National Park Service
Vegetation Inventory Program
Indiana Dunes National Lakeshore, Indiana



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Vegetation Inventory Program
Indiana Dunes National Lakeshore, Indiana

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U.S. Geological Survey
Upper Midwest Environmental Sciences Center

and

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NatureServe

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National Park Service
Vegetation Inventory Program
Indiana Dunes National Lakeshore, Indiana

by

Kevin Hop, Jim Drake, Sara Lubinski, Jennifer Dieck, and Shannon Menard

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 Monitory 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, and NPS Indiana Dunes National Lakeshore, have completed the classification and mapping of plant communities of Indiana Dunes National Lakeshore (INDU, also referred to as Lakeshore) and immediate surroundings.

Photointerpreters, ecologists, and botanists collaborated to describe National Vegetation Classification (NVC) System plant associations (communities) and determine how best to map them using aerial photographs. The team collected 190 vegetation sampling plots within the Lakeshore project extent. Furthermore, data from 484 accuracy assessment (AA) sites were collected (of which 469 were used to test the vegetation map layer accuracy). These data sets led to the identification of 38 NVC plant communities at the Lakeshore plus several more NVC alliance and formation types that could not be described at the association level.

Sixty-seven map classes were developed to map the vegetation and general land cover of INDU and environs, with 56 of them representing vegetation types at various levels in the NVC (association, alliance, and formation). The other 11 map classes depict general land cover; 4 representing non-vegetated land cover and 7 representing developed areas. Features were interpreted using high-quality stereoscopes over light tables and 1:12,000-scale color infrared (CIR) aerial photographs dated October 2004 (fall leaf-change). Polygon units were mapped to 0.5 ha (1.25 acres) minimum mapping unit (MMU) and, for specific wetland map units within the West unit, to 0.1 ha (0.24 acres) MMU. Another set of 1:6,000-scale CIR aerial photographs dated October 2004 were used to aid interpretation mapping of the West unit's MMU. An ancillary set of 1:12,000-scale true color aerial photos dated April 2005 (leaf-off) covering the entire Lakeshore 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 (GIS).

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 photograph centers. The INDU vegetation map feature class layer provides 4,023 polygons of detailed attribute data covering 13,259.1 ha (32,764.0 acres), with an average polygon size of 3.3 ha (8.1 acres). Of the area mapped, 3,527 polygons (87.7%) represent NVC vegetation types, encompassing 8,421.8 ha (20,810.6 acres; 63.5%) of the total map extent. With a 400-meter buffer environs, the Lakeshore lands account for approximately 46% of the entire map extent.

Summary reports generated from the vegetation map layer indicate forest types dominate the vegetative landscape (NVC types), populating 50.9% of the polygons and covering 61.6% of the area, and are largely dominated by the Black Oak Forest community. A thematic AA study was conducted of map classes representing NVC types. Results present an overall accuracy of 78.2% (Kappa index of 76.9%) based on data from 469 of the 484 AA site data. Most individual map class themes exceed the NPS VIP standard of 80% with a 90% confidence interval.

The INDU 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 representative ground photos of vegetation types; database of vegetation plots and AA sites; field data sheets; aerial photograph prints and images; hardcopy maps; and a geodatabase of vegetation types (map layer), fieldwork locations (vegetation plots and AA sites), aerial photo indexes, and a project boundary. All geospatial products are in Universal Transverse Mercator projection, Zone 16, using 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>.

Introduction

Indiana Dunes National Lakeshore Vegetation Mapping Project

The Indiana Dunes National Lakeshore (INDU, also referred to as Lakeshore) Vegetation Mapping Project is an initiative of the National Park Service (NPS) Vegetation Inventory Program (VIP) with a cooperative support from the U.S. Geological Survey (USGS) Vegetation Characterization Program to classify and map plant communities of the Lakeshore. The goals of the project are to adequately describe and map plant communities of the Lakeshore and immediate surroundings and provide the NPS Natural Resource Inventory and Monitoring (I&M) Program, resource managers, and biological researchers with useful baseline vegetation information.

The INDU Vegetation Mapping Project is also part of a cluster approach to classify and map plant communities of the remaining park units within the I&M Great Lakes Network (GLKN). With Voyageurs National Park and Isle Royale already completed (mid-1990s), six GLKN park units needing vegetation inventory remained: 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 slightly staggered timeline, providing opportunity of drawing from results and experiences from park units of the same regional locale. The INDU effort was one of the first park units to enter the NPS VIP process, with the other park units entering the process in due time (Table 1).

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

National park unit	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 INDU project May 2004 with a scoping meeting wherein partners discussed project objectives, goals, and methods. Major collaborators at this meeting included staff from NPS INDU, NatureServe, and the USGS Upper Midwest Environmental Sciences Center. Common to all NPS VIP projects, the three major components of the INDU Vegetation Mapping Project are (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 U.S. Geological Survey (USGS) Vegetation Characterization Program 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). 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 (1.2 acres) and classification accuracy meeting or exceeding 80% (with a 90% confidence level) for map classes representing plant communities. All geospatial products are in Universal Transverse Mercator (UTM) projection using North American Datum of 1983 (NAD83).

The NPS VIP provides an array of data products (<http://biology.usgs.gov/npsveg/overview.html>). Spatial data products include aerial photographs, map classification, map classification description key, spatial database of vegetation communities, hard-copy maps of vegetation communities, metadata for spatial databases, and an accuracy assessment of the vegetation map. Vegetation information includes vegetation classification, dichotomous field key to the vegetation classes, formal descriptions and ground photos of the vegetation classes, and field data in database format. More NPS VIP information and products of completed park mapping projects are on the Internet at <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 National Park units with significant natural resources. One of the I&M Program's long-term goal 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 I&M Program baseline inventory product. More information on the I&M Program is on the Internet at <http://www1.nature.nps.gov/protectingrestoring/IM/inventoryandmonitoring.htm>.

Vegetation Inventory Program Standards

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

- National Vegetation Classification Standard (FGDC 1997),
- 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 on the Program's website (<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). The purpose of the classification standard is to ensure consistent classification of vegetation resources across regions. The use of a standardized national vegetation classification system aids effective resource stewardship by ensuring compatibility and helps widespread use of the information throughout the NPS and other Federal and state agencies.

The National Vegetation Classification Standard is hierarchical with five physiognomic levels and two floristic levels (Table 2, Grossman et al. 1998). Key attributes of the classification standard are (1) based on existing vegetation, (2) applied to natural resources, and (3) a hierarchical system defined by physiognomy and floristics (Faber-Langendoen 2001). The classification is based on the United Nations Educational, Cultural, and Scientific Organization (UNESCO) world physiognomic classification of vegetation (UNESCO 1973), which was modified to provide greater consistency at all hierarchical levels and include additional types, thus setting up the framework for the upper physiognomic levels (Grossman et al. 1998, Drake and Faber-Langendoen 1997). The lower floristic levels are devised from a national framework developed by TNC (and now maintained and revised by NatureServe) and their network of state heritage programs for more than 20 years (Grossman et al. 1998). The physiognomic-floristic classification includes all rooted vascular plants.

Table 2. National Vegetation Classification System physiognomic-floristic hierarchy for terrestrial vegetation.

Level	Primary basis for classification	Example
Class	Growth form and structure of vegetation	Woodland
Subclass	Growth form characteristics (e.g., leaf phenology)	Deciduous woodland
Group	Leaf types, corresponding to climate	Cold-deciduous woodland
Subgroup	Relative human impact (natural/semi-natural or cultural)	Natural/semi-natural
Formation	Additional physiognomic and environmental factors, including hydrology	Temporarily flooded cold-deciduous woodland
Alliance	Dominant/diagnostic species of uppermost or dominant stratum	*Populus deltoides* temporarily flooded woodland alliance
Association	Additional dominant/diagnostic species from any strata	*Populus deltoides* - (*Salix amygdaloides*) / *Salix exigua* woodland

The coarsest physiognomic level of the classification is “class” and categorizes vegetation on its most basic physiognomic structure (e.g., forest, woodland, shrubland). The finest physiognomic level is “formation” and categorizes vegetation by dominance of a given growth form in the uppermost stratum and characteristics of the environment (e.g., cold-deciduous alluvial forests).

The two floristic levels are alliance and association and are the two finest levels of the classification standard. These levels are based on species composition (Maybury 1999) and are developed from dominant or diagnostic species rather than physiognomic patterns of dominant species (Grossman et al. 1998). Faber-Langendoen (2001) explains dominant species as plant species of predominance in a community because of its size, abundance, or coverage. Characteristic (diagnostic) species, in contrast, are plant species commonly found in a particular community and are used in the delimitation of that community. An alliance type has been described as a group of physiognomically uniform plant associations sharing dominant or diagnostic species, usually in the uppermost strata of the vegetation (see Mueller-Dombois and Ellenberg 1974 as cited in Drake and Faber-Langendoen 1997), e.g., *ABIES*

LASIOCARPA - PICEA ENGELMANNII FOREST ALLIANCE. The association is the finest level in the classification and has been defined as “a plant community of definite floristic composition, uniform habitat conditions, and uniform physiognomy” (see Flahault and Schroter 1910 in Morovac 1993 as cited in Drake and Faber-Langendoen 1997), e.g., *Abies lasiocarpa - Picea engelmannii* / *Acer glabrum* Forest. Most schools of floristic classification have used this concept. The classification standard is hereafter referred to as the National Vegetation Classification (NVC).

Noteworthy, the NVC has undergone a major revision by the FGDC Vegetation Subcommittee, which included adjustments to the classification hierarchical structure (FGDC 2008). The 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. The revised NVC version replaces the 1997 version (FGDC 1997). However, at the time of product development for INDU, association and alliance level types of the GLKN region had yet to be formalized into the new hierarchy structure. Thus, the INDU products and this report follow the 1997 version of the NVC.

Content Standard for Digital Geospatial Metadata

Metadata are data about data and describe the content, quality, condition, and other characteristics of 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).

Indiana Dunes National Lakeshore

Location and Brief History

The Indiana Dunes National Lakeshore is located in northwest Indiana on the southern shores of Lake Michigan between Gary and Michigan City (Figure 1). The Lakeshore comprises an area of over 6,073 ha (15,000 acres), and shares the landscape with Indiana Dunes State Park and several industrial sites. Indiana Dunes National Lakeshore is divided into two larger units (East and West), and five smaller units (Calumet Prairie, Heron Rookery, Hobart Prairie Grove, Hoosier Prairie, and Pinhook Bog).



Figure 1. Location of Indiana Dunes National Lakeshore in Indiana.

The Lakeshore was authorized in 1966 by the 89th U.S. Congress after a long history of events—dating back to 1899—to preserve the dunal landscape and the high biological diversity it offers. At its birth, the lakeshore consisted of 3,371 ha (8,330 acres), and four expansions followed (1976, 1980, 1986, and 1992) to increase the size of the Lakeshore to what it is today.

Landscape Setting

Although the Lakeshore is generally flat, there is local topographic relief in dunes, moraines, and ravines. The Lakeshore embraces about 15 miles of Lake Michigan shoreline. Active dunes, dune complexes, wetlands, rivers, forests, savanna, former sand mines and residential developments, and farmland further describe the setting the Lakeshore encamps.

The vegetation of the lakeshore is diverse and rich, a compilation from complex geological processes and a convergence of several North American life zones. In addition, a long cultural history altering the vegetation has contributed to a complex vegetation mosaic between native habitats and anthropogenic uses (Figure 2).



Figure 2. Convergence of native and anthropogenic habitats.

The East unit is characterized mostly by wetlands and mesophytic forests. The West unit is characterized largely by savanna and oak forests. The East and West units are diverse in nature, whereas the smaller satellite units, albeit less diverse and further away from Lake Michigan, each have their unique contributions to the Lakeshore. Calumet Prairie, situated just north of the channelized Little Calumet River, is a mosaic of wet prairie and marsh. Heron Rookery is primarily of beech-maple and floodplain forests with the Little Calumet River running through it. Hobart Prairie Grove provides a small remnant bluff prairie, and is mostly a mosaic of oak savanna, woodland, and forest. Hoosier Prairie is a mosaic of oak savanna, mesic prairie, and wetlands. Pinhook Bog is a mat of sphagnum moss fed by an underground water source in contact with limestone bedrock.

Project Overview

General Process

The three main components of the INDU Vegetation Mapping Project are (1) vegetation classification, (2) vegetation mapping, and (3) map accuracy assessment (AA). Our objectives were to identify and map existing vegetation communities of the Lakeshore and immediate environs.

Color infrared (CIR) aerial photographs of the study area were collected in fall 2004, providing aerial photographs for project fieldwork activities. True color (TC) aerial photographs were also collected in spring 2005. The project scoping meeting was held in May 2005 at INDU headquarters near Porter, Indiana. At this meeting, primary partners met to discuss and plan the project.

During summer 2005, field crews 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 the following winter. The analyses provided detailed ecological information to affirm plant communities at the Lakeshore and document them with local descriptors. The vegetation classification was later modified with additional field reconnaissance data of INDU, vegetation samples from other ongoing park units within the Great Lakes Network (GLKN), and accuracy assessment (AA) site data of INDU.

An understanding of plant communities is essential for mapping them. As vegetation concepts became known from either field or lab, we applied them to our photointerpretation mapping. Before mapping, we performed field reconnaissance trips throughout summer 2006 to correlate vegetation types to their appearances on the aerial photographs. This ultimately resulted in the development of the map classification and conventions.

We completed a draft version of the vegetation map—a spatial database layer—for the AA. Field crews collected field data (stratified and randomly selected) for evaluating the accuracy of vegetation map layer. Results are tabulated into a contingency matrix.

Ultimately, we developed a geodatabase containing five feature classes: vegetation points (containing vegetation sample points and accuracy assessment sites), vegetation polygon map, 1:12,000-scale CIR aerial photograph centers, 1:6,000-scale CIR aerial photograph centers, and project extent boundary. 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 at INDU headquarters May 2–4, 2005. Various cooperators joined together to discuss the project's objectives and methods, receive assignments, and view first hand INDU's landscape (Figure 3). Individuals from NPS INDU, USGS UMESC, and NatureServe met to

- Inform INDU staff and interested neighbors of the classification and mapping project,
- Learn about INDU's management and science issues and concerns,
- 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 3. Scoping meeting participants viewing firsthand the Lakeshore's landscape.

Project Boundary and Map Extent

The mapping project includes all INDU lands plus a 400-meter buffer (Figure 4). This includes the two larger units, East and West, and the five smaller units, Calumet Prairie, Heron Rookery, Hobart Prairie Grove, Hoosier Prairie, and Pinhook Bog. Although portions of Indiana Dunes State Park fall outside the 400-meter buffer, the entire state park is included in the project boundary.

The total map extent is 13,264.9 ha (32,778.2 acres), including all INDU lands and extended environs. The Lakeshore comprises about 6,070 ha (15,000 acres; 46%) of the total map area, with the remaining 7,195 ha (17,778 acres; 54%) being environs. We produced a feature class layer showing the extent of the project boundary and incorporated it into the project's geodatabase.

