic-rich forests of jack pine, located on the interdunal sites of the Grand Sable Dunes, typically on east-facing slopes and within valleys. These forests are closed canopy, often having >80% cover, and have a dense balsam fir subcanopy. The RD of hardwoods to conifers is <25%; with the RD of jack pine to eastern white pine and red pine is >50%; and with the RD of white pine to all other pines is <25%.

When forests were dry with an open canopy, whether on sand dunes or sandplains having typical sandscape vegetation (e.g., American beachgrass, sand cherry, common juniper, bearberry, and woolly beach-heather), the Jack Pine / Blueberry / Feathermoss Forest (FJB) was considered. Alternatively, when the mutual RD of hardwoods and conifers was >25%, the Jack Pine - Aspen / Bush-honeysuckle Forest (FJM) map class was considered, particularly in mesic-rich forests with closed canopy of jack pine over a dense subcanopy of balsam fir. Furthermore, when the RD of black spruce to jack pine and other conifers was >50%, the Black Spruce / Feathermoss Forest (FBS) map class was considered.

For AA, the FJF map class was assessed independently of all other map classes.





Jack Pine / Blueberry / Feathermoss Forest (FJB)

The Jack Pine / Blueberry / Feathermoss Forest (FJB) map class represents the *Pinus banksiana* / *Vaccinium* spp. / *Pleurozium schreberi* Forest Association (CEGL002441) in the NVCS. This map class captures dry to dry-mesic forests of jack pine, located on sand dunes and sandplains. The RD of hardwoods to conifers is <25% and a balsam fir subcanopy is essentially lacking. When located in more mesic-rich locations, with a balsam fir subcanopy, the Jack Pine / Balsam Fir Forest (FJF) map class was considered. When the RD of hardwoods to conifers was >25%, the Jack Pine - Aspen / Bush-honeysuckle Forest (FJM) map class was considered.

When sites of FJB are located on sand dunes, the RD of jack pine to pines and other conifers is >50%. The understory layers are of typical sand dunal vegetation, including American beachgrass, sand cherry, common juniper, bearberry, and woolly beach-heather. It is noteworthy that blueberry dwarf-shrub is absent in the sand dune sites of FJB; however, on sand dunes when tree canopy contributed <60% cover, the Great Lakes Coast Pine Barrens map class (two phases, including HPW and HPB) was considered (regardless of pine dominance).

When sites of FJB are located on sandplains, jack pine is the prominent conifer. The RD of white pine to conifers is <25%; the RD of black spruce to conifers is <50%; and the RD of red pine to conifers is <75%. The forest canopy is usually open, with a significant dwarf-shrub layer of blueberry. Depending on RDs of other conifers to jack pine, other map classes were considered, including White Pine / Blueberry Dry-Mesic Forest (FWP), Black Spruce / Feathermoss Forest (FBS), and Red Pine / Blueberry Dry Forest (FRP).

For AA, the FJB map class was assessed independently of all other map classes.





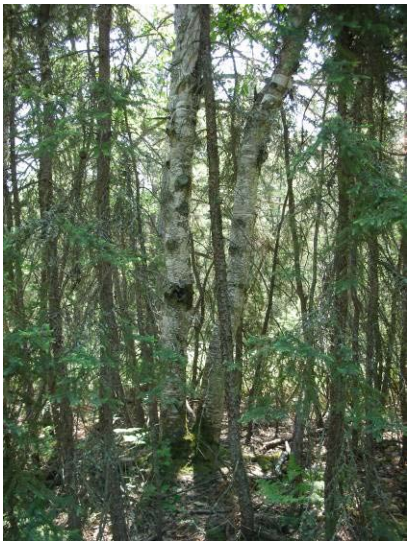
Balsam Fir - Paper Birch Forest (FFB)

The Balsam Fir - Paper Birch Forest map class represents the *Abies balsamea - Betula papyrifera / Diervilla lonicera* Forest Association (CEGL002474) in the NVCS. This map class captures mesic to wet-mesic forests wherein the mutual RD of conifers and hardwoods is >25%, and the RD of balsam fir to other conifers (including northern white-cedar, eastern hemlock, white spruce, and white pine) is >75%. The primary canopy-forming hardwood is paper birch, commonly with some red maple; sugar maple and yellow birch are uncommon. The FFB is located at various sites, including ecotones between the sand dunes/sandplains and the mesic, northern hardwood forests; lake and pond margins; and high-energy streams and waterfalls. Some sites of FFB are impacted by dynamic changes resulting from beaver activity, such as in the Beaver Basin.

Often the paper birch canopy is above the balsam fir subcanopy, obscuring it from view. To determine the correct forest type during the mapping of FFB, it was essential to refer to aerial photographs obtained during spring, leaf-off conditions to determine not merely the conifer component, but also the RDs among conifer species (e.g., the RD of balsam fir to white-cedar). The forest canopy is typically closed yet is more open in sites exposed to harsh winds and snow from Lake Superior.

When the RD of the hardwoods sugar maple and yellow birch to paper birch was >25% (regardless of the density of balsam fir), the Maple - Yellow Birch Northern Hardwoods Forest (FMB) map class was considered. When the RD of paper birch to other hardwoods was >90% and conifers were lacking (with balsam fir primarily of a sparse shrub-height), the Paper Birch / Fir Forest (FPB) map class was considered. Also, when the RD of white cedar to balsam fir was >25%, the conifer - hardwood (FCM) phase of the White-cedar - Boreal Conifer Mesic Forest map class was considered. Furthermore, when white spruce and aspens (quaking and/or bigtooth) were co-dominant with balsam fir and paper birch, and the conifers were prominent in the canopy layer, the Spruce - Fir - Aspen Forest (FCP) map class was considered.

For AA, the FFB map class was assessed independently of all other map classes.


Paper Birch / Fir Forest (FGF)

The Paper Birch / Fir Forest (FGF) map class represents the *Betula papyrifera* / *Diervilla lonicera* - (*Abies balsamea*) Forest Association (CEGL002463) in the NVCS. This map class captures dry mesic to mesic forests in which stands of paper birch are nearly monotypic. The RD of paper birch to other hardwoods is >90%. A sparse layer of balsam fir can be part of the shrub layer but is uncommon to the forest canopy.

When the RD of conifers (mostly of balsam fir) to the paper birch was >10%, the conifer - hardwood (FFB) phase of the Balsam Fir - Paper Birch Forest map class was considered; however, when the RDs of other hardwoods (such as sugar maple and yellow birch) to paper birch (even with dense balsam fir) were >10%, the Maple - Yellow Birch Northern Hardwoods Forest (four phases;, including FMB, FMY, FMF, FMM) map class was considered.

For AA, the FPB 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. This map class captures conifer - hardwood forests wherein white spruce and balsam fir are co-dominant with hardwoods. Hardwoods usually consist of paper birch, aspens (quaking and bigtooth), and red maple, yet other hardwoods (including sugar maple, yellow birch, and balsam poplar) can be present depending on site environment. Pine trees are few or absent. Although the FCP is typically a mesic forest, it is found in a variety of environments at the PIRO.

The following parameters were used to map FCP within various environments at the PIRO:

- In northern hardwood settings, the RD of white spruce and balsam fir to hardwoods in the emergent canopy layer is >50%. When not meeting this criterion, the Maple - Yellow Birch Northern Hardwoods Forest map class (four phases, including FMB, FMY, FMF, and FMM) was considered.
- In riparian bench settings, the RD of white spruce and balsam fir to hardwoods should be >25%. Although some northern white-cedars often complement the conifers in these settings, the RD of white-cedar to conifers should be <25%. When white-cedar exceeded this standard for RD, the conifer - hardwood (FCM) phase of the White-cedar - Boreal Conifer Mesic Forest map class was considered.
- On the Grand Sable Dunes within mesic, subirrigated swales and pockets (and often in somewhat protected areas), the RD of white spruce and balsam fir to hardwoods should be >25%.
- On the Kingston Plains, the RD of white spruce and balsam fir to hardwoods should be >25%. These sites are dry and in close proximity with White Pine - Mixed Deciduous / Bracken Barren Forest and Scrub (two phases; FPB and SSS) and Bracken Grassland (HBF).

Within any of the above environments, when the RD of hardwoods to conifers was <25%, the Spruce - Fir / Mountain Maple Forest (FSF) map class was considered.

The FCP type is known mostly as a boreal-like forest and is somewhat out of place at the PIRO, where extensive, northern hardwood forests dominate. This is true for the FSF type as well. Both the FCP and FSF map classes were to be used sparingly, only to capture the more palpable examples of these forests; therefore, other map classes were to be thoroughly considered before using the FCP map class. Thus, when sites were dominated by paper birch and balsam fir, and white spruce and other hardwoods were few or lacking, the Balsam Fir - Paper Birch Forest (FFB) map class was considered. When in mesic locations on the Grand Sable Dunes and when the RD of jack pine to conifers was >25%, the Jack Pine - Aspen / Bush Honeysuckle Forest (FJM) map class was considered. Furthermore, when in sites of high anthropogenic disturbance, the Conifer - Hardwood Ruderal Forest (FMX) map class was considered. The FCM map-class phase was considered when the RD of white-cedar to conifers was >25%.