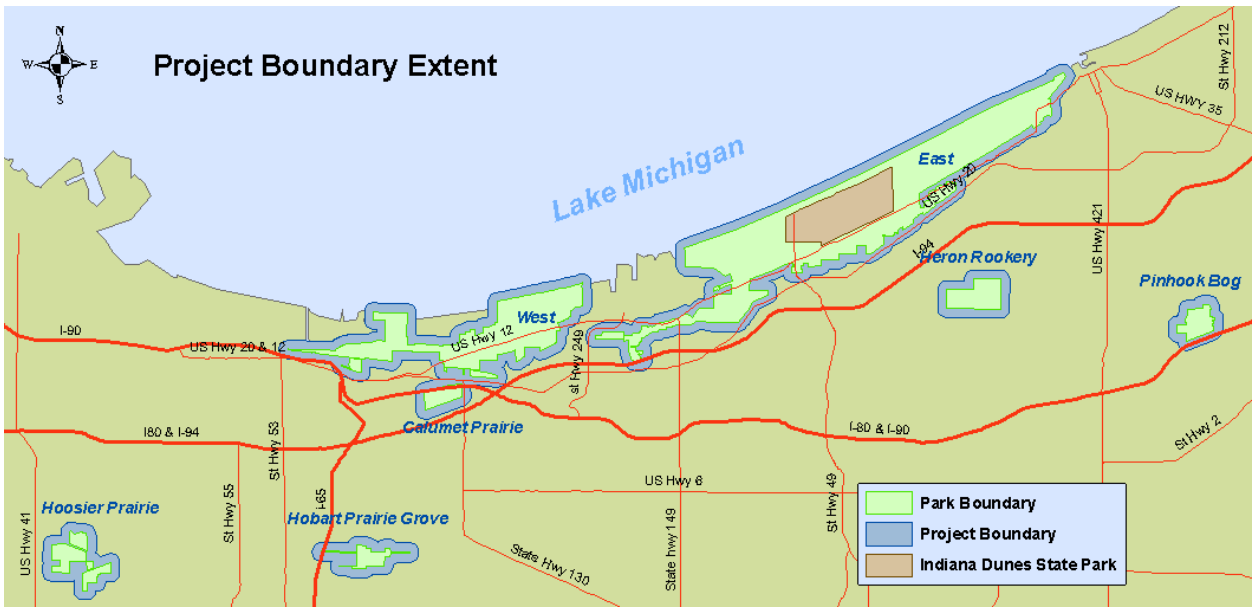


Figure 4. Project boundary extent for the Indiana Dunes National Lakeshore Vegetation Mapping Project.

Aerial Photography

Essential for each NPS VIP project is aerial photography. Aerial photographs provide the baseline imagery data for mapping plant communities and other landscapes. 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). As ecological 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 are available to choose from and Avery (1978) concludes no single film emulsion serves all purposes. Our aim with collecting aerial photography for the INDU project was to capture peak leaf color change, aiding mapping in viewing distinctions between various deciduous forest types.

Two sets of CIR aerial photographs were collected October 21 and 24, 2004, funded by the NPS VIP and the photo mission supervised by GLKN staff. One set was collected of the entire project extent at 1:12,000-scale. The other set was collected of the West unit at 1:6,000-scale to allow for finer detailed interpretation of West unit wetlands; the 1:12,000-scale set was the primary imagery used in photointerpretation mapping.

In support of mapping CIR photos, TC aerial photographs were collected April 2, 2005, providing deciduous leaf-off viewing of the entire project 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 otherwise obscured by deciduous tree canopy on the fall CIR, 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 (9 x 9-inch) of both CIR and TC sets were produced for fieldwork use by mappers and vegetation crews. Diapositives of the CIR sets (both scales) were produced for photointerpretation mapping.

Table 3 gives details to the aerial photography acquired for the INDU Vegetation Mapping Project.

Table 3. Aerial photography sets for the Indiana Dunes National Lakeshore Vegetation Mapping Project.

Photography date	Film type	Scale	Photos	Products	Company
October 21–24, 2004	CIR Transparency (Positive)	1:12,000	222	Contact Print Diapositive Orthophotograph	Williams Aerial & Mapping, Inc. for JFNew
October 24, 2004	CIR Transparency (Positive)	1:6,000	120	Contact Print Diapositive	Williams Aerial & Mapping, Inc. for JFNew
April 2, 2005	TC Transparency (Positive)	1:12,000	240	Contact Print Orthophotograph	Williams Aerial & Mapping, Inc. for JFNew

We produced feature class layers showing the locations of aerial photograph centers for the October 2004 CIR aerial photograph sets (both scales). The CIR photo feature classes are incorporated into the project's geodatabase. Figure 5 shows center locations of the October 2004 CIR 1:12,000-scale aerial photographs and Figure 6 shows center locations of the October 2004 1:6,000-scale aerial photographs. In addition, we produced digital orthophotograph mosaics of the October 2004 CIR 1:12,000-scale aerial photographs.

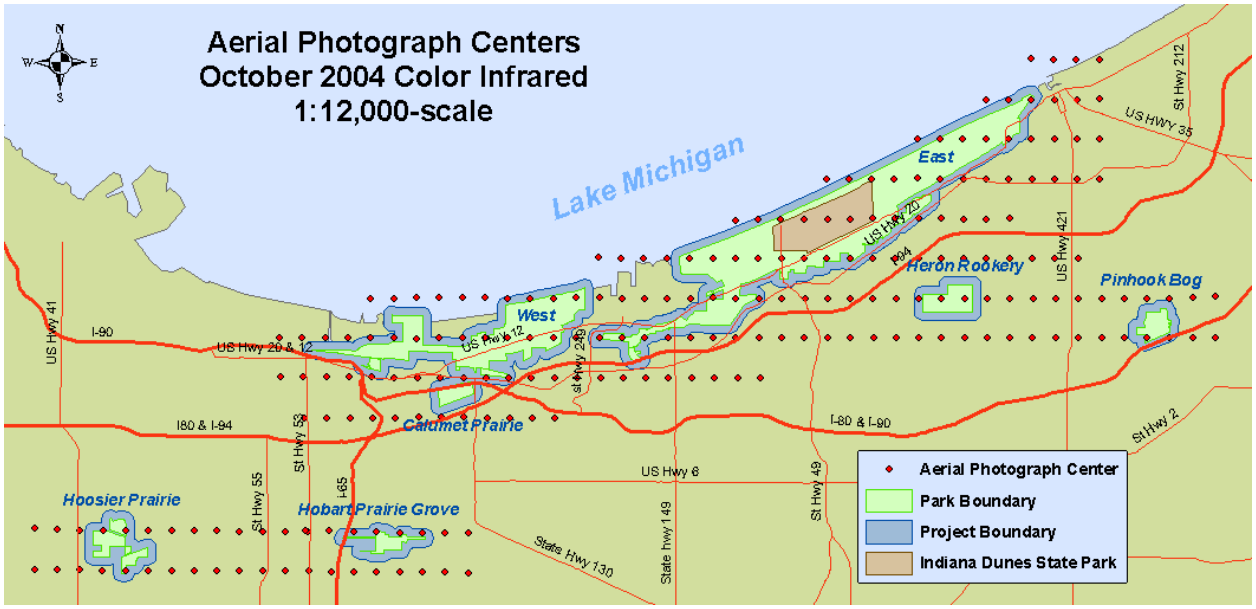


Figure 5. October 2004 1:12,000-scale color infrared aerial photograph centers Indiana Dunes National Lakeshore Vegetation Mapping Project.

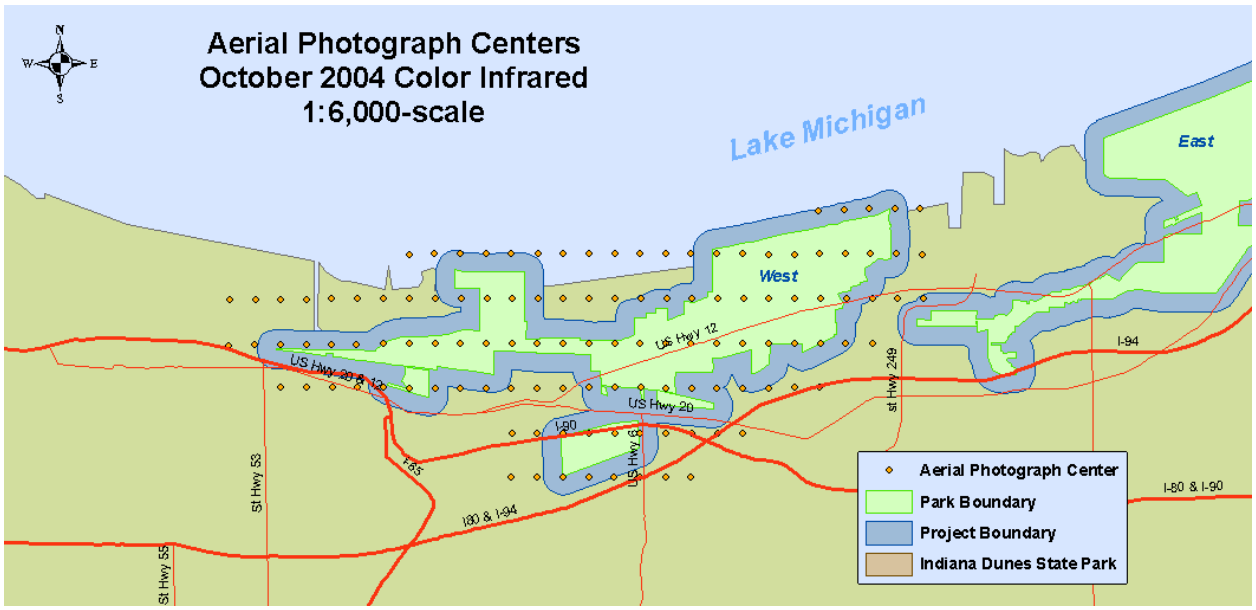


Figure 6. October 2004 1:6,000-scale color infrared aerial photograph centers Indiana Dunes National Lakeshore Vegetation Mapping Project.

Minimum Mapping Units

We applied the NPS VIP standard minimum mapping unit (MMU) of 0.5 ha (1.24 acres) for mapping, with the exceptions of some wet herbaceous and wet shrubland map classes in the West unit where an MMU of 0.1 ha (0.25 acres) was used. We applied a secondary MMU of 2.0 ha (4.94 acres) for physiognomic feature changes within a particular map class (e.g., open vs. closed forest). We also applied an MMU of 1.0 ha (2.47 acres) to capture natural/semi-natural vegetation bound by urban areas. 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 liberally. Also, types unique to its surroundings (e.g., emergent wetland within an upland forest setting) often were mapped down to 0.25 ha (0.62 acres).

Vegetation Classification Organization

Our desire was to organize vegetation classification to the NVC version 2 (FGDC 2008) rather than version 1 (FGDC 1997). Although the structure of NVC version 2 is in place, the placements of floristic types for the GLKN region were not complete at the time of this report and final products. Thus, we resorted to NVC version 1 (FGDC 1997) for organizing both vegetation and map classifications. Once NVC version 2 is populated with the floristic types, an additional table showing the placements can be incorporated into the project's geodatabase.

Vegetation Classification

Methods

Preliminary Classification

The first step in classifying the vegetation of Indiana Dunes National Lakeshore (INDU, also referred to as the Lakeshore) was to prepare a preliminary classification report prior to the May 2005 scoping meeting. This report for the Lakeshore area was generated by reviewing all associations and alliances attributed to three Ecoregions derived by The Nature Conservancy (TNC): Tallgrass Prairie (ECO36), North Central Tillplain (ECO45), and Great Lakes (ECO48). This list covered a much broader area than the INDU project area and included many types that were very unlikely to occur there. The report listing was reviewed by NatureServe, INDU, and U.S. Geological Survey staff to remove vegetation types thought unlikely to occur at the Lakeshore. We also compared the preliminary classification to an existing vegetation classification for the park provided by Noel Pavlovic (Pavlovic unpublished report 2002) to further refine our preliminary classification. Eighty-two associations were included in this preliminary list (NatureServe 2005a). This report served as a rough guide to the number 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 82 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 general area (northern Illinois, northern Indiana) 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 only estimated that we would need three plots to adequately characterize those marshes. We did this kind of analysis for all the associations in the preliminary classification and estimated there would be approximately 58 unique vegetation associations at INDU. Thus, our goal was to collect at least 174 plots.

Some vegetation types in the preliminary classification (e.g., pine forests on dunes, black oak forests) were less well described or expected to have variable composition from stand to stand and we targeted them for 3–5 plots, whereas others (e.g., cattail swamps, water-lily marshes) were well-described and/or compositionally more simple, thus we targeted those for 1–3 plots. We looked into using existing data to supplement our plots or reduce our data collection needs. There were data for monitoring the effects of fires, however, they did not meet Program standards (TNC and ESRI 1996).

We were limited to sampling on Indiana Dunes National Lakeshore and Indiana Dunes State Park. Although the project area extends beyond the boundaries of those park units, our plots are located within their boundaries. Our field team faced the problem of trying to find every vegetation type at the Lakeshore 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 this would allow the field crew to find as many different vegetation types as possible. They had four primary resources to help with this. These resources included 1) maps using a pre-existing vegetation classification of the project area, 2) aerial photographs (1:12,000-scale, color infrared) of the project area, 3) local USGS and NPS staff, and 4) the field crew's own knowledge of the project area gained from prior experience and reconnaissance during this project. The maps produced using the pre-existing vegetation classification

were known to have some inaccuracies and the vegetation classification was at a coarser level than the National Vegetation Classification (NVC) System. However, these maps did help identify general habitats (e.g., upland forest, wetland forest, wetland shrubland).

Field Sampling

Field sampling methodology was adapted from the Program standards (NatureServe 2004). Details are provided therein with a general summary here.

Plots were placed to represent 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 a unique vegetation type given the degree to which the vegetation in the project area had been disturbed. Former residential, industrial, and agricultural activity had affected nearly all of the project area to some degree. This sometimes resulted in combinations of species being dominant that were not well reflected in a regional-level classification like the NVC.

Plots were square or rectangular and were either 100 m^2 or 400 m^2, depending on the dominant physiognomy (Table 4). Boundaries of the plots were marked with flagging or measuring tapes.

Table 4. Plot sizes used for vegetation plot sampling.

Dominant physiognomy	Plot size	Plot area
Forest: trees have their crowns overlapping, usually forming 60-100% cover, and **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, and **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 using cover classes. (See Table 5 for cover classes and strata.) The diameter at breast height (DBH) of trees greater than 10 cm was recorded as well.

Table 5. Cover classes and vegetation strata.

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 as well as locational information, including spatial coordinates using geographic positioning system (GPS) and written physical directions to the plot. 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 7 is an example of a vegetation plot set up. For an example of a plot form, see Appendix A: Plot Sampling Form.



Figure 7. Example of vegetation plot.

Data Analyses and Results

The field team worked from June through September 2005 and sampled 190 plots (Figure 8). All field data were entered into the NPS PLOTS Database Version 2.0, an MS Access database designed for the NPS VIP (NatureServe 2005b). These plots were analyzed using ordination (non-metric multidimensional scaling or NMS) and clustering techniques (Flexible Beta) with PC-Ord 5.0 (McCune and Mefford 1999).

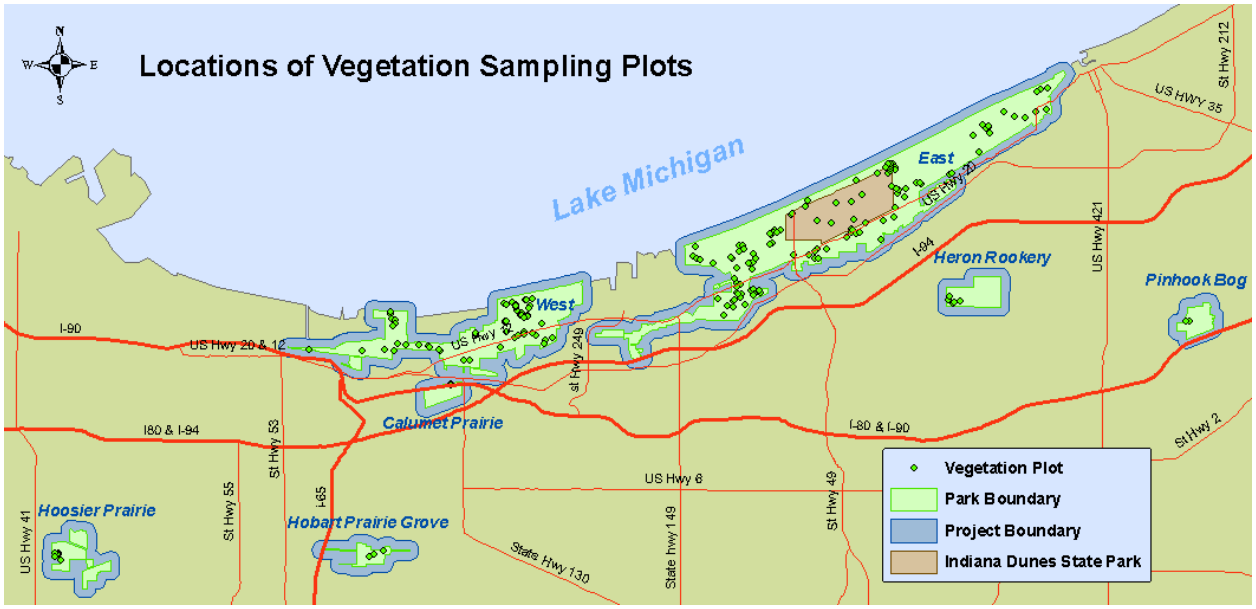


Figure 8. Locations of the 190 vegetation plots sampled for vegetation classification development.

Our strategy was to do iterative runs of the ordination and clustering analyses, removing groups of plots that were identified as most different from the rest in each run. The initial groups reflected the distinction between herbaceous wetlands and all other plots (Figure 9). Subsequent groupings were often less easy to interpret based on dominant species but, in general, upland herbaceous vegetation and shrub wetlands separated next, and finally upland and wetland forests and woodlands.

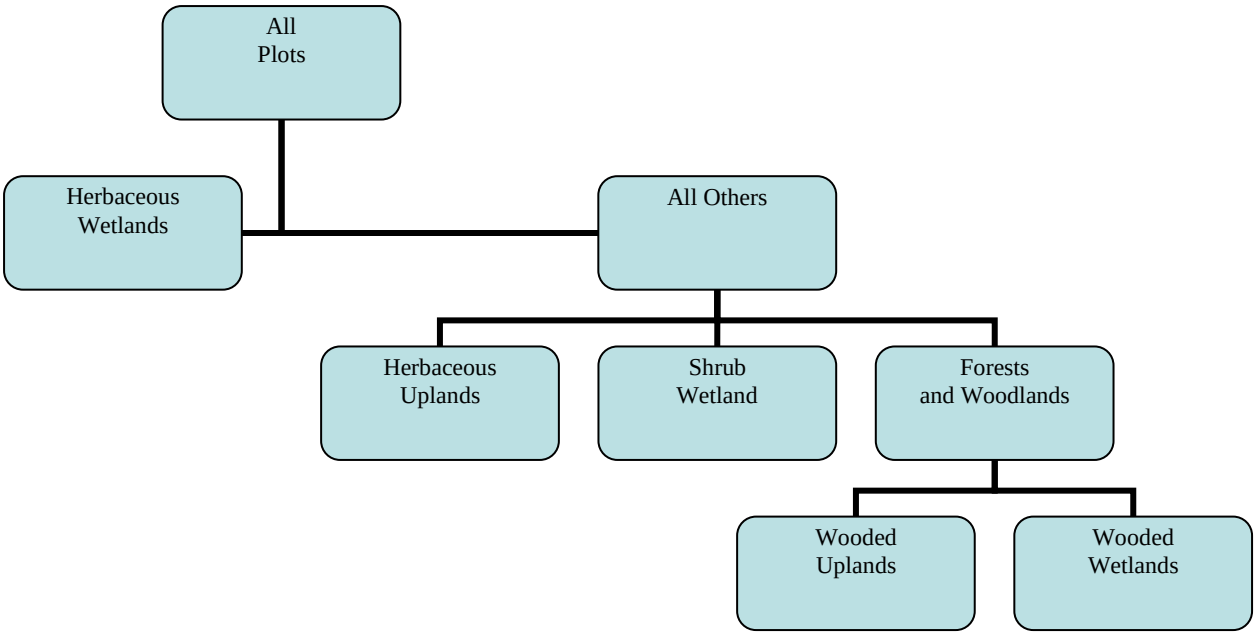


Figure 9. General vegetation groups as defined by cluster and ordination analyses

Throughout the analyses, the groupings were influenced by the history of disturbance at the Lakeshore. Species well adapted to flourishing after disturbance were prevalent in the dataset and blurred the distinction between what otherwise appeared to be separate communities. For example, *Acer rubrum* (red maple), *Fraxinus pennsylvanica* (green ash), and *Prunus serotina* (black cherry) were three of the four most commonly encountered tree species in the INDU dataset. All are common in early successional forests and the first two can be in either upland or wetlands settings. Their abundance in many plots, and across the upland-wetland spectrum in the case of *A. rubrum* and *F. pennsylvanica*, tended to pull together what otherwise were likely to be separate communities. Other species, such as *Rosa multiflora* (multiflora rose), *Alliaria petiolata* (garlic mustard), and *Celastrus orbiculata* (Asian bittersweet), were very common in the understory and had a similar effect. For example, assigning vegetation stands to Red Oak - Sugar Maple - Elm Forest versus Midwestern White Oak - Red Oak Forest can be somewhat difficult in the absence of any disturbance because both types usually have *Quercus rubr*a (red oak), can share associated minor tree species, and have some overlap in the understory species. The former association tends to be more mesic than the latter, and the relative abundance of canopy species, such as *Acer saccharum* (sugar maple) versus *Quercus alba* (white oak) and *Carya* spp. (hickories), are good diagnostic features. At INDU, some stands had significant amounts of *Q. rubra, Q. alba*, and *A. rubrum* or *F. pennsylvanica* with minor amounts of *A. saccharum*, *Tilia americana* (American basswood), and other species. Assigning these plots to an association was difficult. The abundance of disturbance-adapted or generalist species in the dataset resulted in additional weight being put on other species thought to be more characteristic of separate NVC types when assigning plots to vegetation types. This required an ecologist to go through all plots and examine the groupings given by the quantitative analyses. Most plots remained in their groups as assigned by the quantitative analyses but many of the groups were combined and assigned to a NVC type based on the ecologists' judgment.

The classification of the plot data identified 39 vegetation types. Thirty-four of these were at the association level, two were at the alliance level, and three were left at the formation level. Vegetation types left at levels coarser than the association were the result of not enough information being present in the plot data to determine whether they fit within the concept of an existing association or warranted

creating a new association. Two vegetation types were left at the formation level because they represented vegetation that was greatly affected by anthropogenic disturbance. These types, old fields and home sites dominated by herbaceous or woody vegetation, respectively, can vary tremendously from site to site and are not tracked at a detailed level in the NVC. The other type left at the formation level was a unique type—called Mesophytic Pocket Forest in this report—defined for this project at the request of INDU staff and which did not fit any existing NVC association or alliance.

The classification was further refined during the process of mapping and accuracy assessment (AA). The field efforts during these two later phases of the project encountered vegetation types that were not represented by plot data. An additional eight vegetation types were identified from these phases. Three of these were highly disturbed types and were only identified to the formation level.

Lastly, from a decision from the project's wrap-up meeting, we added an additional woodland community. Based on input from NPS users, we added a woodland type dominated by black oak. This fit, conceptually, between an existing wooded herbaceous and a forest type, both dominated by black oak. Vegetation plots and AA sites were re-assigned from the wooded herbaceous and forest communities to the woodland.

In all, a total of 38 plant communities (associations) are identified for the Lakeshore. Another four types rest at the alliance level having no association assignment. In addition, six more types rest at the formation level having no floristic level assignment. Thus, 48 vegetation types are identified. Table 6 lists the vegetation types (associations, alliances, and formations) identified at the Lakeshore and includes the number of times each type was identified with a vegetation plot or an AA site. It is worth noting, there were over twice as many AA sites sampled than vegetation plots (484 vs. 190), so most of the field observations were from AA sites. Also, nine vegetation plots were not used in the classification. These plots were collected in areas that were either too small or composed of mixtures of species that did not represent a distinctive community. Examples include very small openings in forest canopies, roadside verges, and disturbed areas that appeared to represent ecotones between two more distinct communities.

All vegetation types are described in Appendix B: Descriptions to Vegetation Types of Indiana Dunes National Lakeshore. A key to vegetation types is provided in Appendix C: Field Key to Vegetation Types of Indiana Dunes National Lakeshore, 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: Plant Species List of Indiana Dunes National Lakeshore.

Table 6. List of Vegetation Communities with number of field observations.

Formation	Vegetation type	NVC code	Field observe
FOREST CLASS			
Planted/cultivated temperate or subpolar needle-leaved evergreen forest			
	Pine Plantation (Formation)	I.A.8.C.a.	5
Rounded-crowned temperate or subpolar needle-leaved evergreen forest			
	Great Lakes Dune Pine Forest	CEGL002589	2
Lowland or submontane cold-deciduous forest			
	North-central Maple - Basswood Forest	CEGL002062	9
	Beech - Maple Glaciated Forest	CEGL005013	12
	Northeastern Modified Successional Forest	CEGL006599	32
	Midwestern White Oak - Red Oak Forest	CEGL002068	33
	Red Oak - Sugar Maple - Elm Forest	CEGL005017	15
	Black Oak Forest	CEGL002078	43
	Mesophytic Pocket Forest (Formation)	I.B.2.N.a	11
Temporarily flooded cold-deciduous forest			
	Silver Maple - Elm Forest	CEGL002586	12
	Midwestern Cottonwood - Black Willow Forest	CEGL002018	9
	River Birch - Sycamore Forest (Alliance)	A.280	0
	Aspen Temporarily Flooded Forest (Alliance)	A.300	13
	Mixed Deciduous Wetland Forest (Formation)	I.B.2.N.d.	26
Seasonally flooded cold-deciduous forest			
	Maple - Ash - Elm Swamp Forest	CEGL005038	24
	Northern (Great Lakes) Flatwoods	CEGL005037	21
Saturated cold-deciduous forest			
	Southern New England Red Maple Seepage Swamp	CEGL006406	21
	Central Tamarack - Red Maple Rich Swamp	CEGL005232	5
Mixed needle-leaved evergreen - cold-deciduous forest			
	Jack Pine - Oak Forest (Alliance)	A.391	6
	White Pine - White Oak Sand Forest	CEGL002481	5
WOODLAND CLASS			
Cold-deciduous woodland			
	Cottonwood Dune	CEGL005119	7
	North-central Dry-Mesic Oak Woodland	CEGL002142	2
	Black Oak - Northern Pin Oak / Common Hairgrass Woodland	CEGL005029	25
SHRUBLAND CLASS			
Temperate cold-deciduous shrubland			
	Hazelnut Sand Barrens	CEGL005072	6
	Hardhack Wet-Mesic Sand Shrub Meadow	CEGL005069	2
	Sand Cherry Dune Shrubland	CEGL005075	2
	Mixed Deciduous Shrubland (Formation)	III.B.2.N.a	16
Seasonally flooded cold-deciduous shrubland			
	Alder Swamp	CEGL002381	0
	Dogwood - Willow Swamp	CEGL002186	22
Semipermanently flooded cold-deciduous shrubland			
	Northern Buttonbush Swamp	CEGL002190	30

Formation	Vegetation type	NVC code	Field observe
HERBACEOUS VEGETATION CLASS			
Tall sod temperate grassland			
	Midwest Dry-Mesic Sand Prairie	CEGL002210	22
Medium-tall sod temperate or subpolar grassland			
	Great Lakes Beachgrass Dune	CEGL005098	23
	Midwest Sand Barrens	CEGL005099	19
	Mixed Herbaceous Fallow Field (Formation)	V.A.5.N.c	25
Temporarily flooded temperate or subpolar grassland			
	Lakeplain Wet Prairie	CEGL005109	6
Seasonally flooded temperate or subpolar grassland			
	Tussock Sedge Wet Meadow	CEGL002258	20
	Interdunal Wetland	CEGL005105	8
	Reed Canarygrass Eastern Marsh	CEGL006044	4
	Bulrush - Cattail - Bur-reed Shallow Marsh	CEGL002026	14
	Mixed Herbaceous Wet Meadow (Formation)	V.A.5.N.k.	17
Semipermanently flooded temperate or subpolar grassland			
	Eastern Reed Marsh	CEGL004141	22
	Midwest Cattail Deep Marsh	CEGL002233	26
Tall temperate grassland with a sparse cold-deciduous tree layer			
	Black Oak / Lupine Barrens	CEGL002492	10
Medium-tall temperate or subpolar grassland with a sparse needle-leaved evergreen or mixed tree layer			
	Great Lakes Pine Barrens	CEGL005125	1
Saturated temperate perennial forb vegetation			
	Skunk-cabbage Seepage Meadow	CEGL002385	1
Permanently flooded temperate or subpolar hydromorphic-rooted vegetation			
	Water-lily Aquatic Wetland	CEGL002386	21
	Midwest Pondweed Submerged Aquatic Wetland	CEGL002282	3
SPARSE VEGETATION CLASS			
Dunes with sparse herbaceous vegetation			
	Herbaceous Dunes Sparsely Vegetated (Alliance)	A.1855	7

Vegetation Mapping

Methods

Mapping vegetation of Indiana Dunes National Lakeshore (INDU, also referred to as Lakeshore) and environs involved four primary steps: (1) field reconnaissance, (2) map classification, (3) photointerpretation, and (4) digital map automation and database development. Although these steps occurred sequentially, they overlap to some degree.

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, color infrared (CIR) photography is not consistent between photo sets to allow a species or type 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 formal ground verification of our aerial photographs. Ultimately, field reconnaissance helped us correlate vegetative photo signatures—appearances of vegetation on the aerial photographs—to vegetation on the ground (Figure 10). Field reconnaissance also allowed photointerpreters to become more familiar with the local ecology of plant communities, which is always important when applying ecological concepts to the photointerpretation mapping. Where photointerpreters discovered limitations to interpreting plant communities using aerial photographs, environmental models were tested (e.g., soil, aspect) to determine if plant communities could be consistently separated by environmental elements.



Figure 10: Field reconnaissance to correlate vegetation types to their appearances on aerial photographs.

We performed our field reconnaissance throughout the summer of 2006. Much of this effort was accomplished as a team of mappers and ecologists to ensure correct assessment of vegetation types in the field, and subsequently, applied them correctly during photointerpretation 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 significant species to promote proper

perspective of species composition for photointerpretation (e.g., heterogeneous vs. monotypic stand of conifers). In essence, we would build a "model" of photo signatures to base our decisions on during photointerpretation mapping. In addition, estimated tree heights were occasionally recorded to give a perspective when applying the physiognomic height modifier during the mapping.

Map Classification

Map classification and protocols are based on existing classification systems. We linked map classes representing natural/semi-natural plant communities to the National Vegetation Classification (NVC) System associations as identified by NatureServe. Some vegetation types could not be assigned to a plant community because of disturbance (e.g., shrub-herbaceous regeneration from old home sites). For those map classes, we assigned the appropriate NVC alliance or, if necessary, formation type. For non-vegetated features (e.g., roads, urban areas, non-vegetated bodies of water), we derived map classes corresponding closely with Anderson et al. (1976) land cover and land use classification.

For those map classes representing plant communities, we used NatureServe's synonym name (e.g., Water Lily Aquatic Wetland). For map classes with phases, we used NatureServe's synonym name followed by the phase name in parenthesis, such as Black Oak Forest (black oak-white oak phase). For map classes representing NVC formation types and non-vegetated features, we derived generic names describing the vegetation and landscape.

The relation of a map class to a plant community can be complex. What we see on the photographs is not necessarily what defines the plant community. Often, for instance, we are unable to map plant communities independently of each other because of the difficulty of differentiating floristic components on the aerial photographs. Consequently, we map those communities together as one map class. With INDU, however, we find the opposite. In specific cases, we were able to map recurring variations of some plant communities. 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 ecological interests.

We continually updated the map classification throughout the entire project. 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 each map class definition. Finally, accuracy assessment (AA) observation plot data provided a plethora of information, refining concepts of the vegetation classification, thus refining the concepts of the map classes representing them. Throughout the entire process, 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 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 NVC Class, as follows:

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

For non-vegetated features, map class codes begin with "N" for non-vegetated landscapes (e.g., sand beaches, open-water ponds) and "L" for general land use (e.g., industrial sites, roads). The subsequent

two alpha characters for each map class loosely represent the map class description (e.g., AS for alder swamp, WM for wet meadow, LP for lake and pond).

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 7 lists the physiognomic modifiers we used for mapping the Lakeshore.

Table 7. Physiognomic modifiers assigned to polygons during photointerpretation.