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. This map class captures conifer forests wherein white spruce and balsam fir are dominant. Some hardwoods (consisting of paper birch, aspens [quaking and bigtooth], red maple, and balsam poplar) can be present, but their RD to conifers is <25%. Pine trees are few or absent. Although the FSF is typically a mesic forest, it is found in a variety of environments at the PIRO.

The following parameters were used to map FSF within various environments at the PIRO:

- On riparian bench settings, the RD of white spruce and balsam fir to hardwoods should be >75%. Although some northern white-cedars often complement the conifers in these settings, the RD of white-cedar to conifers should be <25%. When white-cedar exceeded this standard for RD, the conifer (FCC) phase of the White-cedar - Boreal Conifer Mesic Forest map class was considered.
- On the Grand Sable Dunes within mesic, subirrigated swales and pockets (and often in somewhat protected areas), the RD of white spruce and balsam fir to hardwoods should be >25%.
- On the Kingston Plains, the RD of white spruce and balsam fir to hardwoods should be >25%. These sites are dry and in close proximity with White Pine - Mixed Deciduous / Bracken Barren Forest and Scrub (two phases; FPB and SSS) and Bracken Grassland (HBF).

Within any of the above environments, when the RD of hardwoods to conifers was >25%, the Spruce - Fir - Aspen Forest (FCP) map class was considered.

The FSF type is known mostly as a boreal-like forest and is somewhat out of place at the PIRO, where extensive, northern hardwood forests dominate. This is true for the FCP type as well. Both the FSF and FCP map classes were to be used sparingly, only to capture the more palpable examples of these forests; therefore, other map classes were to be thoroughly considered before using the FSF map class. Thus, when in mesic locations on the Grand Sable Dunes and when the RD of jack pine to conifers was >25%, the Jack Pine / Balsam Fir Forest (FJF) map class was considered. Also, when in sites of high anthropogenic disturbance, the Conifer Ruderal Forest (FCX) map class was considered. The FCC map-class phase was considered when the RD of white-cedar to conifers was >25%.

For AA, the FSF map class was assessed independently of all other map classes.








Black Spruce - Tamarack / Labrador-tea Poor Swamp (FSS and FTS)

The Black Spruce - Tamarack / Labrador-tea Poor Swamp map class represents the *Picea mariana* - (*Larix laricina*) / *Ledum groenlandicum* / *Sphagnum* spp. Forest Association (CEGL005271) in the NVCS. Two map-class phases are used to map the Black Spruce - Tamarack / Labrador-tea Poor Swamp, including black spruce (FSS) and tamarack (FTS). This map class typically captures poor swamp forests in peatland settings that are dominated by black spruce and/or tamarack. These swamps receive modest amounts of minerotrophic waters from the adjacent landscape, yet they are still nutrient poor. Eastern white pine, hemlock, and northern white-cedar enter these nutrient-poor swamps, particularly along the margins. Trees cover is >25%, including trees even as short as tall-shrub height. When tree cover was <25%, the Leatherleaf Poor Fen (DLF) map class was considered. Sphagnum and peatland ericads, including leatherleaf and Labrador-tea, dominate the ground flora, along with other vegetation common to peatlands, such as cranberry, blueberry, bog rosemary, pitcher plant, and thin-leaved sedges.

Most often, the Black Spruce - Tamarack / Labrador-tea Poor Swamp occurs within well-established peatland complexes. There can be occasions, however, where this nutrient-poor swamp occurs on less developed peatland formations that have more wet-mesic characteristics.

When the RD of black spruce and/or tamarack to other conifers was <25% and the RD of eastern hemlock to white-cedar was >50%, the Hemlock - Yellow Birch Swamp Wet-Mesic Forest (FHS) map class was considered. When the RD of white-cedar to eastern hemlock was >50%, then the White-cedar - (Mixed Conifer) / Alder Swamp (FCS) map class was considered. For sites located on upland settings with a feathermoss floor and lacking peatland characteristics, and when black spruce was the primary conifer (with RD to red pine <75%, to jack pine <50%, and to white pine <25%), then the Black Spruce / Feathermoss Forest (FBS) map class was considered.

The black spruce (FSS) phase captures nutrient-poor swamps wherein the RD of black spruce to all other conifers is >25%. The tamarack (FTS) phase captures nutrient-poor swamps wherein the RD of tamarack to all other conifers is >75%. The two map-class phases were often mapped in close proximity to each other.

For AA, the two map-class phases (FSS and FTS) were combined because they collectively represent one association type. They were, however, left as separate entities in the vegetation map layer. Furthermore, initial AA results showed that we had confused the White-cedar - (Mixed Conifer) / Alder Swamp (FCS) map class with the Black Spruce - Tamarack / Labrador-tea Poor Swamp map class. Thus, for purposes of AA, the White-cedar - (Mixed Conifer) / Alder Swamp (FCS) map class was assessed with the FSS and FTS phases of the Black Spruce - Tamarack / Labrador-tea Poor Swamp map class in order to reach confidence standards. The FCS map class was, however, left as a separate entity in the vegetation map layer.

Black Spruce - Tamarack / Labrador-tea Poor Swamp (black spruce phase)–FSS

The black spruce (FSS) map-class phase represents the Black Spruce - Tamarack / Labrador-tea Poor Swamp map class (as described above). This phase captures nutrient-poor swamp peatlands wherein the RD of black spruce to all other conifers (including tamarack, white pine, eastern hemlock, and northern white-cedar) is >25%. The FSS phase was mapped in close proximity to the tamarack (FTS) phase of this same nutrient-poor swamp type. When the RD of tamarack to all other conifers was >75%, the FTS phase was considered.



Black Spruce - Tamarack / Labrador-tea Poor Swamp (tamarack phase)–FTS

The tamarack (FTS) map-class phase represents the Black Spruce - Tamarack / Labrador-tea Poor Swamp map class (as described above). This phase captures nutrient-poor swamp peatlands wherein the RD of tamarack to all other conifers (including black spruce, white pine, eastern hemlock, and northern white-cedar) is >75%. Black ash and red maple can be common, almost co-dominating with the tamarack; however, more minerotrophic-rich swamps including gray alder shrub are more characteristic of the *Larix laricina* / *Alnus incana* Forest Association (CEGL002471), which is not documented for PIRO. The FTS phase was mapped in close proximity to the black spruce (FSS) phase of this same nutrient-poor swamp type. When the RD of black spruce to all conifers was >25%, the FSS phase was considered.



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. This map class captures conifer swamp forests wherein eastern white-cedar is the dominant conifer and the RD of conifers to hardwoods is >75%. The understory shrub is often of gray alder. Sphagnum and other peatland flora can be common. Hardwoods can be present, such as red maple, yellow birch, and paper birch, and black ash; however, when the RD of black ash and red maple hardwoods to conifers was >25%, the White-cedar - Black Ash Swamp (FCA) map class was considered.

These swamps can be open or with closed tree canopy. They are saturated wet (often part of peatland and beaver complexes), yet can easily grade into a wet-mesic version of White-cedar - Boreal Conifer Mesic Forest (two map class phases, including FCC and FCM, with FCC most probable). The RD of white-cedar to both eastern hemlock and tamarack is >50%, and the RD of black spruce to all conifers is <25%. When the RD of hemlock to white-cedar was >50%, the Hemlock - Yellow Birch Swamp Wet-Mesic Forest (FHS) map class was considered. When the RD of black spruce and/or tamarack to all conifers was >25% and when peatland flora was well established, the Black Spruce - Tamarack / Labrador-tea Poor Swamp map class (two phases, including FSS and FTS) was considered.

For AA, the FCS map class was assessed with the Black Spruce - Tamarack / Labrador-tea Poor Swamp map class (two phases, including FSS and FTS). Initial AA results showed that we confused the White-cedar - (Mixed Conifer) / Alder Swamp (FCS) map class with the Black Spruce - Tamarack / Labrador-tea Poor Swamp map class. Thus, for purposes of AA, the White-cedar - (Mixed Conifer) / Alder Swamp (FCS) map class was assessed with the FSS and FTS phases of the Black Spruce - Tamarack / Labrador-tea Poor Swamp map class in order to reach confidence standards. The map classes were, however, left as separate entities in the vegetation map layer.





Bracken Grassland (HBF)

The Bracken Grassland (HBF) map class represents the Pteridium aquilinum - *Bromus kalmii* Herbaceous Vegetation Association (CEGL005142) in the NVCS. This map class captures herbaceous dry sandplains wherein bracken fern strongly dominates and reindeer lichen is prevalent. The HBF is common to the Kingston Plains in response to old cutover and fire practices. Scrub-shrub and short-tree encroachment is common, yet these types of vegetation contribute <25% cover. Short-statured quaking aspen is a common tree encroaching into HBF.