Category	Modifier	Meaning
Coverage density (Applied to all vegetation map classes)	1 2 3	Closed Canopy/Continuous (60-100% cover) Open Canopy/Discontinuous (25-60% cover) Dispersed-Sparse Canopy (10-25% cover)
Coverage pattern (Applied to all vegetation map classes)	A B C D	Evenly Dispersed Clumped/Bunched Gradational/Transitional Regularly Alternating
Height (Applied to woody terrestrial vegetation map classes only)	2 3 4	15-30 m (50-98 ft) 5-15 m (16-50 ft) 0.5-5 m (1.5-16 ft)

An example of a map attribute code is “FBW-1A3.” This map attribute code describes those map polygons with the vegetation type assigned to the Black Oak-White Oak Phase (FBW) of the Black Oak Forest map class—representing the *Quercus velutina* / *Carex pensylvanica* Forest Association—with a coverage density of 60–100%, a coverage pattern that is evenly distributed, and an average tree height of 5–15 m (16–50 ft). Having this series of map classification and physiognomic modifiers can greatly enhance the interpretation of the map layers 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 photointerpretation mapping provided us with the highest resolution possible. The diapositive photos are also dimensionally stable and virtually not affected from 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 1:12,000-scale October 2004 CIR aerial photos using the fiducials (standard reference points) and photo identification information. We viewed the CIR aerial photos for interpretation using Richards MIM light tables and Bausch & Lomb Zoom 240 stereoscopes with variable zoom capabilities. Small shrub and herbaceous wetlands of the West unit were mapped at 0.1 ha minimum mapping unit (MMU). The remaining map classes for the entire project extent were mapped with an MMU of 0.5 ha between map classes, and an MMU of 2.0 ha between physiognomic modifiers within a map class unit. Interpreted data—map polygons and attributes—was applied to photo overlays covering the 1:12,000-scale CIR photos. For those small shrub and herbaceous wetlands of the West unit, we viewed the 1:6,000-scale CIR photos through stereoscopes. However, we applied the interpreted data to the 1:12,000-scale CIR photos. The April 2005 TC aerial photos were viewed digitally on computer to aid the interpretation of the CIR photos.

Each transparency photo was paired up with the adjacent photo so we could view the images three-dimensionally. Normally we used the middle portion of each photograph for the photointerpretation data to minimize edge distortion. We delineated feature polygons and scribed their corresponding map attribute codes onto the acetate overlays using Rapidograph ink pens (4x0-size, 0.18 mm) and Rapidraw black India ink (3084; waterproof, fast drying for film). With each transparency, we typically drew larger polygons first and followed with smaller polygons down to the MMU guidelines. Inherent to these aerial photos are angle distortions and scale changes from high ridges to low valley bottoms. Thus, in applying the MMU, we tended to err below the guideline rather than above. We applied standard photo signature characteristics, including texture, color, pattern, and position in the landscape to guide placement of polygons. In addition to photo signature characteristics, understanding the environmental distribution of the vegetation types helped us not only identify types, but also properly place polygon boundaries. For each polygon, we applied the appropriate map class code and physiognomic modifier codes (collectively, the map attribute code).

Digital Map Automation and Database Development

We converted the photointerpreted data into a GIS-usable format employing three fundamental processes: (1) orthorectify, (2) digitize, and (3) develop the geodatabase. All digital map automation was projected in Universal Transverse Mercator (UTM) projection, Zone 16, using North American Datum of 1983 (NAD83).

Orthorectify: We orthorectified the interpreted overlays using OrthoMapper (Version 3.23), 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 using existing orthorectified horizontal and vertical base maps. This process was completed to produce orthophotographs of the park. Of primary importance to us, OrthoMapper also has the capability to orthorectify the photointerpreted overlays of each photograph based on the reference information provided from the orthophotographs.

First, we acquired from the NPS Great Lakes Network office individual raw image files of the October 2004 CIR aerial photographs in Tagged Image File Format (TIFF) format (20 micron resolution; equal to 1270 dpi). We resampled the images to a resolution of 365 dpi, producing final TIFF images of 0.5-m^2 pixel resolutions. OrthoMapper software was then used to orthorectify each individual image using the April 2005 TC orthophotographs (again, acquired from the NPS Great Lakes Network office) as the background reference imagery. Once the CIR orthophotos were created[1], each photointerpreted overlay was scanned to 1-bit (black-and-white) images at a resolution of 1200 dpi, again producing a series of TIFF images. Once more, OrthoMapper was used to register each overlay image, this time to their corresponding orthophoto.

Digitize: To produce a polygon vector layer for use in ArcGIS, we converted each raster-based image mosaic of orthorectified overlays containing the photointerpreted data into a grid format using ArcGIS (Version 9.2, © 2006 Environmental Systems Research Institute, Redlands, California). In ArcGIS, we used the ArcScan extension to trace the raster data and produce ESRI shapefiles. We digitally assigned map attribute codes (both map class codes and physiognomic modifier codes) to the polygons, and

[1] We also produced six orthophoto mosaics from the individually orthorectified October 2004 CIR images, one mosaic for each INDU unit. We used Image Analysis (Version 1.1) for the East, West (including Calumet Prairie), and Hobart Prairie Grove units and OrthoMapper for the Pinhook Bog, Heron Rookery, and Hoosier Prairie units. We stored these mosaics as TIFF images. Then, we used the software program MrSid Geospatial Encoder (Version 1.4) to compress the mosaics using a 20:1 compression ratio. In all, we produced six orthorectified MrSid (.sid) format images.

checked the digital data against the photointerpreted overlays for line and attribute consistency. Ultimately, we merged the individual layers into a seamless layer of INDU and immediate environs.

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, link to NVC association and alliance codes), 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 sites, 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 and Discussion

Map Classes

We developed 67 map classes (including map class phases) to map the Lakeshore and environs. Of these 67 map classes, 56 represent vegetation types within the NVC. The other 11 map classes represent general land cover, either land use (e.g., road, residential) or non-vegetated areas (e.g., lake, stream). Table 8 provides a breakdown of these map classes in regards to the finer levels of NVC: association, alliance, and formation. Map classes representing non-NVC units are listed as well. Explanations to each NVC class and non-NVC units are provided after the table.

Table 8. Map class distribution relation within the National Vegetation Classification, organized by NVC CLASS.

NVC class	Map class	Association	Alliance	Formation
FOREST	28	14	17	8
WOODLAND	4	3	3	1
SHRUBLAND	6	5	4	3
HERBACEOUS VEGETATION	17	14	14	11
SPARSE VEGETATION	1	0	1	1
NVC TOTAL	**56**	**36***	**39***	**24***

NON-NVC	Map Class
TERRESTRIAL NON-VEGETATED	4
DEVELOPED AREA	7
NON-NVC TOTAL	**11**
MAP CLASS GRAND TOTAL	**67**

* Two of the 38 associations designated for this project were not captured directly by any one map class; the Sand Cherry Dune Shrubland (CEGL005075) and the Skunk-cabbage Seepage Meadow (CEGL002385). Also, one of the 40 alliances designated for this project was not captured directly by any one map class; the Skunk-cabbage - Yellow Marsh-marigold Saturated Herbaceous Alliance (A.1694). Furthermore, four formation level types are recognized in addition to those types derived from the vegetation classification data; the Planted/Cultivated Cold-deciduous Forest (I.B.2.C.b.)—deciduous orchards, the Perennial Grass Crops (hayland, pastureland) (V.A.5.C.a.), the Annual Close-grown Forbs and Grasses Formation (V.D.2.C.a.), and the Annual Row-crop Forbs and Grasses (V.D.2.C.b.). Also one formation designated for this project was not captured directly by any one map class; the Saturated temperate perennial forb vegetation (V.B.2.N.f.)—for the Skunk-cabbage Seepage Meadow association.

NVC Map Classes

Fifty-two map classes represent natural/semi-natural types and four represent cultural. Nine map classes rest at the formation level, four being cultural. Four map classes rest at the alliance level. Forty-three map

classes represent 36 association types, 15 of these classes are phases to 7 association types, and 1 of these map classes represents 2 association types. The following is a breakdown of map classes and their relation to the NVC, organized by NVC CLASS.

Forest: Twenty-six map classes represent natural/semi-natural types and two represent cultural. Four map classes rest at the formation level, two being cultural (plantation and orchard). Three map classes rest at the alliance level, thus the reason for more alliance types than association types. Twenty-one map classes represent the 14 association types; 13 of these map classes are phases to 6 of the association types.

Woodland: Four map classes represent the three association types; two of these map classes are phases to one of the association types.

Shrubland: One map class rests at the formation level. The other five map classes represent the five association types.

Worth noting, one association type is absent from the table reports. The vegetation classification characterizes the *Prunus pumila* - (*Ptelea trifoliata*) Dune Shrubland (CEGL005075), adding one more type to the association and alliance levels. This type is believed most common as an inclusion to the Great Lakes Beachgrass Dune and Midwest Sand Barrens associations (mapped together with one herbaceous map class), typically because they are either <MMU or not visible on the aerial photos.

Herbaceous Vegetation: Fifteen map classes represent natural/semi-natural types and two represent cultural (agriculture). Four map classes rest at the formation level, two being cultural. Thirteen map classes represent the 13 association types, 2 of these map classes are phases to 1 of the association types, and 1 of these map classes represents 2 association types.

Worth noting, one association type is absent from the table reports. The vegetation classification characterizes the *Symplocarpus foetidus* Herbaceous Vegetation (CEGL002385), adding one more type to the association, alliance, and formation levels. This type, however, is of small seep areas well below MMU and is inclusive to numerous Forest map classes. Not one single map class captures the inclusion of this type.

Sparse Vegetation: The one map class rests at the alliance level; no association type was derived.

Non-NVC Map Classes

Eleven map classes represent non-NVC units, which correlate to a modified version of Anderson et al. (1976) land use and land cover classification. We've categorized these non-NVC map classes into two groups: Terrestrial Non-vegetated and Developed Area.

Of the eleven map classes, four map classes are of the Terrestrial Non-vegetated group and represent non-vegetated features. Two of these map classes are barren land and the other two are open-water. The remaining map classes are of the Developed Area group. Seven map classes, although they may contain vegetation as part of their unit, describe general land use features (e.g., roads, residential, industrial).

Map Classification Link to NVC Types

Table 9 lists the map classes (map class phases included) and their relation to the NVC. It has a hierarchical organization, organized within the NVC, first by class, then formation, alliance, and finally association. Map classes rest in the finest level of the NVC possible. Although the standard MMU consists of 0.5 ha, those map classes receiving MMU of 0.1 ha mapping (West unit only) are denoted with an asterisk (*) by the map class code within the Table; essentially they are map classes representing many of the wet herbaceous and wet shrubland types.

Table 9. Map classification for the Indiana Dunes National Lakeshore Vegetation Mapping Project.

Map class code	Map class name	Formation code	Alliance code	Association code
FOREST CLASS				
Rounded-crowned Temperate or Subpolar Needle-leaved Evergreen Forest Formation				
***Pinus banksiana* Forest Alliance**				
***Pinus banksiana - Pinus resinosa - Pinus strobus* Dune Forest Association**				
FPD	Great Lakes Dune Pine Forest	I.A.8.N.b.	A.116	CEGL002589
Lowland or Submontane Cold-deciduous Forest Formation				
FMP	Mesophytic Pocket Forest	I.B.2.N.a.	N/A	N/A
***Acer saccharum - Tilia americana* - (*Quercus rubra*) Forest Alliance**				
***Acer saccharum - Tilia americana* / *Ostrya virginiana - Carpinus caroliniana* Forest Association**				
FAT	North-central Maple - Basswood Forest	I.B.2.N.a.	A.220	CEGL002062
***Fagus grandifolia - Acer saccharum* - (*Liriodendron tulipifera*) Forest Alliance**				
***Fagus grandifolia - Acer saccharum* Glaciated Midwest Forest Association**				
FAF	Beech - Maple Glaciated Forest (beech - maple phase)	I.B.2.N.a.	A.227	CEGL005013
FBA	Beech - Maple Glaciated Forest (aspen phase)	I.B.2.N.a.	A.227	CEGL005013
***Prunus serotina - Acer rubrum - Amelanchier canadensis - Quercus* spp. Forest Alliance**				
***Prunus serotina - Liriodendron tulipifera - Acer rubrum - Fraxinus americana* - (*Robinia pseudoacacia*) Forest Association**				
FCM	Northeastern Modified Successional Forest (coniferous phase)	I.B.2.N.a.	A.237	CEGL006599
FDM	Northeastern Modified Successional Forest (deciduous phase)	I.B.2.N.a.	A.237	CEGL006599
***Quercus alba* - (*Quercus rubra, Carya* spp.) Forest Alliance**				
***Quercus alba - Quercus rubra - Carya ovata* Glaciated Forest Association**				
FWR	Midwestern White Oak - Red Oak Forest (white oak - red oak phase)	I.B.2.N.a.	A.239	CEGL002068
FOH	Midwestern White Oak - Red Oak Forest (hickory phase)	I.B.2.N.a.	A.239	CEGL002068
***Quercus rubra* - (*Acer saccharum*) Forest Alliance**				
***Quercus rubra* - (*Acer saccharum, Quercus alba*) Forest Association**				
FRO	Red Oak - Sugar Maple - Elm Forest	I.B.2.N.a.	A.251	CEGL005017
***Quercus velutina - Quercus alba* - (*Quercus coccinea*) Forest Alliance**				
***Quercus velutina* / *Carex pensylvanica* Forest Association**				
FBW	Black Oak Forest (black oak - white oak phase)	I.B.2.N.a.	A.1911	CEGL002078
FPF	Black Oak Forest (pin oak phase)	I.B.2.N.a.	A.1911	CEGL002078
FAO	Black Oak Forest (aspen phase)	I.B.2.N.a.	A.1911	CEGL002078

Map class code	Map class name	Formation code	Alliance code	Association code
Temporarily Flooded Cold-deciduous Forest Formation				
FDW	Mixed Deciduous Wetland Forest	I.B.2.N.d.	N/A	N/A
***Acer saccharinum* Temporarily Flooded Forest Alliance**				
***Acer saccharinum* - *Ulmus americana* Forest Association**				
FSC	Silver Maple - Elm Forest	I.B.2.N.d.	A.279	CEGL002586
***Betula nigra* - (*Platanus occidentalis*) Temporarily Flooded Forest Alliance**				
FWM	River Birch - (Sycamore) Temporarily Flooded Forest	I.B.2.N.d.	A.280	N/A
***Populus deltoides* Temporarily Flooded Forest Alliance**				
***Populus deltoides* - *Salix nigra* Forest Association**				
FCW	Midwestern Cottonwood - Black Willow Forest	I.B.2.N.d.	A.290	CEGL002018
***Populus tremuloides* Temporarily Flooded Forest Alliance**				
FWA	Quaking Aspen Temporarily Flooded Forest	I.B.2.N.d.	A.300	N/A
Seasonally Flooded Cold-deciduous Forest Formation				
***Acer rubrum* - *Fraxinus pennsylvanica* Seasonally Flooded Forest Alliance**				
***Acer* (*rubrum, saccharinum*) - *Fraxinus* spp. - *Ulmus americana* Forest Association**				
FMS	Maple - Ash - Elm Swamp Forest	I.B.2.N.e.	A.316	CEGL005038
***Quercus palustris* - (*Quercus bicolor*) Seasonally Flooded Forest Alliance**				
***Quercus palustris* - *Quercus bicolor* - *Acer rubrum* Flatwoods Forest Association**				
FPS	Northern (Great Lakes) Flatwoods (pin oak phase)	I.B.2.N.e.	A.329	CEGL005037
FSW	Northern (Great Lakes) Flatwoods (swamp white oak phase)	I.B.2.N.e.	A.329	CEGL005037
Saturated Cold-deciduous Forest Formation				
***Acer rubrum* - *Fraxinus pennsylvanica* Saturated Forest Alliance**				
***Acer rubrum* - *Fraxinus* (*pennsylvanica, americana*) / *Lindera benzoin* / *Symplocarpus foetidus* Forest Association**				
FRS	Southern New England Red Maple Seepage Swamp	I.B.2.N.g.	A.3035	CEGL006406
***Larix laricina* Saturated Forest Alliance**				
***Larix laricina* - *Acer rubrum* / (*Rhamnus alnifolia, Vaccinium corymbosum*) Forest Association**				
FTM	Central Tamarack - Red Maple Rich Swamp (tamarack - red maple phase)	I.B.2.N.g.	A.349	CEGL005232
FCR	Central Tamarack - Red Maple Rich Swamp (northern white-cedar phase)	I.B.2.N.g.	A.349	CEGL005232
Mixed Needle-leaved Evergreen - Cold-deciduous Forest Formation				
***Pinus banksiana* - *Quercus* (*ellipsoidalis, velutina*) Forest Alliance**				
FJO	Jack Pine - (Northern Pin Oak, Black Oak) Forest	I.C.3.N.a.	A.391	N/A