Particularly within the Kingston Plains, when shrub or mixed conifer - hardwood trees contributed >25% cover, the White Pine - Mixed Deciduous / Bracken Barren Forest and Scrub map class was considered, either the forest (FPB) phase or the scrub (SSS) phase. Also, when the herbaceous vegetation was more mixed with ruderal species as a result of disturbance, the Ruderal Grassland (HMX) map class was considered.

For AA, the HBF map class was assessed independently of all other map classes.









Ruderal Shrubland (SMX)

The Ruderal Shrubland (SMX) map class represents, in part, the Eastern Ruderal Shrubland & Grassland Group [Placeholder] (G059) of the NVCS. Because of disturbance from human activities (e.g., logging, homestead) and natural factors (e.g., wind-throw), thus leading to an inherent variability of floristic vegetation, an association type could not be determined. Most occurrences of SMX are the result of human activity rather than natural factors. This map class captures ruderal upland shrublands wherein shrubs contribute >25% cover. Shrubs consist of any species common or unique to the PIRO area. These shrublands can be open or with closed canopy wherein trees contribute <25% cover.

When trees contributed >25% cover, either the Conifer Ruderal Forest (FCX) map class, the Hardwood Ruderal Forest (FDX) map class, or the Conifer - Hardwood Ruderal Forest (FMX) map class was considered, depending on the RDs of conifers and hardwoods to each other. Conversely, when shrubs contributed <25% cover, the Ruderal Grassland (HMX) map class was considered. The HMX map class also represents, in part, the Eastern Ruderal Shrubland & Grassland Group [Placeholder] (G059) in the NVCS.

Because of the disturbance regime inherent to ruderal forests, the SMX map class was not assessed for accuracy.



Ruderal Grassland (HMX)

The Ruderal Grassland (HMX) map class represents, in part, the Eastern Ruderal Shrubland & Grassland Group [Placeholder] (G059) in the NVCS. Because of disturbance from anthropogenic activities (e.g., logging, homestead), thus leading to an inherent variability of floristic vegetation, an association type could not be determined. This map class captures ruderal, upland, herbaceous fields wherein shrubs and trees each contribute <25% cover. Herbaceous vegetation consists of various grasses and herbs common or unique to the PIRO area; however, the emphasis is on non-native vegetation.

When trees contributed >25% cover, either the Conifer Ruderal Forest (FCX) map class, the Hardwood Ruderal Forest (FDX) map class, or the Conifer - Hardwood Ruderal Forest (FMX) map class was considered, depending on the RDs of conifers and hardwoods to each other. Likewise, when trees contributed <25% cover, yet shrubs contributed >25% cover, the Ruderal Shrubland (SMX) map class was considered, depending on RDs of conifer and deciduous shrubs to each other. The SMX map class also represents, in part, the Eastern Ruderal Shrubland & Grassland Group [Placeholder] (G059) in the NVCS.

Because of the disturbance regime inherent to ruderal herbaceous fields, the HMX map class was not assessed for accuracy.



Thimbleberry Shrubland (N/A)

Because they are too small to map (well below the size of a MMU), no map class was derived for the Thimbleberry Shrubland vegetation type, which is the *Rubus parviflorus* Shrubland [Provisional] Association (CEGL005248) in the NVCS, because areas of this vegetation type are essentially too small to map (less than a MMU). Thus, where sites of this vegetation type exist, other map classes would have captured them as inclusions. Sites of Thimbleberry Shrubland were likely mapped as an inclusion within the Ruderal Shrubland (SMX) map class as well as in various forest map classes, most likely including the Maple - Yellow Birch Northern Hardwoods Forest class (four phases, including FMB, FMY, FMF, and FMM).

Sites of Thimbleberry Shrubland are found within human-disturbed sites and forest canopy gaps. These shrublands consist mostly of thimbleberry.

Because of the lack of a map class for this vegetation type, the Thimbleberry Shrubland was not assessed for accuracy.





Great Lakes Beachgrass Dune (HAB)

The Great Lakes Beachgrass Dune (HAB) map class represents the *Ammophila breviligulata* - (*Schizachyrium scoparium*) Herbaceous Vegetation Association (CEGL005098) in the NVCS. This map class captures American beachgrass as the primary vegetation component on sandy shorelines, active sand dunes and foredunes, and sandspits. The herbaceous cover can be low but is usually >10%. Other herbaceous components may consist of beach-pea, Canada wildrye, and scouringrush horsetail.

Total tree canopy contributes <10% cover, because the constant moving of sands from winds off of Lake Superior restrict tree propagation in environments of HAB. When tree cover is 10–60% consisting of a red pine, eastern white pine, and/or jack pine, the Great Lakes Coast Pine Barrens map class (two phases, including HPB and HPW) was considered.

Within HAB, shrubs of woolly beach-heather, common juniper, bearberry, and sand cherry may persist, yet these should contribute <25% total cover. When shrubs contributed >25% cover, the Great Lakes Beach-heather Dune Dwarf-shrubland (DBH), Great Lakes Juniper Dune Shrubland (DJD), or Sand Cherry Dune Shrubland (SCW) map classes were considered, depending on RDs of shrub components; however, these shrublands were often represented as inclusions to HAB because they were often in areas smaller than the size of a MMU. Dynamic interdunal wetlands and non-vegetated sands (e.g., sand blowouts) were also represented as inclusions within HAB. When vegetation cover on sandy shorelines was absent or nominal at best, the Sand & Cobble Beach (NSB) map class was considered (these areas were on the Lake Superior shores where vegetation is prevented from persisting).

Beachgrass, and the density thereof, was difficult to discern on the aerial photographs because the sand dunes overexposed the CIR imagery, diffusing even moderate density covers of herbaceous vegetation, as well as of short-shrubs, such as sand cherry. Subtle clues were vital to mapping HAB; even the faintest of vegetative appearance on the aerial photos proved to be a significant amount (>25% cover) of beachgrass. Thus, the mapping of HAB was aggressive in order to capture it. Furthermore, because sand cherry was also somewhat diffused by the sand and could not always be seen, it is expected that SCW in areas larger than the size of a MMU may well be mapped within HAB.

For AA, the HAB map class was assessed independently of all other map classes.













Great Lakes Beach-heather Dune Dwarf-shrubland (DBH)

The Great Lakes Beach-heather Dune Dwarf-shrubland (DBH) map class represents the *Hudsonia tomentosa* Dune Dwarf-shrubland Association (CEGL004024) in the NVCS. This map class captures open dwarf-shrublands on active sand dunes and foredunes where woolly beach-heather is the dominant shrub. American beachgrass, common juniper, bearberry, and sand cherry are often present. Dwarf-shrub cover is >25%, and the RD of beach-heather to other shrubs (including juniper and sand cherry) is >50%. When the RD of juniper to beach-heather was >50%, the Great Lakes Juniper Dune Shrubland (DJD) map class was considered, and when the RD of sand cherry to all other shrubs was >50%, the Sand Cherry Dune Shrubland (SCW) map class was considered. When dwarf-shrubs contributed <25% cover, the Great Lakes Beachgrass Dune (HAB) map class was considered.

It is noteworthy that in sandscape settings, where beach ridges and wetland swales are mosaic with each other, the DBH is included in the swamp - dune mosaic (FWW) phase of the White Pine - Red Maple Swamp map class (this decision was made to accommodate limitations of mapping scale).

Tree canopy is <10% cover, because moving sands and winds off of Lake Superior limits tree propagation in this environment. When tree cover was 10–60%, consisting of red pine, eastern white pine, and/or jack pine, the Great Lakes Coast Pine Barrens map class (two phases, including HPB and HPW) was considered.

Often, DBH was found in areas smaller than the size of a MMU and was, thus, mapped as inclusions to HAB, DJD, SCW, HPB, and HPW, which are often in close proximity to each other.

For AA, the DBH map class was assessed independently of all other map classes.



Great Lakes Juniper Dune Shrubland (DJD)

The Great Lakes Juniper Dune Shrubland (DJD) map class represents the *Juniperus horizontalis - Arctostaphylos uva-ursi - Juniperus communis* Dune Dwarf-shrubland Association (CEGL005064) in the NVCS. This map class captures open short-shrublands on active sand dunes and foredunes where common juniper is the dominant shrub. American beachgrass, woolly beach-heather, bearberry, and sand cherry are often present. Shrub cover is >25%, the RD of juniper to beach-heather is >50%, and the RD of juniper to sand cherry is >25%. It is noteworthy that bearberry can actually be dominant within DJD. When the RD of beach-heather to all other shrubs was >50%, the Great Lakes Beach-heather Dune Dwarf-shrubland (DBH) map class was considered. When the RD of sand cherry to juniper was >75%, the Sand Cherry Dune Shrubland (SCW) map class was considered. When shrubs contributed <25% cover, the Great Lakes Beachgrass Dune (HAB) map class was considered.

Tree canopy contributes <10% cover, because moving sands and winds off of Lake Superior limits tree propagation in this environment. When tree cover was 10–60%, consisting of red pine, eastern white pine, and/or jack pine, the Great Lakes Coast Pine Barrens map class (two phases, including HPB and HPW) was considered.

Often, DJD was found in areas smaller than the size of a MMU and was, thus, mapped as inclusions to HAB, DBH, SCW, HPB, and HPW, as well as Jack Pine / Blueberry / Feathermoss Forest (FJB) on Long Island, which are often in close proximity to each other.

For AA, the DJD map class was assessed independently of all other map classes.



Great Lakes Coast Pine Barrens (HPB and HPW)

The Great Lakes Coast Pine Barrens map class represents the *Pinus banksiana* - (*Pinus resinosa*) - *Pinus strobus* / *Juniperus horizontalis* Wooded Herbaceous Vegetation Association (CEGL005125) in the NVCS. This map class consists of two phases, barrens (HPB) and woodland (HPW). The Great Lakes Coast Pine Barrens map class captures red pine, eastern white pine, and/or jack pine forests on active sand dunes, foredunes, and sandplains where tree canopy contributes 10–60% cover. Often times, jack pine is dominant, with little or no white pine or red pine present. The RD of hardwoods to conifers is <25%. When tree canopy contributed >60% cover on active sand dunes, the Great Lakes Dune Pine Forest (FPD) map class was considered, unless one of the pine species dominated the forest, in which case other pine-forest map classes were considered.

On sand dunes, namely the Grand Sable Dunes, the ground vegetation is of typical sand dunal species, including American beachgrass, sand cherry, common juniper, bearberry, and woolly beach-heather. It is common to find small pockets (<MMU) of Great Lakes Beachgrass Dune (HAB), Great Lakes Beach-heather Dune Dwarf-shrubland (DBH), Great Lakes Juniper Dune Shrubland (DJD), and Sand Cherry Dune Shrubland (SCW) within the Great Lakes Coast Pine Barrens. Sand blowouts are also common.

On sandplains but not on active dunes (namely above Minors Beach), the ground vegetation includes blueberry and reindeer lichen, which is not typical of sand dunal species. When pine forests of sandscapes were further inland (e.g., Kingston Plains), other pine-dominant map classes were considered, including White Pine / Blueberry Dry-Mesic Forest (FWP), Red Pine / Blueberry Dry Forest (FRP), and Jack Pine / Blueberry / Feathermoss Forest (FJB). These forests can have a somewhat open tree canopy.

The barrens (HPB) phase captures the pine barrens wherein the tree canopy contributes 10–25% cover. The woodland (HPW) phase captures the pine barrens wherein the tree canopy contributes 25–60% cover.

For AA, the two map-class phases (HPB and HPW) were combined because they collectively represent one association type. They were, however, left as separate entities in the vegetation map layer.

Great Lakes Coast Pine Barrens (barrens phase)–HPB

The barrens (HPB) map-class phase represents the Great Lakes Coast Pine Barrens map class (as described above) wherein tree canopy contributes 10–25% cover. When tree canopy contributed 25–60% cover, the woodland (HPW) phase of this same map class was considered.





Great Lakes Coast Pine Barrens (woodland phase)–HPW

The woodland (HPW) map-class phase represents the Great Lakes Coast Pine Barrens map class (as described above) wherein tree canopy contributes 25–60% cover. When tree canopy contributed 10–25% cover, the barrens (HPB) phase of this same map class was considered.









Cottonwood Dune Open Woodland (WCD)

The Cottonwood Dune Open Woodland (WCD) map class represents the *Populus deltoides* - (*Juniperus virginiana*) Dune Woodland Association (CEGL005119) in the NVCS. This map class captures short-statured woodlands consisting mostly of balsam poplar, situated just above Lake Superior on the dunal crests and ridges of the Grand Sable Dunes. Tree canopy is open and usually contributes >25% cover. Pines and other conifers are nominally present or absent. The ground vegetation is of typical sand dunal species, including American beachgrass, sand cherry, common juniper, bearberry, and woolly beach-heather. When hardwoods contributed <25% cover, the Great Lakes Beachgrass Dune (HAB) map class was considered.

For AA, the WCD map class was assessed independently of all other map classes.



Sand Cherry Dune Shrubland (SCW)

The Sand Cherry Dune Shrubland (SCW) map class represents the *Prunus pumila* - (*Ptelea trifoliata*) Dune Shrubland Association (CEGL005075) of the NVCS. This map class captures dry, open short-shrublands dominated by sand cherry that are located on the Grand Sable Dunes. Other dunal shrubs often co-exist, including common juniper, beach-heather, and willows.

When the RD of beach-heather to all other shrubs was >50%, the Great Lakes Beach-heather Dune Dwarf-shrubland (DBH) map class was considered. When the RD of common juniper to sand cherry was >25%, the Great Lakes Juniper Dune Shrubland (DJD) map class was considered. When shrubs contributed <25% cover, the Great Lakes Beachgrass Dune (HAB) map class was considered.

Sand cherry, and the density thereof, was difficult to discern on the aerial photographs because the sand dunes overexposed the CIR imagery, diffusing even moderate density covers of shrub vegetation, as well as herbaceous vegetation. Shrubs were most evident on slopes and less so on level plains and summits of the dunes. It is expected that SCW occurring in areas greater than the size of a MMU were possibly mapped within HAB, particularly in areas occurring on the tops of dunes.

For AA, the SCW map class was assessed independently of all other map classes.



Bog Birch - (Willow species) Saturated Shrubland (SBB)

The Bog Birch - (Willow species) Saturated Shrubland (SBB) map class represents the *Betula pumila* - (*Salix* spp.) Saturated Shrubland Alliance (A.1021) in the NVCS; an association type within the NVCS was not determined. This map class captures seasonally saturated short-shrub fen basins, with short-shrubs consisting of bog birch and sweetgale. Short-shrubs contribute >25% cover that is typically open, with sweetgale strongly dominant and a RD of bog birch to other short-shrubs of >10%. Sedges dominate the herbaceous layer, but leatherleaf and other ericads are not necessarily present. Within basin settings, sites of SBB receive little or no flooding.

Within sites similar to SBB wherein sweetgale was dominant, but the RD of bog birch to short-shrubs was <10%, the Sweet Gale Shrub Fen (SFF) map class was considered. When dwarf-shrub ericads leatherleaf and Labrador-tea were more prominent on established sphagnum peat (nutrient-poor fen sites) and the short-shrubs contributed <25% cover, the Leatherleaf Poor Fen (DLF) map class was considered. Furthermore, when SBB was found in shorefen locations and herbaceous emergent vegetation (e.g., cattail) was present, the Leatherleaf - Sweet Gale Shore Fen (DLS) map class was considered. Also, when all shrub strata each contributed <25% cover, herbaceous map classes were considered, including Northern Sedge Poor Fen (HSP) when in nutrient-poor fen sites and Wiregrass Sedge Shore Fen (HSS) when in shorefen sites.

For AA, the SBB map class was assessed independently of all other map classes.



Wiregrass Sedge Shore Fen (HSS)

The Wiregrass Sedge Shore Fen (HSS) map class represents the *Carex lasiocarpa* - (*Carex rostrata*) - *Equisetum fluviatile* Herbaceous Vegetation Association (CEGL005229) in the NVCS. This map class captures seasonally saturated, sedge-dominated shorefens on sphagnum peat that receive minerotrophic influence from adjacent water sources. These minerotrophic-rich, herbaceous shorefens often receive flooding caused by beaver activity or stream swelling. Woollyfruit sedge is the herbaceous component best characterizing HSS and is usually dominant. Ericads and other nutrient-poor fen vegetation are essentially absent.

Although some sphagnum peat is established, dwarf-shrub ericads are normally absent. When shrubs (primarily sweetgale and/or leatherleaf) contributed >25% cover, the Leatherleaf - Sweetgale Shore Fen (DLS) map class was considered; however, when dwarf-shrub ericads and sphagnum peat were absent and there was a wetland substrate consisting of muck, the Northern Sedge Wet Meadow (HSG) map class was considered, particularly when more broad-leaved sedge species were thought to be present. Determining the presence or absence of ericads was not always easy because ericads can be shorter than the herbaceous layer, even to the point of hindering their appearance on aerial photographs. In these instances, we considered various cues, including environmental position and water inundation—when extensive inundation had occurred, the HSG map class was considered.

When sedges were located in shorefen sites on peatland that were nutrient poor (with low minerotrophic influence from proximate water sources), especially in low-flow peatland drainage settings or in kettle basins, the Northern Sedge Poor Fen (HSP) map class was considered. Although HSP is an herbaceous vegetation type, some element of ericads and other nutrient-poor vegetation are typically present.

For AA, the HSS map class was assessed independently of all other map classes.