Map class code	Map class name	Formation code	Alliance code	Association code
***Pinus strobus* - *Quercus* (*alba, rubra, velutina*) Forest Alliance**				
***Pinus strobus* - *Quercus alba* / (*Corylus americana, Gaylussacia baccata*) Forest Association**				
FPO	White Pine - White Oak Sand Forest	I.C.3.N.a.	A.401	CEGL002481
Planted/cultivated Temparate or Subpolar Needle-leaved Evergreen Forest Formation				
FPP	Conifer Plantation	I.A.8.C.a.	N/A	N/A
Planted/cultivated Cold-deciduous Forest Formation				
FOD	Deciduous Orchard	I.B.2.C.b.	N/A	N/A
WOODLAND CLASS				
Cold-deciduous Woodland Formation				
***Quercus alba* – (*Quercus velutina*) Woodland Alliance**				
***Quercus velutina* - (*Quercus ellipsoidalis*) - *Quercus alba* / *Deschampsia flexuosa* Woodland**				
WBL	Black Oak - Northern Pin Oak / Common Hairgrass Woodland	II.B.2.N.a.	A.612	CEGL005029
***Quercus macrocarpa* - *Quercus* (*alba, ellipsoidalis, velutina*) Woodland Alliance**				
***Quercus alba* - *Quercus macrocarpa* - *Quercus rubra* / *Corylus americana* Woodland Association**				
WBO	North-central Dry-Mesic Oak Woodland	II.B.2.N.a.	A.619	CEGL002142
***Populus deltoides* Woodland Alliance**				
***Populus deltoides* - (*Juniperus virginiana*) Dune Woodland Association**				
WCF	Cottonwood Dune (natural foredune phase)	II.B.2.N.a.	A.1493	CEGL005119
WDC	Cottonwood Dune (disturbance phase)	II.B.2.N.a.	A.1493	CEGL005119
SHRUBLAND CLASS				
Temperate Cold-deciduous Shrubland Formation				
SMX	Mixed Deciduous Shrubland	III.B.2.N.a.	N/A	N/A
***Corylus americana* - (*Spiraea tomentosa, Malus ioensis*) Shrubland Alliance**				
***Spiraea tomentosa* - *Salix humilus* / *Andropogon gerardii* - *Panicum virgatum* Shrubland Association**				
SSP*	Hardhack Wet-Mesic Sand Shrub Meadow	III.B.2.N.a.	A.897	CEGL005069
***Corylus americana* - *Salix humilus* / *Schizachyrium scoparium* Shrubland Association**				
SHB	Hazelnut Sand Barrens	III.B.2.N.a.	A.897	CEGL005072
Seasonally Flooded Cold-deciduous Shrubland Formation				
***Alnus incana* Seasonally Flooded Shrubland Alliance**				
***Alnus incana* Swamp Shrubland Association**				
SAS*	Speckled Alder Swamp	III.B.2.N.e.	A.986	CEGL002381

Map class code	Map class name	Formation code	Alliance code	Association code
***Cornus sericea* - *Salix* spp. Seasonally Flooded Shrubland Alliance**				
***Cornus sericea* - *Salix* spp. - (*Rosa palustris*) Shrubland Association**				
SMS*	Dogwood - Willow Swamp	III.B.2.N.e.	A.989	CEGL002186
Semipermanently Flooded Cold-deciduous Shrubland Formation				
***Cephalanthus occidentalis* Semipermanently Flooded Shrubland Alliance**				
***Cephalanthus occidentalis* / *Carex* spp. Northern Shrubland Association**				
SBS*	Northern Buttonbush Swamp	III.B.2.N.f.	A.1011	CEGL002190
HERBACEOUS VEGETATION CLASS				
Tall Sod Temperate Grassland Formation				
***Schizachyrium scoparium* - *Sorghastrum nutans* Herbaceous Alliance**				
***Schizachyrium scoparium* - *Sorghastrum nutans* - *Andropogon gerardii* - *Lespedeza capitata* Sand Herbaceous Vegetation Association**				
HLB	Midwest Dry-Mesic Sand Prairie	V.A.5.N.a.	A.1198	CEGL002210
Medium-tall Sod Temperate or Subpolar Grassland Formation				
HMX	Mixed Herbaceous Fallow Field	V.A.5.N.c.	N/A	N/A
***Ammophila breviligulata* Herbaceous Alliance and/or *Schizachyrium scoparium* - (*Sporobolus cryptandrus*) Herbaceous Alliance**				
***Ammophila breviligulata* - (*Schizachyrium scoparium*) Herbaceous Vegetation Association and/or *Schizachyrium scoparium* - *Carex tonsa* var. *rugosperma* - *Carex muehlenbergii* - *Lithospermum caroliniense* - *Opuntia humifusa* Herbaceous Vegetation Association**				
HAB	Great Lakes Beachgrass Dune and/or Midwest Sand Barrens	V.A.5.N.c.	A.1207 / A.1224	CEGL005098 / CEGL005099
Temporarily Flooded Temperate or Subpolar Grassland Formation				
***Spartina pectinata* Temporarily Flooded Herbaceous Alliance**				
***Spartina pectinata* - *Carex* spp. - *Calamagrostis canadensis* Lakeplain Herbaceous Vegetation Association**				
HCP*	Central Cordgrass Wet Prairie	V.A.5.N.j.	A.1347	CEGL005109
Seasonally Flooded Temperate or Subpolar Grassland Formation				
HWM*	Mixed Herbaceous Wet Meadow	V.A.5.N.k.	N/A	N/A
***Cladium mariscoides* Seasonally Flooded Herbaceous Alliance**				
***Dasiphora fruticosa* ssp. *floribunda* / *Cladium mariscoides* - *Juncus balticus* - (*Rhynchospora capillacea*) Herbaceous Vegetation Association**				
HDW*	Interdunal Wetland	V.A.5.N.k.	A.1368	CEGL005105
***Carex stricta* Seasonally Flooded Herbaceous Alliance**				
***Carex stricta* - *Carex* spp. Herbaceous Vegetation Association**				
HSM*	Tussuck Sedge Wet Meadow	V.A.5.N.k.	A.1397	CEGL002258
***Phalaris arundinacea* Seasonally Flooded Herbaceous Alliance**				
***Phalaris arundinacea* Eastern Herbaceous Vegetation Association**				
HPH*	Reed Canary Grass Eastern Marsh	V.A.5.N.k.	A.1381	CEGL006044

Map class code	Map class name	Formation code	Alliance code	Association code
***Typha* spp. - (*Schoenoplectus* spp., *Juncus* spp.) Seasonally Flooded Herbaceous Alliance**				
***Schoenoplectus tabernaemontani* - *Typha* spp. - (*Sparganium* spp., *Juncus* spp.) Herbaceous Vegetation Association**				
HBC*	Bulrush - Cattail - Burreed Shallow Marsh	V.A.5.N.k.	A.1394	CEGL002026
Semipermanently Flooded Temperate or Subpolar Grassland Formation				
***Phragmites australis* Semipermanently Flooded Herbaceous Alliance**				
***Phragmites australis* Eastern North America Temperate Semi-natural Herbaceous Vegetation Association**				
HPM*	Eastern Reed Marsh	V.A.5.N.l.	A.1431	CEGL004141
***Typha* (*angustifolia, latifolia*) - (*Schoenoplectus* spp.) Semipermanently Flooded Herbaceous Alliance**				
***Typha* spp. Midwest Herbaceous Vegetation Association**				
HCM*	Midwest Cattail Deep Marsh	V.A.5.N.l.	A.1436	CEGL002233
Tall Temperate Grassland with a Sparse Cold-deciduous Tree Layer Formation				
***Quercus velutina* - (*Quercus ellipsoidalis*) Wooded Herbaceous Alliance**				
***Quercus velutina* - (*Quercus alba*) - *Quercus ellipsoidalis* / *Schizachyrium scoparium* - *Lupinus perennis* Wooded Herbaceous Vegetation Association**				
HOB	Black Oak / Lupine Barrens	V.A.6.N.c.	A.1492	CEGL002492
Medium-tall Temperate or Subpolar Grassland with a Sparse Needle-leaved Evergreen or Mixed Tree Layer Formation				
***Pinus banksiana* - (*Pinus resinosa*) Wooded Herbaceous Alliance**				
***Pinus banksiana* - (*Pinus resinosa*) - *Pinus strobus* / *Juniperus horizontalis* Wooded Herbaceous Vegetation Association**				
HPB	Great Lakes Pine Barrens	V.A.6.N.f.	A.1499	CEGL005125
Permanently Flooded Temperate or Subpolar Hydromorphic-rooted Vegetation Formation				
***Potamogeton* spp. - *Ceratophyllum* spp. - *Elodea* spp. Permanently Flooded Herbaceous Alliance**				
***Potamogeton* spp. - *Ceratophyllum* spp. Midwest Herbaceous Vegetation Association**				
HSV*	Midwest Pondweed Submerged Aquatic Wetland	V.C.2.N.a.	A.1754	CEGL002282
***Nymphaea odorata* - *Nuphar* spp. Permanently Flooded Temperate Herbaceous Alliance**				
***Nuphar lutea* ssp. *advena* - *Nymphaea odorata* Herbaceous Vegetation Association**				
HWL*	Water-lily Aquatic Wetland	V.C.2.N.a.	A.1984	CEGL002386
Perennial grass crops (hayland, pastureland) Formation				
HGC	Perennial Grass Crops	V.A.5.C.a.	N/A	N/A
Annual Close-grown Forbs and Grasses Formation and/or Annual Row-crop Forbs and Grasses Formation				
HCF	Crop Field	V.D.2.C.a. / V.D.2.C.b.	N/A	N/A

Map class code	Map class name	Formation code	Alliance code	Association code
SPARSE VEGETATION CLASS				
Dunes with Sparse Herbaceous Vegetation Formation				
Herbaceous Dunes Sparsely Vegetated Alliance				
VDS	Herbaceous Dunes Sparsely Vegetated	VII.C.1.N.a.	A.1855	N/A
GENERAL LANDCOVER (Non-NVC)				
Terrestrial Natural/Semi-natural Non-vegetated				
Barren Beach				
NLB	Lakeshore Sand and Cobble Beach	N/A	N/A	N/A
NSD	Barren Sand Dune	N/A	N/A	N/A
Open Water-body				
NSR	Open Water Stream and River	N/A	N/A	N/A
NLP*	Open Water Lake and Pond	N/A	N/A	N/A
Developed Area				
Developed Area				
LID	Industrial	N/A	N/A	N/A
LRC	Residential and Commercial	N/A	N/A	N/A
LQR	Quarry	N/A	N/A	N/A
LAP	Artificial Pond	N/A	N/A	N/A
LRR	Road and Railroad	N/A	N/A	N/A
LFS	Farmstead	N/A	N/A	N/A
LBL	Barren Land	N/A	N/A	N/A

Map Classification Descriptions

In addition to providing descriptions to NVC vegetation types (Appendix B: Descriptions to Vegetation Types of Indiana Dunes National Lakeshore), we also derived descriptions for each map class to

- describe each map class from a photointerpretation perspective,
- describe the link between each map class and the NVC type it represents,
- provide a ground photo image for each map class, and
- provide a succinct explanation of how map classes were employed during the AA analysis.

Appendix E: Descriptions to Map Classes of Indiana Dunes National Lakeshore gives descriptions to each map class we used in mapping the Lakeshore and environs. The appendix includes map classes (and their phases) representing both NVC and non-vegetated units.

Map Layer Summary Report

Table 10 provides a summary report of the INDU vegetation spatial data layer, summarizing frequency, area, and average polygon size for each map class. Table 11 provides a compilation of the map classes to the NVC formation level. The summary reports organize the map classes by NVC class and formation 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 them.

Table 10. Area report of the Indiana Dunes National Lakeshore vegetation map layer, via map classes.

Map class code	Map class name	Frequency	Area (Ha)	Ave (Ha)	Area (Ac)	Ave (Ac)
FOREST CLASS						
Rounded-crowned Temperate or Subpolar Needle-leaved Evergreen Forest Formation						
FPD	Great Lakes Dune Pine Forest	4	3.0	0.7	7.3	1.8
Lowland or Submontane Cold-deciduous Forest Formation						
FMP	Mesophytic Pocket Forest	10	6.7	0.7	16.6	1.7
FAT	North-central Maple - Basswood Forest	7	6.7	1.0	16.6	2.4
FAF	Beech - Maple Glaciated Forest (beech - maple phase)	9	62.0	6.9	153.3	17.0
FBA	Beech - Maple Glaciated Forest (aspen phase)	4	2.8	0.7	6.9	1.7
FCM	Northeastern Modified Successional Forest (coniferous phase)	41	47.0	1.1	116.1	2.8
FDM	Northeastern Modified Successional Forest (deciduous phase)	485	1,080.2	2.2	2,669.1	5.5
FWR	Midwestern White Oak - Red Oak Forest (white oak - red oak phase)	208	574.9	2.8	1,420.5	6.8
FOH	Midwestern White Oak - Red Oak Forest (hickory phase)	18	22.9	1.3	56.6	3.1
FRO	Red Oak - Sugar Maple - Elm Forest	5	13.6	2.7	33.6	6.7
FBW	Black Oak Forest (black oak - white oak phase)	386	1,721.7	4.5	4,254.4	11.0
FPF	Black Oak Forest (pin oak phase)	9	16.0	1.8	39.6	4.4
FAO	Black Oak Forest (aspen phase)	18	12.0	0.7	29.8	1.7
Temporarily Flooded Cold-deciduous Forest Formation						
FDW	Mixed Deciduous Wetland Forest	106	199.4	1.9	492.7	4.6
FSC	Silver Maple - Elm Forest	24	96.0	4.0	237.1	9.9
FWM	River Birch - (Sycamore) Temporarily Flooded Forest	15	49.1	3.3	121.3	8.1
FCW	Midwestern Cottonwood - Black Willow Forest	101	302.9	3.0	748.4	7.4
FWA	Quaking Aspen Temporarily Flooded Forest	49	34.0	0.7	84.0	1.7
Seasonally Flooded Cold-deciduous Forest Formation						
FMS	Maple - Ash - Elm Swamp Forest	149	578.8	3.9	1,430.4	9.6
FPS	Northern (Great Lakes) Flatwoods (pin oak phase)	51	140.3	2.8	346.6	6.8
FSW	Northern (Great Lakes) Flatwoods (swamp white oak phase)	19	84.7	4.5	209.4	11.0
Saturated Cold-deciduous Forest Formation						
FRS	Southern New England Red Maple Seepage Swamp	15	44.4	3.0	109.6	7.3
FTM	Central Tamarack - Red Maple Rich Swamp (tamarack - red maple phase)	3	28.0	9.3	69.1	23.0
FCR	Central Tamarack - Red Maple Rich Swamp (northern white-cedar phase)	1	0.9	0.9	2.2	2.2

Map class code	Map class name	Frequency	Area (Ha)	Ave (Ha)	Area (Ac)	Ave (Ac)
Mixed Needle-leaved Evergreen - Cold-deciduous Forest Formation						
FJO	Jack Pine - (Northern Pin Oak, Black Oak) Forest	22	19.9	0.9	49.1	2.2
FPO	White Pine - White Oak Sand Forest	8	7.8	1.0	19.3	2.4
Planted/cultivated Temparate or Subpolar Needle-leaved Evergreen Forest Formation						
FPP	Conifer Plantation	22	15.3	0.7	37.8	1.7
Planted/cultivated Cold-deciduous Forest Formation						
FOD	Deciduous Orchard	5	13.3	2.7	32.9	6.6
WOODLAND CLASS						
Cold-deciduous Woodland Formation						
WBL	Black Oak - Northern Pin Oak / Common Hairgrass Woodland	89	341.1	3.8	843.0	9.5
WBO	North-central Dry-Mesic Oak Woodland	3	3.8	1.3	9.3	3.1
WCF	Cottonwood Dune (natural foredune phase)	45	31.8	0.7	78.7	1.7
WDC	Cottonwood Dune (disturbance phase)	34	37.9	1.1	93.7	2.8
SHRUBLAND CLASS						
Temperate Cold-deciduous Shrubland Formation						
SMX	Mixed Deciduous Shrubland	108	133.1	1.2	328.8	3.0
SSP	Hardhack Wet-Mesic Sand Shrub Meadow	3	1.2	0.4	2.9	1.0
SHB	Hazelnut Sand Barrens	22	7.8	0.4	19.3	0.9
Seasonally Flooded Cold-deciduous Shrubland Formation						
SAS	Speckled Alder Swamp	1	0.8	0.8	1.9	1.9
SMS	Dogwood - Willow Swamp	166	153.5	0.9	379.3	2.3
Semipermanently Flooded Cold-deciduous Shrubland Formation						
SBS	Northern Buttonbush Swamp	70	61.8	0.9	152.6	2.2
HERBACEOUS VEGETATION CLASS						
Tall Sod Temperate Grassland Formation						
HLB	Midwest Dry-Mesic Sand Prairie	14	11.9	0.9	29.5	2.1
Medium-tall Sod Temperate or Subpolar Grassland Formation						
HMX	Mixed Herbaceous Fallow Field	271	540.7	2.0	1,336.0	4.9
HAB	Great Lakes Beachgrass Dune and/or Midwest Sand Barrens	114	311.2	2.7	768.9	6.7

Map class code	Map class name	Frequency	Area (Ha)	Ave (Ha)	Area (Ac)	Ave (Ac)
Temporarily Flooded Temperate or Subpolar Grassland Formation						
HCP	Central Cordgrass Wet Prairie	92	47.6	0.5	117.7	1.3
Seasonally Flooded Temperate or Subpolar Grassland Formation						
HWM	Mixed Herbaceous Wet Meadow	50	56.2	1.1	138.8	2.8
HDW	Interdunal Wetland	16	7.9	0.5	19.5	1.2
HSM	Tussuck Sedge Wet Meadow	49	29.2	0.6	72.1	1.5
HPH	Reed Canary Grass Eastern Marsh	28	26.5	0.9	65.4	2.3
HBC	Bulrush - Cattail - Burreed Shallow Marsh	16	21.5	1.3	53.2	3.3
Semipermanently Flooded Temperate or Subpolar Grassland Formation						
HPM	Eastern Reed Marsh	52	32.5	0.6	80.2	1.5
HCM	Midwest Cattail Deep Marsh	261	432.6	1.7	1,069.0	4.1
Tall Temperate Grassland with a Sparse Cold-deciduous Tree Layer Formation						
HOB	Black Oak / Lupine Barrens	8	38.2	4.8	94.5	11.8
Medium-tall Temperate or Subpolar Grassland with a Sparse Needle-leaved Evergreen or Mixed Tree Layer Formation						
HPB	Great Lakes Pine Barrens	22	18.8	0.9	46.3	2.1
Permanently Flooded Temperate or Subpolar Hydromorphic-rooted Vegetation Formation						
HSV	Midwest Pondweed Submerged Aquatic Wetland	35	41.7	1.2	103.0	2.9
HWL	Water-lily Aquatic Wetland	27	45.0	1.7	111.2	4.1
Perennial grass crops (hayland, pastureland) Formation						
HGC	Perennial Grass Crops	36	59.8	1.7	147.7	4.1
Annual Close-grown Forbs and Grasses Formation and/or Annual Row-crop Forbs and Grasses Formation						
HCF	Crop Field	82	734.2	9.0	1,814.3	22.1
SPARSE VEGETATION CLASS						
Dunes with Sparse Herbaceous Vegetation Formation						
VDS	Wooded Great Lakes Dune Sparse Vegetation	19	9.5	0.5	23.4	1.2

Map class code	Map class name	Frequency	Area (Ha)	Ave (Ha)	Area (Ac)	Ave (Ac)
GENERAL LANDCOVER (Non-NVC)						
Terrestrial Natural/Semi-natural Non-vegetated						
Barren Beach						
NLB	Lakeshore Sand and Cobble Beach	9	94.2	10.5	232.7	25.9
NSD	Barren Sand Dune	17	19.4	1.1	47.8	2.8
Open Water-body						
NSR	Open Water Stream and River	13	56.4	4.3	139.4	10.7
NLP	Open Water Lake and Pond	50	1,369.6	27.4	3,384.4	67.7
Developed Area						
LID	Industrial	20	381.7	19.1	943.2	47.2
LRC	Residential and Commercial	249	2,209.3	8.9	5,459.2	21.9
LQR	Quarry	3	13.6	4.5	33.6	11.2
LAP	Artificial Pond	53	63.3	1.2	156.5	3.0
LRR	Road and Railroad	52	549.4	10.6	1,357.7	26.1
LFS	Farmstead	26	33.8	1.3	83.6	3.2
LBL	Barren Land	4	46.6	11.7	115.2	28.8

Table 11. Area report of the Indiana Dunes National Lakeshore vegetation map layer, via NVC formations.

Map class code	Map class name	Frequency	Area (Ha)	Ave (Ha)	Area (Ac)	Ave (Ac)
FOREST CLASS		**1,794**	**5,184.2**	**2.9**	**12,810.3**	**7.1**
Rounded-crowned Temperate or Subpolar Needle-leaved Evergreen Forest Formation		4	3.0	0.7	7.3	1.8
Lowland or Submontane Cold-deciduous Forest Formation		1200	3,566.5	3.0	8,813.0	7.3
Temporarily Flooded Cold-deciduous Forest Formation		295	681.3	2.3	1,683.5	5.7
Seasonally Flooded Cold-deciduous Forest Formation		219	803.9	3.7	1,986.4	9.1
Saturated Flooded Cold-deciduous Forest Formation		19	73.2	3.9	181.0	9.5
Mixed Needle-leaved Evergreen - Cold-deciduous Forest Formation		30	27.7	0.9	68.4	2.3
Planted/cultivated Temparate or Subpolar Needle-leaved Evergreen Forest Formation		22	15.3	0.7	37.8	1.7
Planted/cultivated Cold-deciduous Forest Formation		5	13.3	2.7	32.9	6.6

Map class code	Map class name	Frequency	Area (Ha)	Ave (Ha)	Area (Ac)	Ave (Ac)
WOODLAND CLASS		**171**	**414.7**	**2.4**	**1,024.7**	**6.0**
	Cold-deciduous Woodland Formation	171	414.7	2.4	1,024.7	6.0
SHRUBLAND CLASS		**370**	**358.1**	**1.0**	**884.8**	**2.4**
	Temperate Cold-deciduous Shrubland Formation	133	142.0	1.1	351.0	2.6
	Seasonally Flooded Cold-deciduous Shrubland Formation	167	154.3	0.9	381.2	2.3
	Semipermanently Flooded Cold-deciduous Shrubland Formation	70	61.8	0.9	152.6	2.2
HERBACEOUS VEGETATION CLASS		**1,173**	**2,455.4**	**2.1**	**6,067.5**	**5.2**
	Tall Sod Temperate Grassland Formation	14	11.9	0.9	29.5	2.1
	Medium-tall Sod Temperate or Subpolar Grassland Formation	385	851.8	2.2	2,104.9	5.5
	Temporarily Flooded Temperate or Subpolar Grassland Formation	92	47.6	0.5	117.7	1.3
	Seasonally Flooded Temperate or Subpolar Grassland Formation	159	141.2	0.9	349.0	2.2
	Semipermanently Flooded Temperate or Subpolar Grassland Formation	313	465.1	1.5	1,149.3	3.7
	Tall Temperate Grassland with a Sparse Cold-deciduous Tree Layer Formation	8	38.2	4.8	94.5	11.8
	Medium-tall Temperate or Subpolar Grassland with a Sparse Needle-leaved Evergreen or Mixed Tree Layer Formation	22	18.8	0.9	46.3	2.1
	Permanently Flooded Temperate or Subpolar Hydromorphic-rooted Vegetation Formation	62	86.7	1.4	214.3	3.5
	Perennial Grass Crops (hayland, pastureland) Formation	36	59.8	1.7	147.5	4.1
	Annual Close-grown Forbs and Grasses and/or Annual Row-crop Forbs and Grasses Formation	82	734.2	9.0	1,814.3	22.1
SPARSE VEGETATION CLASS		**19**	**9.5**	**0.5**	**23.4**	**1.2**
	Dunes with Sparse Herbaceous Vegetation Formation	19	9.5	0.5	23.4	1.2
	NVC Subtotal	**3,527**	**8,421.8**	**2.4**	**20,810.6**	**5.9**
GENERAL LANDCOVER (Non-NVC)						
	Terrestrial Natural/Semi-natural Non-vegetated	**89**	**1,539.6**	**17.3**	**3,803.7**	**42.7**
	Barren Beach	26	113.5	4.4	280.6	10.8
	Open Water-body	63	1,425.8	22.6	3,523.1	55.9
	Developed Area	**408**	**3,2997.7**	**8.1**	**8,148.9**	**20.0**
	Non-NVC Subtotal	**496**	**4,837.3**	**9.8**	**11,953.4**	**24.1**
	GRAND TOTAL	**4,023**	**13,259.1**	**3.3**	**32,764.0**	**8.1**

Brief Analysis and Discussion

Collectively, the INDU spatial database layer is comprised of 4,023 polygons covering 13,259.1 ha, with an average polygon size of 3.3 ha. Map classes representing NVC types comprise 3,527 polygons and cover 8,421.8 ha (87.7% of all polygons, and 63.5% of the entire area), having an average polygon size of 2.4 ha. The NVC Forest Class comprises the majority of polygons and area covered by NVC types, with 1,794 polygons covering 5,184.2 ha (50.9% of NVC polygons, and 61.6% of NVC area). The Forest Class is largely dominated by the Lowland or Submontane Cold-deciduous Forest Formation both in polygon frequency and area (1200 polygons, or 66.9%, and 3,566.5 ha, or 68.8%, of area). This is largely because of the Black Oak Forest community (including all map class phases) having 413 polygons covering 1749.7 ha and the Northeastern Modified Successional Forest community (including all map class phases) having 526 polygons covering 1127.2 ha. From this quick analysis, we begin to see INDU is largely made up of upland deciduous forests.

The non-vegetated landscape comprises about a third of the map layer area, consisting of only 496 polygons, yet covers 4,837.3 ha (12.3% of all polygons and 36.5% of the entire area). The average polygon size is considerably larger than that of other NVC map classes; non-NVC map classes have an average polygon size of 9.8 ha. Of the non-NVC map classes, two dominate: Residential and Commercial (LRC) and Open Water Lake and Pond (NLP). The NLP map class is presented only 50 times in the map layer, but covers 1,369.6 ha (28.3% of the non-NVC unit area), and promotes this map class as having the highest average polygon size of the map layer (27.4 ha). This is largely because of the buffer extent into Lake Michigan. The LRC map class covers 2,209.3 ha mapped with 249 polygons. This is 45.7% of the area represented by non-NVC units, and 16.7% of the entire map layer area. This attests to the urbanized setting INDU is located within.

Considerably more analyses and deductions can be attained even from these simple summary reports. Other summary tables can be derived from the map layer of localized areas (e.g., INDU lands excluding the environs, Pinhook Bog unit, buffer zone from shoreline) 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, historic land use). By doing this, one can make further deductions regarding vegetation and its ecology.

Map Layer Presentation

Figure 11 presents the map layer produced for the INDU 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 11 is generalized, collapsing map classes at the NVC formation level.

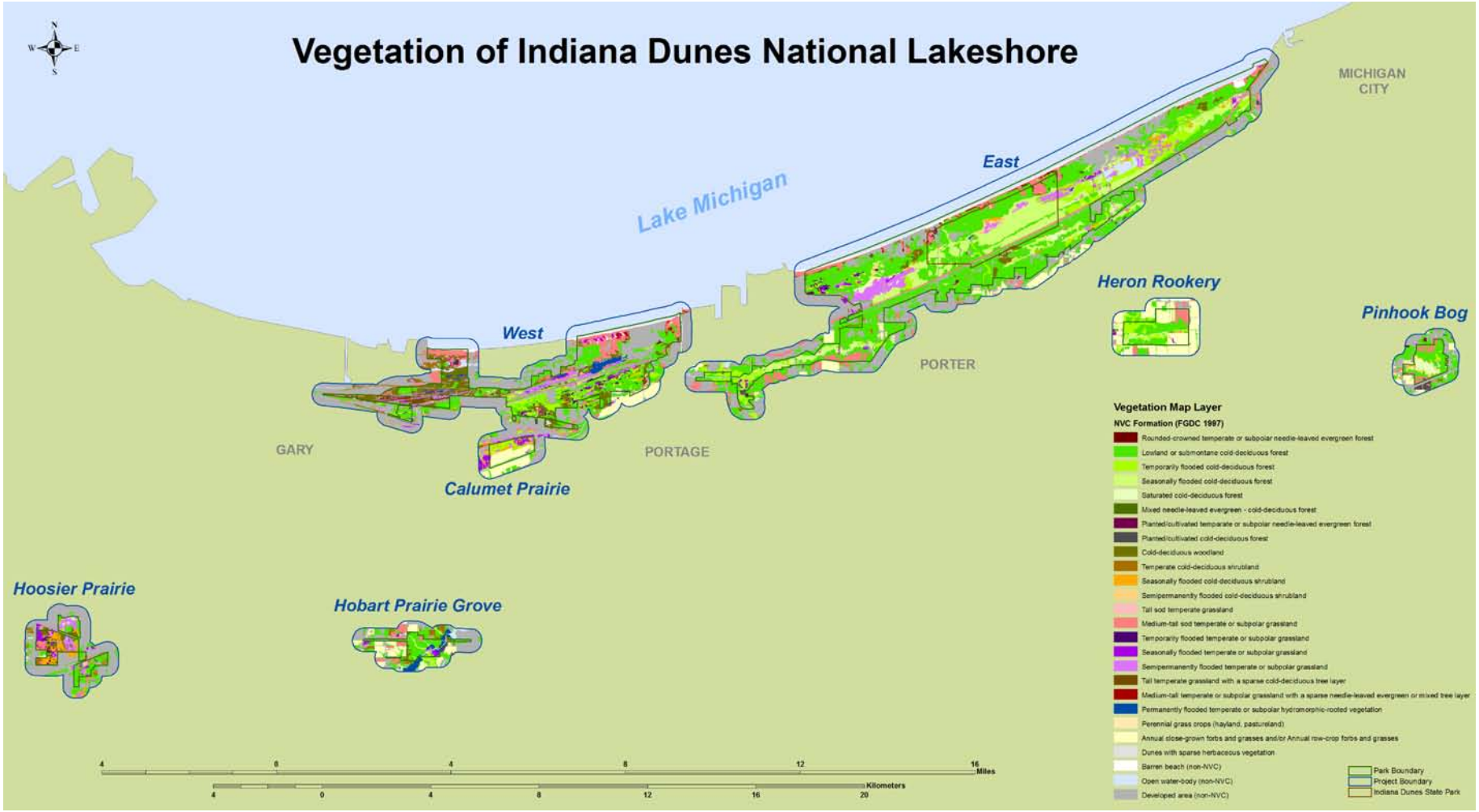


Figure 11. Map composition showing vegetation types and land use of Indiana Dunes National Lakeshore and environs, produced from the vegetation map layer.