Sweet Gale Shrub Fen (SSF)

The Sweet Gale Shrub Fen (SFF) map class represents the *Myrica gale* Fen Shrubland Association (CEGL005141) in the NVCS. This map class captures seasonally saturated fen basins including short shrubs that consist primarily of sweetgale. Short shrubs contribute >25% cover, and are typically more closed canopy, with sweetgale strongly dominant. If present at all, the RD of bog birch to short shrubs is <10%. Leatherleaf is usually the dominant dwarf-shrub, and a sparse conifer tree and shrub layer may be present. Although within basin settings, SSF units receive little or no flooding, nor are they found within shorefen locations.

When within sites with vegetation similar to SSF—wherein sweetgale was dominant, but the RD of bog birch to short-shrubs was >10%, the Bog Birch - (Willow species) Saturated Shrubland (SBB) map class was considered. On established sphagnum peat (nutrient-poor fen sites) when dwarf-shrub ericads leatherleaf and Labrador-tea were more prominent and the short-shrubs contributed <25% cover, the Leatherleaf Poor Fen (DLF) map class was considered. At shorefen locations where there was emergent herbaceous vegetation (e.g., cattail), the Leatherleaf - Sweet Gale Shore Fen (DLS) map class was considered. When all shrub strata were each <25% cover, herbaceous map classes were considered, including Northern Sedge Poor Fen (HSP) (when at nutrient-poor fen sites) and Wiregrass Sedge Shore Fen (HSS) (when at shorefen sites).

For AA, the SSF map class was assessed independently of all other map classes.



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. This map class captures sedge-dominated, seasonally saturated, nutrient-poor fens on sphagnum peat that receive low minerotrophic influence from adjacent water sources. When next to lakes and ponds, these nutrient-poor fens do not receive flooding. These minerotrophic-poor fens are dominated by narrow-leaved sedges, with some element of ericads, and other nutrient-poor vegetation are typically present, although they contribute <25% cover. These nutrient-poor fens are common to low-flow peatland drainages and kettle basins, often in close proximity to sites of Leatherleaf Poor Fen (DLF) and Black Spruce - Tamarack / Labrador Tea Poor Swamp (two phases, including FSS and FTS). It is expected that HSP was often mapped as an inclusion (areas smaller than the size of a MMU) to DLF and FSS/FTS.

When dwarf shrubs (consisting primarily of leatherleaf and other nutrient-poor ericads) in fen settings contributed >25% cover, the Leatherleaf Poor Fen (DLF) map class was considered. Also, when sites were sedge-dominated, nutrient-rich shorefens receiving high minerotrophic influence from proximate water sources and having essentially no ericads present (although sphagnum may have been present), the Wiregrass Sedge Shore Fen (HSS) map class was considered.

For AA, the HSP 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. This map class captures seasonally saturated shorefens on sphagnum peat that are dominated by short shrubs (>25% cover). Short-shrubs consist primarily of sweetgale and/or leatherleaf. These minerotrophic-rich shorefens are typical of sandscape positions where the underlying water table of Lake Superior impacts the hydrology of the wetland. They also occur along streamsides and within beaver pond complexes receiving seasonal flooding. Other dwarf-shrub ericads may include some bog rosemary and cranberry. Tamarack, black spruce, and white pine may be scattered with canopy cover of <25%. Also, tall-shrubs (including gray alder and willows) may be present but should contribute <25% cover. When >25% cover consisted of tall-shrubs, then either the Dogwood - Willow Swamp (SDW) map class or the Gray Alder Swamp Shrubland (SAS) map class was considered.

Within these shorefen environments, when all shrub strata each contributed <25% cover, the Wiregrass Sedge Shore Fen (HSS) map class was considered. Determining the presence or absence of ericads was not always easy because ericads can be shorter than the herbaceous layer, even to the point of hindering their appearance on aerial photographs. It is noteworthy that inclusions of HSS (in areas smaller than a MMU) are common within DLS. Furthermore, when short-shrubs predominately consisted of dwarf-shrub ericads—leatherleaf, Labrador-tea, bog-rosemary, cranberry, but not sweetgale—and in nutrient-poor fen environments not receiving minerotrophic waters either indirectly from Lake Superior or directly from river or beaver pond flooding, the Leatherleaf Poor Fen (DLF) map class was considered.

When in nutrient-poor fen settings (not in nutrient-rich shorefens), either the Bog Birch - (Willow species) Saturated Shrubland (SBB) map class, the Sweet Gale Shrub Fen (SFF) map class, or the Northern Sedge Poor Fen (HSP) map class was considered, depending on shrub and herbaceous components.

It is noteworthy that units mapped with DLS received one of two possible height modifiers to the map-class attribute. Normally, dwarf-shrub map classes receive a height modifier of <0.5 m; however, sometimes sweetgale dominates these short-shrub shorefens. Thus, those units mapped as DLS wherein sweetgale dominated over leatherleaf, the 0.5–5-m height modifier was assigned. On the other hand, when leatherleaf dominated over sweetgale, the <0.5-m height modifier was assigned.

For AA, the DLS and the DLF map classes were assessed together. Initial AA results showed confusion between these two map classes; thus, they were combined in order to reach confidence standards. These map classes were, however, left as separate entities in the vegetation map layer.





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. This map class captures poor fens within peatlands that are dominated by leatherleaf and other ericads, including Labrador-tea, cranberry, and bog-rosemary. These peatlands are located within basins receiving low minerotrophic influence from surrounding water sources, either directly (as with seasonal flooding from beaver pond complexes or rivers) or indirectly (as with sandscapes of Lake Superior). When located near to water sources as described above, the Leatherleaf - Sweetgale Shore Fen (DLS) map class was considered (sweetgale is commonly associated with these minerotrophic-rich shorefens).

Scattered black spruce, tamarack, and white pine are commonly present, but canopy cover (even as short-tree or tall-shrub) is <25%. When black spruce and/or tamarack contributed >25% cover over the ericad layer, the Black Spruce - Tamarack / Labrador-tea Poor Swamp map class (two phases, including FSS and FTS) was considered. Furthermore, when the entire shrub and tree layers contributed <25% cover, leaving primarily an herbaceous-rich layer dominated by narrow-leaved sedges within these poor fen settings, the Northern Sedge Poor Fen (HSP) map class was considered. It is noteworthy that inclusions of HSP (in areas smaller than the size of a MMU) are common within DLF.

For AA, the DLF and the DLS map classes were assessed together. Initial AA results showed confusion between these two map classes; thus, they were combined in order to reach confidence standards. These map classes were, however, left as separate entities in the vegetation map layer.









Water Horsetail - Spikerush Marsh (HHT)

The Water Horsetail - Spikerush Marsh (HHT) map class represents the *Equisetum fluviatile* - (*Eleocharis palustris*) Herbaceous Vegetation Association (CEGL005258) in the NVCS. This map class captures wetland margins of interior lakes and ponds dominated by water horsetail and common spikerush. When other wetland herbaceous vegetation was dominant, other map classes were considered. It is noteworthy that HHT units occur in similar settings as both Inland Freshwater Strand Beach (VAV) and Lake Mudflats (VMF).

For AA, the VBS map class was assessed independently of all other map classes.



Midwest Mixed Emergent Deep Marsh (HCM)

The Midwest Mixed Emergent Deep Marsh (HCM) map class represents the *Typha* spp. - *Schoenoplectus acutus* - Mixed Herbs Midwest Herbaceous Vegetation Association (CEGL002229) in the NVCS. This map class captures deep-marsh emergent wetlands dominated by hardstem bulrush and cattails. Sedges can be present, but their RD to bulrush and cattails should be <25%. When the RD of sedges to bulrush, cattails, and other herbaceous emergents was >25%, the Northern Sedge Wet Meadow (HSG) map class was considered. When the RD of bluejoint to all other herbaceous emergents was >25%, the Bluejoint Wet Meadow (HCC) map class was considered.

For AA, the HCM, HSG, and HCC map classes were assessed together. Initial AA results indicated confusion between these two map classes; thus, they were combined in order to reach confidence standards. These map classes were, however, left as separate entities in the vegetation map layer.





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. This map class captures wetland meadows receiving disturbance from dynamic hydrology (largely because of beaver activity) and wherein there is a diverse mix of emergent herbaceous vegetation (pioneering and persistent). The disturbance is such that the community of vegetation is non-distinct to any one established, herbaceous vegetation type, particularly Bluejoint Wet Meadow (HCC) and Northern Sedge Wet Meadow (HSG). Although bluejoint and sedges are common to HWM, the RDs of each to the mix of herbaceous vegetation is <25%. Woolgrass can be a common component of HWM. The soil substrate of HWM, similar to HCC and HSG, is muck, with little peat if any. It is noteworthy that herbaceous beaver meadows can be classified as HWM, HCC, or HSG, depending on beaver activity and subsequent vegetation response. Those beaver meadows having frequent or recent changes likely received the HWM map class during mapping.

Trees and shrubs are often present, but they each contribute <25% cover. When shrubs contributed >25% cover and predominantly consisted of gray alder, the Gray Alder Swamp Shrubland (SAS) map class was considered. When tree canopy contributed >25% cover, with black ash and red maple most prominent, the black ash (FBA) phase Black Ash - Mixed Hardwood Swamp map class was considered.