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 accuracy assessment 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 accuracy assessment are "producers' accuracy," which is the probability that an accuracy assessment 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 an error of commission). Both users' and producers' accuracy can be obtained from the same set of data using different analyses. Errors occur when map classes are not the same as the classes observed in the field. A major assumption of accuracy assessment is that the process of mapping and the process of the assessment (i.e., the application of the classification system) are identical so a "false error" is not detected because of procedural differences. In actuality, the process of accuracy assessment 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 acquire accuracy assessment sites. We included all primary map classes representing National Vegetation Classification (NVC) natural/semi-natural vegetation types (association, alliance, or formation) as the individual themes to randomly select sites. Map class phases were collapsed into the primary map class. (Recall a map class phase is a version of a plant community recognizable on the aerial photographs and important to distinguish as a map unit for either management or ecological interests.) Private lands outside Indiana Dunes National Lakeshore (INDU, also referred to as the Lakeshore) were off limits for the evaluation, but all locations within the Lakeshore and Indiana Dunes State Park were included. The number of samples needed for each map class was determined 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 hectares 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 hectares 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 hectares of the total area but consists of more than 30 polygons. The recommended sample size is 20. The rationale for reducing the sample size is that the class occupies a small area. At the same time, however, the class consists of a considerable number of distinct polygons that are possibly widely distributed. The number of samples therefore remains relatively high because of the high frequency of the class.

Scenario D: The class is rare. It has more than 5 but fewer than 30 polygons and covers less than 50 hectares 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 5 polygons and occupies less than 50 hectares 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 5, 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 meeting 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 at INDU and added extra points to account for inaccessible or remote sites that could potentially be difficult or impractical to reach once in the field. For map classes where the MMU was 0.5 ha, a 10-m buffer was applied to the polygon edges to help ensure the GPS's placement within the correct polygon boundaries. For wetland map classes on the West unit where the MMU was 0.1 ha, a 2-m buffer was applied to the polygon edges. Once the buffer was applied, random AA points were generated for each map class using Hawth's Tools for ArcGIS (Beyer, H.L. 2004). The AA points were then assigned a random number used to identify each AA site location.

We equipped the field teams with several tools to maximize their ability to accurately locate each point. We plotted 1:12,000-scale hard-copy maps (using a background mosaic of the CIR images at the same scale) for the East, West, and Calumet Prairie units. We plotted 1:10,000-scale hard copy maps for the Pinhook Bog, Hobart Prairie Grove, Heron Rookery, and Hoosier Prairie units. Each of these maps displayed locations of the accuracy assessment sites, the unlabelled polygon boundaries of the vegetation map, and the park and state boundaries. In addition, coordinates to AA sites were uploaded into GPS receivers (UTM projection, Zone 16, using NAD83) to help navigate the field teams.

Field Data Collection

The field teams used Garmin GPS units to navigate to the sites. They also used hard copy maps with the AA site location demarked to help navigate around environmental barriers. Once the sample site was reached, the field crew evaluated an area equal to MMU size (using draft version of the field key to vegetation types of INDU) and determined the appropriate NVC vegetation type. The field crew also recorded the field GPS coordinate location, 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.

Our original goal was to collect 652 sites for AA. However, budget limitations restricted the number of field people hired and thus resulted in 484 sites collected by 3 different teams, about 25% less than originally intended.

Data Analyses

The AA field data were entered into the NPS PLOTS Database Version 2 (TNC 2005b) and reviewed for data entry errors. The analyses of the map accuracy using the field data included the following steps:

- Initial comparison analysis of the field and map data,

- Review of all disagreements and correcting for false errors as necessary,
- Final comparison analysis of the field and map data,
- 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 Comparison Analysis: We completed a spatial join of the field assessment spatial coordinate data with the map polygon data. This allowed us to compare each field AA call to the corresponding map class code. We used Microsoft Excel 2003 (Microsoft Corporation) to compare and tabulate the field assessments to the map polygons. Our comparison accounted for all alternative map class calls indicated on the field data sheets. Our analysis accepted alternate field calls matching map polygon calls as correct.

Review of Disagreements: All mismatches (disagreements) were subsequently reviewed for false errors. A false error is defined as a mismatch between the map polygon and an accuracy assessment call if caused by an error in GPS field coordinates, a missing or misapplied field call, or a field site assessment area smaller than the polygon minimum mapping unit (an inclusion). This review process involved looking at every polygon and its corresponding accuracy assessment site on the photos. Using both the accuracy assessment site and the vegetation map layers in ArcGIS (Version 9.2, © 2006 Environmental Systems Research Institute, Redlands, California), we located and viewed the sites on each photo using 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 corrected disagreements deemed false errors resulting in either a match or a true error using the following concepts:

(1) Spatial GPS coordinate error – Occurred when the GPS acquired inaccurate field coordinates causing the site to be located inside an adjacent polygon on the map layer. Through sampling design—selecting sites more than 10 m from polygon edges—we were able to minimize these errors for all regions of the park except for the wetland shrub and herbaceous map classes in the West Unit, where the 10-m buffer could not be used. Sites that were determined to have spatial GPS field coordinate displacement were adjusted accordingly to reflect the intended polygon's map class.

(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 the other vegetation class(es) 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 call in preparation for the second comparison analysis. (We also updated the project's PLOTS Database.)

(3) Inclusion – The area assessed in the field during the accuracy assessment 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 vegetative features can be quite apparent from each other on the aerial photographs (e.g., open woodland vs. dense forest), allowing easy assessment of site inclusions in the lab.

Final Comparison: Of the 484 accuracy assessment sites originally collected, we dropped 15 sites because of problems with the data (e.g. missing UTM coordinates, incomplete or redundant data). We used the remaining 469 sites for the final comparison analysis (Figure 12).

Individual Map Class Analysis: For individual map class accuracy results that fall below Program standards, we studied the comparisons to examine what map classes were in confusion. If a repetitive confusion was evident, we then determined whether to merge the map classes for accuracy purposes or to leave the map classes as is, even if it results in lower accuracy.

Final Output: The results of the final analyses were transferred into a contingency table (matrix) where we calculated user and producer accuracy percentages for each map class. The matrix shows both the frequency of agreement and placement of disagreements.

Accuracy Assessment Spatial Database: For use in GIS, we produced a spatial database of the AA site locations along with supporting tables, and incorporated them into the project's geodatabase. The field data are also included in the project's PLOTS Database.

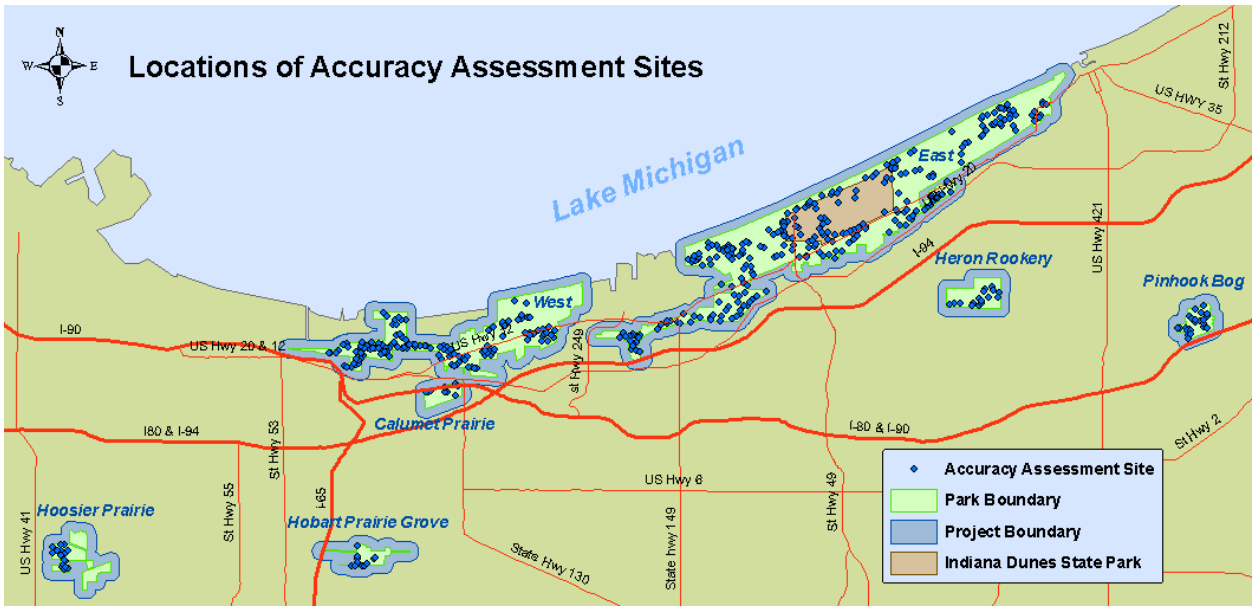


Figure 12. Locations of 469 accuracy assessment sites used to test the vegetation map layer.

Results

Overall accuracy is 78.2% for primary map classes representing NVC natural/semi-natural vegetation types. A kappa adjustment for chance agreements resulted in a final overall accuracy of 76.9%. The AA contingency matrix is provided in Appendix G: Accuracy Assessment Contingency Table. The matrix shows each map class's accuracy 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 National Park Service (NPS) Vegetation Inventory Program (VIP) accuracy requirement. The most important factor affecting accuracy was the small polygons we attempted to map down to 0.1 ha in the West unit. Many of these polygons were obscured by trees on the aerial photographs, often creating shadows instead of recognizable signatures. We attempted to discern the correct vegetation types using clues from unshadowed near-by signatures or finding unshadowed corners in the small polygons that hinted at the vegetation types. Unfortunately, 18 errors, creating both errors of omission and commission, were incorrectly missed to other herbaceous or shrubland types in these small polygons. Had these not been missed, the overall accuracy for the vegetation map layer would have reached more than 81%.

Small polygons that were often missed to other vegetation communities are as follows:

Midwest Cattail Deep Marsh (HCM): 2 errors to Eastern Reed Marsh (HPM), 1 error to Northern Buttonbush Swamp (SBS), and 1 error to Water-lily Aquatic Wetland (HWL).

Central Cordgrass Wet Prairie (HCP): 1 error to Quaking Aspen Temporarily Flooded Forest (FWA), 1 error to Midwest Dry-Mesic Sand Prairie (HLB).

Tussock Sedge Wet Meadow (HSM): 1 error to Bulrush - Cattail - Burreed Shallow Marsh (HBC), 1 error to Wet Meadow (HWM).

Midwest Pondweed Submerged Aquatic Wetland (HSV): 1 error to Tussock Sedge Wet Meadow (HSM), 1 error to Eastern Reed Marsh (HPM).

Northern Buttonbush Swamp (SBS): 1 error to Mixed Deciduous Shrubland (SMX), 1 error to Bulrush - Cattail - Burreed Shallow Marsh (HBC), 1 error to Water-lily Aquatic Wetland (HWL), 1 error to Mixed Deciduous Wetland Forest (FDW).

Dogwood -Willow Swamp (SMS): 1 error to Northern Buttonbush Swamp (SBS), 2 errors to Eastern Reed Marsh (HPM), 1 error to Jack Pine - (Northern Pin Oak, Black Oak) Forest (FJO).

Some individual accuracies did not meet the 80% requirement (taking into account the 90% confidence intervals). The following are map classes not meeting the required accuracy, either with the actual percentage or within the 90% confidence interval:

(1) Silver Maple - Elm Forest (FSC): Users' accuracy for this class is 25% with a 90% confidence interval of -23–73%. Of the four polygons mapped as FSC, 3 AA sites within those polygons were found to be different vegetation types: 1 error to Midwestern Cottonwood - Black Willow Forest (FCW), and 2 errors to Mixed Deciduous Wetland Forest (FDW), a disturbed wetland forest type. Errors were caused by misinterpreting the percentages of individual tree species or because the level of disturbance was assessed differently between the photointerpreter and the AA teams.

(2) Dogwood -Willow Swamp (SMS): Users' accuracy for this class is 53% with a 90% confidence interval of 31–74%. Of the 19 polygons mapped as SMS, 9 AA sites within those polygons were found to be different vegetation types: 1 error to Water-lily Aquatic Wetland (HWL, 2 errors to Eastern Reed Marsh (HPM), 2 errors to Mixed Herbaceous Wet Meadow (HWM), 1 error to Tussock Sedge Meadow (HSM), 1 error to Northern Buttonbush Swamp (SBS), 1 error to Jack Pine - (Northern Pin Oak, Black Oak) Forest (FJO), and 1 error to Mixed Deciduous Wetland Forest (FDW). Reasons for the errors were because of shadowed polygons, differences between the mappers and AA teams in estimating the percent of shrub present, or not accurately identifying the type of shrub. The forest type found by the AA team was a mixture of scattered trees and shrubs.

(3) Midwest Cattail Deep Marsh (HCM): Users' accuracy for this class is 57% with a 90% confidence interval of 37–77%. Of the 21 polygons mapped as HCM, 9 AA sites within those polygons were found to be other vegetation types: 2 errors to Dogwood - Willow Swamp (SMS), 1 error to Northern Buttonbush Swamp (SBS), 1 error to Tussock Sedge Wet Meadow (HSM), 1 error to Wet Meadow (HWM), 1 error as Bulrush - Cattail - Burreed Shallow Marsh (HBC), 2 errors to Eastern Reed Marsh (HPM), and 1 error to Water-lily Aquatic Wetland (HWL). Errors were caused by misinterpreting the amount of shrub present, misinterpreting cattail for other herbaceous species, or misinterpreting the percentage amount of cattail needed for HCM.

(4) Midwest Dry-Mesic Sand Prairie (HLB): Producers' accuracy for this class is 43% with a 90% confidence interval of 18–68%. Of the 14 accuracy assessment sites found to be HLB, 8 polygons were mapped as other vegetation types: 1 error to Midwestern Cottonwood - Black Willow Forest (FCW), 2 errors to the Midwest Sand Barrens/Great Lakes Beachgrass Dune Map Group (HAB), 1 error to Hazelnut Sand Barrens (SHB), and 4 errors to Central Cordgrass Wet Prairie (HCP). Errors were made where photo signatures appeared transitional, or when the AA team found a higher density of trees present.

(5) Wet Meadow (HWM): Producers' accuracy for this class is 50% with a 90% confidence interval of 24–76%. Of the 14 accuracy assessment sites found to be HWM, 7 polygons were mapped as other vegetation types: 1 error to a Midwestern White Oak - Red Oak Forest (FWR), 2 errors to Dogwood - Willow Swamp (SMS), 2 errors to Central Cordgrass Prairie (HCP), 1 error to Midwest Cattail Deep March (HCM), and 1 error to Tussock Sedge Wet Meadow (HSM). Errors were caused, in part, by shadows. This vegetation type could include shrub cover or even a sparse layer of trees, and thus created errors when there was disagreement in the percent covers between the AA teams and the photo interpreter.

(6) Bulrush - Cattail - Burreed Shallow Marsh (HBC): Producers' accuracy for this class is 33% with a 90% confidence interval of -7–73%. Of the 6 accuracy assessment sites found to be HBC, 4 polygons were mapped as other vegetation types: 1 error to Northern Buttonbush Swamp (SBS), 1 error to Tussock Sedge Wet Meadow (HSM), 1 error to Midwest Cattail Deep Marsh (HCM), and 1 error to Midwest Pondweed Submerged Aquatic Wetland (HSV). Errors were typically caused by the difficulties attempting to map transitional areas.

(7) Eastern Reed Marsh (HPM): Producers' accuracy for this class is 50% with a 90% confidence interval of 26–74%. Of the 16 accuracy assessment sites found to HPM, 8 polygons were mapped as other vegetation types: 2 errors to Dogwood - Willow Swamp (SMS), 1 error to Northern Buttonbush Swamp (SBS), 1 error to Wet Meadow (HWM), 2 errors to Midwest Cattail Deep Marsh (HCM) and 2 errors to Midwest Pondweed Submerged Aquatic Wetland (HSV). Errors were caused by attempting to map polygons where shadows obscured the signatures, by disagreements in the percentage of shrub cover, or by changes in vegetation growth between the time the photos were taken and the AA teams collected the ground data.

Discussion

Accuracy requirements for the NPS VIP specify an 80% accuracy for both the collective map classes and individual map classes (themes) representing NVC floristic vegetation types. As stated above, AA fell slightly below the required accuracy because of attempts to map very small polygons on the West unit that were often obscured by shadows on the aerial photographs.