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. This map class captures herbaceous wetland meadows dominated by bluejoint; they are commonly receptive to beaver activity. Sedges are often present, but their RD to all herbaceous vegetation should be <25%. Barring sedges and cattail, the RD of bluejoint to all other emergent herbaceous vegetation is >25%. When the RD of sedges to bluejoint was >25%, the Northern Sedge Wet Meadow (HSG) map class was considered. Also, when the amount of bluejoint component to sedges could not be determined from aerial photographs, the HSG map class was typically the default map class. When herbaceous vegetation consisted of a diverse mix and the RD of bluejoint and sedges to herbaceous vegetation was each <25%, the Wet Meadow Mixed Herbaceous (HWM) map class was considered. The soil substrate of HCC, similar to HSG and HWM, is muck, with little peat at the most.

For AA, the HCC, HSG, and HCM map classes were assessed together. Initial AA results showed confusion among these three map classes; thus, they were combined in order to reach confidence standards. These map classes were, however, left as separate entities in the vegetation map layer.





Northern Sedge Wet Meadow (HSG)

The Northern Sedge Wet Meadow (HSG) map class represents the *Carex* (*rostrata, utriculata*) - *Carex lacustris* - (*Carex vesicaria*) Herbaceous Vegetation Association (CEGL002257) in the NVCS. This map class captures wetland meadows having emergent herbaceous vegetation but wherein the RD of sedges to herbaceous vegetation (including bluejoint) is >25%. These sedge-dominated wetland meadows can occur on sandscapes and within bays in close proximity to shorefens or can occur more inland, in association with beaver meadows. When the RD of sedges to herbaceous vegetation was <25%, either the Bluejoint Wet Meadow (HCC) map class or the Wet Meadow Mixed Herbaceous (HWM) map class were considered, depending on density of herbaceous components present. It is noteworthy that when we were unable to determine the amount of bluejoint component relative to sedges from aerial photographs, HSG was typically the default map class.

The soil substrate of HSG, similar to that of HCC and HWM, is mostly muck; however, some peat build up is common to HSG. When the substrate is more peat-based and less muck, or when it is located on sandscapes receiving minerotrophic water influence from Lake Superior (indirectly as it might be) the Wiregrass Sedge Shore Fen (HSS) map class was considered.

For AA, the HCG, HSC, and HCM map classes were assessed together. Initial AA results showed confusion among these three map classes; thus, they were combined in order to reach confidence standards. These map classes were, however, left as separate entities in the vegetation map layer.





Dogwood - Willow Swamp (SDW)

The Dogwood - Willow Swamp (SDW) represents the Cornus sericea - Salix spp. - (*Rosa palustris*) Shrubland Association (CEGL002186) in the NVCS. This map class captures swamp shrublands having >25% shrub cover dominated by red-osier dogwood and willows. If present at all, the RD of gray alder to shrubs is <25%. When the RD of alder to shrubs was >25%, the Gray Alder Swamp Shrubland (SAS) map class was considered. SDW can be in perched basins, streambeds, and sandscapes.

When shrubs contributed <25% cover, other herbaceous wetland map classes were considered, including Bluejoint Wet Meadow (HCC), Northern Sedge Wet Meadow (HSG), and Wet Meadow Mixed Herbaceous (HWM), depending on herbaceous components and site locations. When sites were more fen-like with sweetgale prominent, either the Sweet Gale Shrub Fen (SFF) map class or the Bog Birch - (Willow species) Saturated Shrubland (SBB) map class was considered, depending on the RD of bog birch present.

For AA, the SDW map class was assessed independently of all other map classes.





Northern Water-lily Aquatic Wetland (HFA)

The Northern Water-lily Aquatic Wetland (HFA) map class represents the *Nymphaea odorata - Nuphar* (*microphylla*, *variegata*) Herbaceous Vegetation Association (CEGL002562) in the NVCS. This map class captures deep water marshes wherein floating-leaved aquatic vegetation (mostly of yellow pond-lily and watershield) contributes >10% cover, with emergent vegetation contributing <10% cover. Submergent vegetation, such as floating pondweed, may be of high density. HFA vegetation is customary to small ponds, and most sites are located landward and are formed in response to beaver activity, but HFA also occurs on sandscapes of Lake Superior.

Much of the floating aquatic and submergent vegetation had senesced before aerial photography was collected in October; thus, observable appearances on the aerial photographs were minimal. Sites of HFA were mapped when floating aquatic vegetation was observable on the fall aerial photographs. Based on field experience, it is expected that more 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 are captured with the Midwest Pondweed Submerged Aquatic Wetland (HSV) map class, because HSV shares the same deep water marsh environment. Readers should 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 and HSV map classes were assessed together because of the senesced condition of both types of vegetation, which are found within the same deep marsh environments. These map classes were, however, left as separate map-class entities in the vegetation map layer.



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) of the NVCS. This map class captures deep water marshes wherein submergent vegetation (most commonly floating-leaved pondweed) contributes >10% cover, with emergent herbaceous vegetation and floating-leaved aquatic vegetation each contributing <10% cover. HSV vegetation is customary to small ponds, and most sites are located are landward and are formed in response to beaver activity, but HSV also occurs on sandscapes of Lake Superior.

Much of the submergent and floating aquatic vegetation had senesced before aerial photography was collected in October; thus, observable appearances on the aerial photographs were minimal. Sites of HSV were mapped when submergent vegetation was observable on the fall aerial photographs. Based on field experience, it is expected that more HSV in areas greater than the size of a MMU existed at the time photography was obtained than what could actually be observed on the photographs. Thus, the approach in mapping most ponds was to assign the HSV map class even when appearance of submergent vegetation was lacking. This was an aggressive effort to map HSV based on likely locations. Again, this 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.

When open water bodies <8 ha in area were determined to be too deep for submergent and floating aquatic vegetation to grow, the Open Water Pond (NWP) map class was considered. In areas larger than 8 ha, the Open Water Lake (NWL) map class was considered. The NWP and NWL map classes are not represented in the NVCS.

Because floating aquatic vegetation was also senesced at the time photography was obtained, we assume that some Northern Water-lily Aquatic Wetland (HFA) units were captured within the HSV map class, because HFA shares the same deep water marsh environment.

For AA, the HSV and HFA map classes were assessed together because of the senesced condition of both types of vegetation, which are found within the same deep marsh environments. These classes were, however, left as separate map-class entities in the vegetation map layer.



Inland Freshwater Strand Beach (VAV)

The Inland Freshwater Strand Beach (VAV) map class represents the Inland Freshwater Strand Beach Sparse Vegetation Association (CEGL002310) in the NVCS. This map class captures exposed sand flats with a sparse layer of vegetation, located along margins of interior lakes (but not of Lake Superior). Vegetation is in a pioneering state and consists of herbaceous species, as well as some woody shrub and tree saplings. The best examples of VAV are at Beaver Lake. Some VAV areas were likely too small to map (well below the size of a MMU). In these cases, other wetland map classes, including Open Water Lake (NWL), were used to capture VAV (as inclusions). When on exposed mudflats, the Lake Mudflats (VMF) map class was considered. It is noteworthy that both VAV and VMF are found in similar settings as is Water Horsetail - Spikerush Marsh (HHT).

For AA, the VAV map class was assessed independently of all other map classes.



Lake Mudflats (VMF)

The Lake Mudflats (VMF) map class represents the Lake Mudflats Sparse Vegetation Association (CEGL002313) in the NVCS. This map class captures exposed mudflats with a sparse layer of vegetation, located along margins of interior lakes (but not of Lake Superior). Vegetation is in a pioneering state and consists of herbaceous species, as well as some woody shrubs and tree saplings. The best examples of VMF are at Beaver Lake. Some sites of VMF were likely too small to map (well below the size of a MMU). In these cases, other wetland map classes, including Open Water Lake (NWL), were used to capture VMF (as inclusions). When on exposed sandflats, the Inland Freshwater Strand Beach (VAV) map class was considered. It is noteworthy that both VMF and VAV are found in similar settings as is Water Horsetail - Spikerush Marsh (HHT).

For AA, the VBS map class was assessed independently of all other map classes.



Eroding Clay Bank (N/A)

Because they are too small to map (well below the size of a MMU), no map class was derived for the Eroding Clay Bank vegetation type, which is the Eroding Clay Bank Sparse Vegetation Association (CEGL002584) in the NVCS. Thus, where sites of this vegetation type exist, other map classes would have captured them as inclusions. Sites of Eroding Clay Bank were likely mapped as an inclusion within the Great Lakes Shore Sandstone Cliff (VSC) map class. Eroding Clay Bank would be found as eroding embankments above the shoreline of Lake Superior, usually with sparse vegetation (mostly herbaceous) contributing <10% cover.

Because of the lack of a map class for this vegetation type, the Eroding Clay Bank was not assessed for accuracy.

No representative pictures are available.

Inland Limestone Pavement (N/A)

Because they are too small to map (well below the size of a MMU), no map class was derived for the Inland Limestone Pavement vegetation type, which is the Sandstone Midwest Moist Cliff Sparse Vegetation Association (CEGL002287) in the NVCS. Thus, where sites of this vegetation type exist, other map classes would have captured them as inclusions. Sites of Inland Limestone Pavement were likely mapped as an inclusion within the Maple - Yellow Birch Northern Hardwoods Forest map class (four phases, including FMB, FMY, FMF, and FMM). These small limestone outcrops are located landward (not along Lake Superior).

Because of the lack of a map class for this vegetation type, the Inland Limestone Pavement was not assessed for accuracy.

No representative pictures are available.

Great Lakes Sandstone Bedrock Shore (VBS)

The Great Lakes Sandstone Bedrock Shore (VBS) map class represents the Sandstone Bedrock Great Lakes Shore Sparse Vegetation Association (CEGL002507) in the NVCS. This map class captures sandstone bedrock ledges along the shores of Lake Superior. These flat ledges are near level (usually within 3 m) in elevation compared to Lake Superior; thus, these areas receive direct lake moisture from wave action and the splashing thereof. Although they include sparse vegetation contributing <10% cover, these bedrock shores are home to a variety of plants, mostly herbaceous but also including dwarf shrubs, mosses, and lichens. These plants take hold in small cracks and crevices within the sandstone bedrock ledges.

Common within the VBS class are inclusions (areas smaller than the size of a MMU) of Great Lakes Shore Sandstone Cliff (VSC), which are sandstone ledges nearer the elevation of Lake Superior. When in areas of MMU size, the VSC map class was used.

For AA, the VBS map class was assessed independently of all other map classes.





Great Lakes Shore Sandstone Cliff (VSC)

The Great Lakes Shore Sandstone Cliff (VSC) map class represents the Sandstone Great Lakes Shore Cliff Sparse Vegetation Association (CEGL002503) in the NVCS. This map class captures sandstone bedrock cliffs and ledges located directly above the shores of Lake Superior. These cliffs and ledges are elevated >3 m above the lake; thus, they receive little direct lake moisture. These are the Pictured Rocks for which the national lakeshore is named. Although they include sparse vegetation contributing <10% cover, these bedrock cliffs are home to a variety of plants, which are mostly herbaceous but also include dwarf-shrubs, mosses, and lichens. These plants take hold in small cracks and crevices within the sandstone bedrock ledges.

Common within the VSC class are inclusions (areas smaller than the size of a MMU) of Great Lakes Sandstone Bedrock Shore (VBS), which are sandstone ledges nearer the elevation of Lake Superior. When in areas of MMU size, the VBS map class was used.

For AA, the VSC map class was assessed independently of all other map classes.





Midwest Moist Sandstone Cliff (N/A)

Because they it occurs in areas too small to map (well below the size of a MMU), no map class was derived for the Midwest Moist Sandstone Cliff vegetation type, which is the Sandstone Midwest Moist Cliff Sparse Vegetation Association (CEGL002287) in the NVCS. Thus, where sites of this vegetation type exist, other map classes would have captured them as inclusions. Sites of Midwest Moist Sandstone Cliff were likely mapped as inclusions within various forest map classes. Many sites were likely mapped within the Maple - Yellow Birch Northern Hardwoods Forest map class (four phases, including FMB, FMY, FMF, and FMM). These steep, vertical sandstone cliffs occur landward (not along Lake Superior). The cliffs are usually >3 m high, and the sparse, yet diverse, herbaceous layer is restricted to rock crevices and small ledges.

Because of the lack of a map class for this vegetation type, the Midwest Moist Sandstone Cliff was not assessed for accuracy.

No representative pictures are available.

Deciduous Orchard (FOD)

The Deciduous Orchard (FOD) map class falls under the Agricultural Vegetation Cultural Class (7) in the NVCS, wherein it is defined down to Level 6, Fruit - Orchards Subgroup. This map class captures an old orchard within the 400-m buffer beyond the PIRO boundary near Grand Marais.

Because the FOD is a cultural vegetation map class, it was not assessed for accuracy.

No representative pictures are available.

Developed Area (NDV)

The Developed Area (NDV) map class falls under the Developed Vegetation Cultural Class (8) in the NVCS, wherein it is defined down to Level 3, Other Developed Urban / Built Up Vegetation Formation. From there, finer break outs 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 National Land Cover Database (NLCD 2001). The NDV map class captures areas having regular anthropogenic use. Examples at the PIRO include roads and their right-of-ways, urban areas, homesteads and farmsteads, campgrounds, picnic areas, and various PIRO grounds (such as lighthouses, ranger stations, visitor centers, headquarters, and building structures).

The following sections describe NLCD classes 21–24, which were used to further attribute (using a special modifier) the NDV map class. The High Intensity (24) class was not used for the mapping of PIRO, yet remains included here for completeness and comparison purposes. Definitions are taken from the NLCD.

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.

No representative pictures are available.

Because NDV is a cultural vegetation map class, it was not assessed for accuracy.

Stream & River (NSR)

The Stream & River (NSR) map class represents, in part, the Open Water (11) class in the NLCD 2001. This map class captures open water streams and rivers. Submergent aquatic vegetation may be sparsely present (usually in shallow waters close to shorelines), but sites should have <10% vegetated. When submergent vegetation contributed >10% cover, the Midwest Pondweed Submerged Aquatic Wetland (HSV) map class was considered. Some examples of NSR are Hurricane River, Miners River, Mosquito River, and Sevenmile Creek.

Because NSR is a non-vegetation map class, 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 2001. This map class captures open water bodies <8 ha in area. When areas >8 ha, the Open Water Lake (NWL) map class was considered, which also represents, in part, the Open Water (11) class in the NLCD. These ponds are usually deep enough such that vegetation is unable to take root. Wetland vegetation—emergent and/or aquatic—may be present (usually in shallow waters close to shorelines) but should contribute <10% cover.

Usually, shallow ponds within beaver meadows and sandscape lagoons provide an environment for wetland vegetation to thrive, and some with aquatic vegetation. Much of the aquatic vegetation had senesced before aerial photography was collected in October; therefore, in many instances, observable appearances were lacking on the aerial photographs. This posed a problem for mapping the Midwest Pondweed Submerged Aquatic Wetland (HSV) and Northern Water-lily Aquatic Wetland (HFA) classes. During field observations, most shallow ponds appearing as open water on the aerial photographs were found to have aquatic vegetation. Thus, the approach in 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 NWP is a non-vegetation map class, it was not assessed for accuracy.

No representative pictures are available.

Open Water Lake (NWL)

The Open Water Lake (NWL) map class represents, in part, the Open Water (11) class in the NLCD 2001. This map class captures open water bodies that are >8 ha in area and have <10% vegetation present. When areas were <8 ha in size, the Open Water Pond (NWP) map class was considered, which also represents, in part, the Open Water (11) class in the NLCD. The NWL map class captures, in essence, the Lake Superior waters along PIRO, as well as interior lakes more landward, including Beaver Lake, Grand Sable Lake, Kingston Lake, Legion Lake, Little Beaver Lake, and Trappers Lake.

Because NWL is a non-vegetation map class, it was not assessed for accuracy.







Sand & Cobble Beach (NSB)

The Sand & Cobble Beach (NSB) map class represents the Barren Land (31) class in the NLCD 2001. This map class captures sand and cobble shorelines along Lake Superior that largely lack vegetation. These locations have persistent and direct impacts from Lake Superior such that vegetation types cannot establish. When vegetation was present, particularly on sandy beaches with American beachgrass as the primary vegetation, the Great Lakes Beachgrass Dune (HAB) map class was considered.

Because NSB is a non-vegetation map class, it was not assessed for accuracy.



Table E-2. Map classification listing, sorted alphabetically by map-class code, used for the Pictured Rocks National Lakeshore vegetation mapping project.

Map-class Code	Map-class Name
DBH	Great Lakes Beach-heather Dune Dwarf-shrubland
DJD	Great Lakes Juniper Dune Shrubland
DLF	Leatherleaf Poor Fen
DLS	Leatherleaf - Sweetgale Shore Fen
FBA	Black Ash - Mixed Hardwood Swamp (black ash phase)
FBS	Black Spruce / Feathermoss Forest
FCA	White-cedar - Black Ash Swamp
FCC	White-cedar - Boreal Conifer Mesic Forest (conifer phase)
FCM	White-cedar - Boreal Conifer Mesic Forest (conifer - hardwood phase)
FCP	Spruce - Fir - Aspen Forest
FCS	White-cedar - (Mixed Conifer) / Alder Swamp
FCX	Conifer Ruderal Forest
FDX	Hardwood Ruderal Forest
FFB	Balsam Fir - Paper Birch Forest
FGF	Paper Birch / Fir Forest
FHB	Great Lakes Hemlock - Beech - Hardwood Forest
FHC	Hemlock Mesic Forest
FHM	North-Central Hemlock - Hardwood Forest
FHS	Hemlock - Yellow Birch Swamp Wet-Mesic Forest
FJB	Jack Pine / Blueberry / Feathermoss Forest
FJF	Jack Pine / Balsam Fir Forest
FJM	Jack Pine - Aspen / Bush-honeysuckle Forest
FLD	Black Ash - Mixed Hardwood Swamp (lowland phase)
FMB	Maple - Yellow Birch Northern Hardwoods Forest (classic phase)
FMF	Maple - Yellow Birch Northern Hardwoods Forest (balsam fir shrub phase)
FMM	Maple - Yellow Birch Northern Hardwoods Forest (sugar maple phase)
FMX	Conifer - Hardwood Ruderal Forest
FMY	Maple - Yellow Birch Northern Hardwoods Forest (yew phase)
FOD	Deciduous Orchard
FPB	White Pine - Mixed Deciduous / Bracken Barren Forest and Scrub (forest phase)
FPD	Great Lakes Dune Pine Forest
FPE	Conifer Plantation
FRA	Red Pine - Aspen - Birch Forest
FRP	Red Pine / Blueberry Dry Forest
FSF	Spruce - Fir / Mountain Maple Forest
FSS	Black Spruce - Tamarack / Labrador-tea Poor Swamp (black spruce phase)
FTS	Black Spruce - Tamarack / Labrador-tea Poor Swamp (tamarack phase)
FWA	White Pine - Aspen - Birch Forest
FWH	Great Lakes White Pine - Hemlock Forest
FWM	White Pine - Red Maple Swamp (swamp phase)

Map-class Code	Map-class Name
FWO	White Pine - Red Oak Forest
FWP	White Pine / Blueberry Dry-Mesic Forest
FWW	White Pine - Red Maple Swamp (swamp - dune mosaic phase)
HAB	Great Lakes Beachgrass Dune
HCC	Bluejoint Wet Meadow
HCM	Midwest Mixed Emergent Deep Marsh
HFA	Northern Water-lily Aquatic Wetland
HHT	Water Horsetail - Spikerush Marsh
HMX	Ruderal Grassland
HPB	Great Lakes Coast Pine Barrens (barrens phase)
HPW	Great Lakes Coast Pine Barrens (woodland phase)
HSG	Northern Sedge Wet Meadow
HSP	Northern Sedge Poor Fen
HSS	Wiregrass Sedge Shore Fen
HSV	Midwest Pondweed Submerged Aquatic Wetland
HWM	Wet Meadow Mixed Herbaceous
N/A	White-cedar Seepage Swamp
NDV	Developed Area
NSB	Sand & Cobble Beach
NSR	Stream & River
NWL	Open Water Lake
NWP	Open Water Pond
SAS	Gray Alder Swamp Shrubland
SBB	Bog Birch - (Willow species) Saturated Shrubland
SCW	Sand Cherry Dune Shrubland
SDW	Dogwood - Willow Swamp
SMX	Ruderal Shrubland
SSF	Sweet Gale Shrub Fen
SSS	White Pine - Mixed Deciduous / Bracken Barren Forest and Scrub (scrub phase)
VAV	Inland Freshwater Strand Beach
VBS	Great Lakes Sandstone Bedrock Shore
VMF	Lake Mudflats
VSC	Great Lakes Shore Sandstone Cliff
WCD	Cottonwood Dune Open 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 contingency matrix for the Pictured Rocks National Lakeshore 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. (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.)

The columns represent vegetation types in the National Vegetation Classification Standard (NVCS). These columns tabulate the producer's 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																																													COMISSION			
	MAP CODES	FPD	FJF	FJB	FRP	FWP	FWH	FCC, FCM	FBS	FFB	FSF	FSS, FTS, FCS	FHS	FMB, FMY, FMF, FMM, FLD, FBA	FGF	WCD	FPB, SSS	FJM	FRA	FWA	FWO	FHC	FHM, FHB	FCP	FWM, FWW	FCA	SCW	SAS	SDW	SBB	SSF	DBH	DJD	DLS, DLF	HAB	HWM	HSG, HCC, HCM	HSS	HSP	HPB, HPW	HBF	HHT	HSV, HFA	VSC	VBS	VAV	VMF	TOTAL	USERS' ACCUR-ACY	90% Confidence Intervals	
MAP DATA - PREDICTION DATA	FPD	2									1																																					3	67%	5%	128%
	FJF		5																																													5	100%	90%	110%
	FJB	1	1	26	1																																			2								31	84%	71%	96%
	FRP			2	28	1																																										31	90%	80%	101%
	FWP				2	23	1										2						1																	2								31	74%	60%	89%
	FWH						4																																									4	100%	88%	113%
	FCC, FCM							21				1	2	5									3	3																								35	60%	45%	75%
	FBS		1	4					5			3					2																							1								16	31%	9%	53%
	FFB								1	3										1																												5	60%	14%	106%
	FSF								1		2	1																												1								5	40%	-6%	86%
	FSS, FTS, FCS							1				58												1		2								1														63	92%	86%	98%
	FHS							1				1	2																																			4	50%	-4%	104%
	FMB, FMY, FMF, FMM, FLD, FBA							4		1				56									2																									63	89%	82%	96%
	FGF														2																																	2	100%	75%	125%
	WCD															2																																2	100%	75%	125%
	FPB, SSS				1	1					1						45																															48	94%	87%	101%
	FJM								1								1	2						1																								5	40%	-6%	86%
	FRA				2	2				2				1	1	1	2		14	3																												28	50%	33%	67%
	FWA						2			1				1	3		1		1	17		1	5																									32	53%	37%	69%
	FWO																				6																											6	100%	92%	108%
	FHC						2					2	1									24																										29	83%	69%	96%
	FHM, FHB							5		1			1	8									40	2																								57	70%	59%	81%
	FCP	1											1	4		1				2				16			1		2																			28	57%	40%	74%
	FWM, FWW												2												4																							6	67%	27%	107%
	FCA							8				1	1	2									1			15																						28	54%	36%	71%
	SCW																										4								1													5	80%	41%	119%
	SAS																											20						1														21	95%	85%	105%
	SDW																											2	2								1											5	40%	-6%	86%
	SBB																													1																		1	100%	50%	150%
	SSF																														1																	1	100%	50%	150%
	DBH																										1					2																3	67%	5%	128%
	DJD																																5															5	100%	90%	110%
	DLS, DLF											1																5			2			23			2											33	70%	55%	84%
	HAB															2																			23											1		26	88%	76%	101%
	HWM											1		1														1								21	1		1									26	81%	66%	95%
	HSG, HCC, HCM																																	2			24	3	1									30	80%	66%	94%
	HSS																																				3	2										5	40%	-6%	86%
	HSP																																	1					2			1						4	50%	-4%	104%
	HPB, HPW																																							31								31	100%	98%	102%
	HBF																3																								27							30	90%	79%	101%
	HHT																																				2					3						5	60%	14%	106%
	HSV, HFA																																										4					4	100%	88%	113%
	VSC																																											5				5	80%	41%	119%
	VBS																																												2			2	100%	75%	125%
	VAV																																	1												2		3	67%	5%	128%
	VMF																																														1	1	100%	50%	150%
OMISSION	Total	4	7	32	34	27	9	40	8	8	4	69	10	78	6	6	56	2	15	23	6	25	52	23	4	17	6	28	4	1	3	2	5	29	24	21	33	5	4	37	27	4	4	5	2	3	1	813			
	PRODUCERS' ACCURACY	50%	71%	81%	82%	85%	44%	53%	63%	38%	50%	84%	20%	72%	33%	33%	80%	100%	93%	74%	100%	96%	77%	70%	100%	88%	67%	71%	50%	100%	33%	100%	100%	79%	96%	100%	73%	40%	50%	84%	100%	75%	100%	100%	100%	67%	100%	626			
	90% Confidence Interval -	-4%	36%	68%	70%	72%	12%	38%	28%	3%	-4%	76%	-6%	63%	-7%	-7%	71%	75%	79%	57%	92%	88%	66%	52%	88%	72%	27%	56%	-4%	50%	-28%	75%	90%	65%	87%	98%	58%	-6%	-4%	72%	98%	27%	88%	90%	75%	5%	50%	Total Samples = 813			
	90% Confidence Interval +	104%	107%	94%	95%	98%	77%	67%	97%	72%	104%	92%	46%	81%	73%	73%	90%	125%	107%	91%	108%	104%	87%	88%	113%	104%	107%	87%	104%	150%	95%	125%	110%	93%	105%	102%	87%	86%	104%	95%	102%	123%	113%	110%	125%	128%	150%	Total Correct = 626			

OVERALL ACCURACY = 77.1% KAPPA INDEX = 76.0% KAPPA INDEX LOWER 90% CONFIDENCE LEVEL = 73.5% KAPPA INDEX UPPER CONFIDENCE LEVEL = 78.6%

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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National Park Service
U.S. Department of the Interior

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