An AA is accomplished through field data collection using a stratified random sampling design, with subsequent comparison to the mapped polygons. Errors occur when map classes assigned to the polygons do not agree with the vegetation types observed from the field sampling. While this sounds straightforward, in actuality it is not, in part because a major assumption of AA is violated—the assumption that the mapping process and the assessment process are identical, thus false errors do not occur because of procedural differences. The AA procedure, however, is based on field observance, while the procedure of mapping is based on aerial photointerpretation. The two different perspectives each have inherent subjectivity that naturally leads to disagreements when compared to one another. The disagreements do not necessarily mean one perspective is right and the other is wrong. Thus, the usefulness of traditional statistical analysis methods to determine the accuracy is limiting because definitions of "error" and "accuracy" within this traditional framework leave no room to account for interpretive judgment calls that are inherent to both mapping and field data collection.

In concluding the analysis, we had subjected the AA data to a lengthy review process to overcome the majority of inherent shortcomings. This allowed us to determine a realistic estimate of the thematic assessment. Although we have conducted AA analysis with several other mapping projects in the past, we have not yet discovered a better way of comparing the two data sets. Thus, we found ourselves faced with many hours of discerning problems and correcting false errors. These scenarios included investigating coordinates placed in unfavorable spots, thus making it difficult, if not impossible, to classify mapped polygons (even generalizing average canopy covers of species occurring across a variety of plant

assemblages are separated by subjective decisions of relative cover). Our efficiency during the analysis process was broken into seemingly non-ending piles of data sheets and aerial photos as we tried to discern each scenario. Yet, the alternative of conducting a purely mechanized comparison and simply reporting the results would be less favorable because the results would be calculated with many false errors and indubitably fail in meeting NPS VIP accuracy requirements.

We were aware that training field crews and spending several days in the field would allow for better understanding and knowledge of the AA field process. In fact, we realized that more field time could have been spent with the AA crews to circumvent many issues that were later discovered during the analysis. These issues ranged from finding too many sites that were inclusions (areas too small to map) to poorly taken (or missing) ground photos of the sites. A review of procedures is needed, especially when data are collected by several different teams that were not all able to be at the initial training, as was the case at INDU. In addition, a better vegetation key could have been written prior to the field season.

Lastly, some errors recognized in the AA process simply occurred because of the nature of the data. Many plant species occur in multiple vegetation types, and it takes only a small disparity in the subjective estimate of relative cover values to result in differences. Also, because the area of the field site is often a small area within a larger polygon, the relative canopy cover at the field site may actually be different from the rest of polygon, resulting in an error (except when the field site was an obvious inclusion).

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National Park Service
Vegetation Inventory Program
Indiana Dunes National Lakeshore, Indiana

September 2009

Appendix A

Plot Sampling Form

NATIONAL PARK VEGETATION MAPPING PROGRAM: PLOT SURVEY FORM

IDENTIFIERS/LOCATORS

Plot Code_____ Polygon Code_____

Provisional CommunityName_____

State____ Park Name_____ Park Site Name_____

Quad Name_____ Quad Code_____

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

Waypoint_____ Zone_____ Datum_____ Error +/-_____ m Elevation_____

please do not complete the following information when in the field

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

Survey Date_____ Surveyors_____

Directions to Plot:

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

Plot representativeness:

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

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

ENVIRONMENTAL DESCRIPTION

Slope_____Aspect_____

Topographic Position

Landform

Surficial Geology

Cowardian System
___Upland
___Riverine
___Palustrine
___Lacustrine

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

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

VEGETATION DESCRIPTION

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

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

please see above table for height and cover scales

Animal Use Evidence

Natural and Anthropogenic Disturbance Comments:

Overall Qualitative Assessment:

Plot Code ____

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

Stratum	Species Name	Cover Class	Stratum	Species Name	Cover Class

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

National Park Service
Vegetation Inventory Program
Indiana Dunes National Lakeshore, Indiana

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Appendix B

Descriptions to Vegetation Types of Indiana Dunes National Lakeshore

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I. FOREST 6

I.A.8.N.b. Rounded-crowned temperate or subpolar needle-leaved evergreen forest 6

A.116 *Pinus banksiana* Forest Alliance 6
[CEGL002589] *Pinus banksiana - Pinus resinosa - Pinus strobus* Dune Forest 6

I.B.2.N.a. Lowland or submontane cold-deciduous forest 8

A.220 *Acer saccharum - Tilia americana* - (*Quercus rubra*) Forest Alliance 8
[CEGL002062] *Acer saccharum - Tilia americana* / *Ostrya virginiana - Carpinus caroliniana* Forest 8

A.227 *Fagus grandifolia - Acer saccharum* - (*Liriodendron tulipifera*) Forest Alliance 11
[CEGL005013] *Fagus grandifolia - Acer saccharum* Glaciated Midwest Forest 11

A.237 *Prunus serotina - Acer rubrum - Amelanchier canadensis - Quercus* spp. Forest Alliance 14
[CEGL006599] *Prunus serotina - Liriodendron tulipifera - Acer rubrum - Fraxinus americana* - (*Robinia pseudoacacia*) Forest 14

A.239 *Quercus alba - (Quercus rubra, Carya* spp.) Forest Alliance 17
[CEGL002068] *Quercus alba - Quercus rubra - Carya ovata* Glaciated Forest 17

A.251 *Quercus rubra* - (*Acer saccharum*) Forest Alliance 20
[CEGL005017] *Quercus rubra* - (*Acer saccharum, Quercus alba*) Forest 20

A.1911 *Quercus velutina - Quercus alba* - (*Quercus coccinea*) Forest Alliance 23
[CEGL002078] *Quercus velutina* / *Carex pensylvanica* Forest 23

I.B.2.N.d. Temporarily flooded cold-deciduous forest 26

A.279 *Acer saccharinum* Temporarily Flooded Forest Alliance 26
[CEGL002586] *Acer saccharinum - Ulmus americana* Forest 26

A.280 *Betula nigra* - (*Platanus occidentalis*) Temporarily Flooded Forest Alliance 29
[A.280] *Betula nigra* - (*Platanus occidentalis*) Temporarily Flooded Forest Alliance 29

A.290 *Populus deltoides* Temporarily Flooded Forest Alliance 31
[CEGL002018] *Populus deltoides - Salix nigra* Forest 31

A.300 *Populus tremuloides* Temporarily Flooded Forest Alliance 34
[A.300] *Populus tremuloides* Temporarily Flooded Forest Alliance 34

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A.316 *Acer rubrum - Fraxinus pennsylvanica* Seasonally Flooded Forest Alliance 37
[CEGL005038] *Acer* (*rubrum, saccharinum*) - *Fraxinus* spp. - *Ulmus americana* Forest 37

A.329 *Quercus palustris* - (*Quercus bicolor*) Seasonally Flooded Forest Alliance 40
[CEGL005037] *Quercus palustris - Quercus bicolor - Acer rubrum* Flatwoods Forest 40

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A.3035 *Acer rubrum - Fraxinus pennsylvanica* Saturated Forest Alliance 42
[CEGL006406] *Acer rubrum - Fraxinus* (*pennsylvanica, americana*) / *Lindera benzoin* / *Symplocarpus foetidus* Forest 42

A.349 *Larix laricina* Saturated Forest Alliance 45
[CEGL005232] *Larix laricina - Acer rubrum* / *(Rhamnus alnifolia, Vaccinium corymbosum)* Forest 45

I.C.3.N.a. Mixed needle-leaved evergreen - cold-deciduous forest 47

A.391 *Pinus banksiana - Quercus* (*ellipsoidalis, velutina*) Forest Alliance 47
[A.391] *Pinus banksiana - Quercus* (*ellipsoidalis, velutina*) Forest Alliance 47

A.401 *Pinus strobus - Quercus* (*alba, rubra, velutina*) Forest Alliance 49
[CEGL002481] *Pinus strobus - Quercus alba /* (*Corylus americana, Gaylussacia baccata*) Forest 49

II. WOODLAND 51

II.B.2.N.a. Cold-deciduous woodland 51

A.1493 *Populus deltoides* Woodland Alliance 51
[CEGL005119] *Populus deltoides* - (*Juniperus virginiana*) Dune Woodland 51

A.619 *Quercus macrocarpa - Quercus* (*alba, ellipsoidalis, velutina*) Woodland Alliance 53
[CEGL002142] *Quercus alba - Quercus macrocarpa - Quercus rubra* / *Corylus americana* Woodland 53

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A.612 *Quercus alba* - (*Quercus velutina*) Woodland Alliance **57**
[CEGL005029] *Quercus velutina* - (*Quercus ellipsoidalis*) - *Quercus alba* / *Deschampsia flexuosa* Woodland 57

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[CEGL005072] *Corylus americana - Salix humilis* / *Schizachyrium scoparium* Shrubland 59
[CEGL005069] *Spiraea tomentosa - Salix humilis* / *Andropogon gerardii - Panicum virgatum* Shrubland 61

A.912 *Prunus pumila* Shrubland Alliance **63**
[CEGL005075] *Prunus pumila* - (*Ptelea trifoliata*) Dune Shrubland 63

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[CEGL002381] *Alnus incana* Swamp Shrubland 65

A.989 *Cornus sericea* - *Salix* spp. Seasonally Flooded Shrubland Alliance **68**
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A.1224 *Schizachyrium scoparium* - (*Sporobolus cryptandrus*) Herbaceous Alliance **80**
[CEGL005099] *Schizachyrium scoparium - Carex tonsa var. rugosperma - Carex muehlenbergii - Lithospermum caroliniense - Opuntia humifusa* Herbaceous Vegetation 80

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V.A.5.N.k. Seasonally flooded temperate or subpolar grassland **85**

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[CEGL002258] *Carex stricta - Carex* spp. Herbaceous Vegetation 85

A.1368 *Cladium mariscoides* Seasonally Flooded Herbaceous Alliance **88**
[CEGL005105] *Dasiphora fruticosa* ssp. *floribunda* / *Cladium mariscoides - Juncus balticus* - (*Rhynchospora capillacea*) Herbaceous Vegetation 88

A.1381 *Phalaris arundinacea* Seasonally Flooded Herbaceous Alliance **91**
[CEGL006044] *Phalaris arundinacea* Eastern Herbaceous Vegetation 91

A.1394 *Typha* spp. - (*Schoenoplectus* spp., *Juncus* spp.) Seasonally Flooded Herbaceous Alliance **94**
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[A.1855] Herbaceous Dunes Sparsely Vegetated Alliance 115

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I. Forest

I.A.8.N.b. Rounded-crowned temperate or subpolar needle-leaved evergreen forest

A.116 *Pinus banksiana* Forest Alliance

Jack Pine Forest Alliance

[CEGL002589] *Pinus banksiana - Pinus resinosa - Pinus strobus* Dune Forest

Translated Name: **Jack Pine - Red Pine - Eastern White Pine Dune Forest**

Common Name: **Great Lakes Dune Pine Forest**

Ecological System(s):

- Great Lakes Dune (CES201.026)
- Great Lakes Wooded Dune and Swale (CES201.726)

Circumscription Confidence: 3 - Weak

Concept Author(s): D. Faber-Langendoen

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*, *Pinus resinosa*, and *Pinus strobus*. This type has not been well-described, and further characterization is needed.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Terrestrial

Indiana Dunes National Lakeshore Environment: This pine dune forest was sampled on a gentle north-facing slope with well-drained sand soil and on a steep northeast-facing slope. It often occurs within a patchwork of other community types.

Global Environment: Stands are found on dune systems along Lake Superior, Lake Michigan and Lake Huron.

VEGETATION DESCRIPTION

Indiana Dunes National Lakeshore Vegetation: The moderately dense canopy is dominated by *Pinus banksiana* (state-imperiled) and may include lesser amounts of *Quercus rubra* or *Quercus velutina*. *Tilia americana* may form a moderate subcanopy. Shrubs are relatively sparse and include *Juniperus communis* (state-imperiled), *Hamamelis virginiana*, *Prunus serotina*, and *Ptelea trifoliata var. mollis*. The herbaceous layer is dominated by *Calamovilfa longifolia*.

Global Vegetation: The canopy is more-or-less closed and is dominated by *Pinus banksiana*, *Pinus resinosa*, and *Pinus strobus*. This type has not been well-described, and further characterization is needed.

Global Dynamics:

INDIANA DUNES NATIONAL LAKESHORE FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform
Pinus banksiana	Tree canopy	Needle-leaved tree
Quercus velutina	Tree canopy	Broad-leaved deciduous tree
Tilia americana	Tree subcanopy	Broad-leaved deciduous tree
Calamovilfa longifolia	Herb (field)	Graminoid

GLOBAL FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform

INDIANA DUNES NATIONAL LAKESHORE OTHER NOTEWORTHY SPECIES

Juniperus communis, *Lonicera tatarica*, *Pinus banksiana*

GLOBAL OTHER NOTEWORTHY SPECIES

CONSERVATION STATUS RANK

Global Rank & Reasons: G3Q 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

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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.

RELATED CONCEPTS

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

CLASSIFICATION & OTHER COMMENTS

Indiana Dunes National Lakeshore Classification Comments: Indiana Dunes NL is at the southern limit of the range of this association and it is rare in the area. Most coastal forests have too much deciduous component (especially *Tilia americana* and/or *Quercus velutina*) to fit the criteria for this conifer-dominated association.

Indiana Dunes National Lakeshore Other Comments:

Global Classification Comments: Type is not described in Ontario by Lee (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, Pinus resinosa* or *Pinus strobus* inland forests on sand. Type (whether as forest or barrens) has been eliminated in Illinois.

ELEMENT DISTRIBUTION

Indiana Dunes National Lakeshore Range: This uncommon community is found on the dunes near Lake Michigan. It does not range inland beyond the first few dunes, but remnant jack pines are sometimes found further inland.

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, WI

USFS Ecoregions: 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

Indiana Dunes National Lakeshore Map Units Summary:

Indiana Dunes National Lakeshore Inventory Notes:

Indiana Dunes National Lakeshore Plots: INDU.VP135, INDU.AA724.

Local Description Author(s): M.J. Russo

Global Description Author(s): D. Faber-Langendoen

References: Bakowsky and Lee 1996, Chapman et al. 1989, Midwestern Ecology Working Group n.d.

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I.B.2.N.a. Lowland or submontane cold-deciduous forest

A.220 *Acer saccharum - Tilia americana* - (*Quercus rubra*) Forest Alliance

Sugar Maple - American Basswood - (Northern Red Oak) Forest Alliance

[CEGL002062] *Acer saccharum - Tilia americana / Ostrya virginiana - Carpinus caroliniana* Forest

Translated Name: **Sugar Maple - American Basswood / Eastern Hop-hornbeam - American Hornbeam Forest**
Common Name: **North-central Maple - Basswood Forest**
Ecological System(s):

- Laurentian-Acadian Northern Hardwoods Forest (CES201.564)
- North-Central Interior Maple-Basswood Forest (CES202.696)

Circumscription Confidence: 1 - Strong
Concept Author(s): J. Drake

ELEMENT CONCEPT

Global Summary: This maple - basswood forest is found in the north-central United States. Stands occur on flat to steep slopes on loamy soils derived from glacial till or, less commonly, loess. The soils are well-drained, fertile, and deep. The tree canopy of this community is moderately dense to dense and greatly affects the composition of the understory. *Acer saccharum* and *Tilia americana* are the most prevalent tree species. Other common tree species include *Carpinus caroliniana, Carya cordiformis, Carya ovata, Fraxinus pennsylvanica, Juglans nigra, Ostrya virginiana, Quercus alba, Quercus rubra,* and *Ulmus* spp. The scattered shrub layer contains species such as *Cornus alternifolia, Ribes* spp., *Sambucus* spp., and *Zanthoxylum americanum*. Spring ephemerals are a distinctive part of the herbaceous layer. Common herbaceous species include *Anemone quinquefolia, Claytonia* spp., *Dicentra cucullaria, Erythronium* spp., *Polygonatum pubescens, Sanicula odorata (= Sanicula gregaria), Trillium grandiflorum,* and *Uvularia grandiflora*.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Terrestrial
Indiana Dunes National Lakeshore Environment: This maple - basswood forest is found on flat to steep slopes on dunes and moraines. The soils are loamy sand to silty clay loam and well-drained. This community is protected from frequent fires.
Global Environment: This community is found on flat to steep slopes on loamy soils derived from glacial till or, less commonly, loess (Curtis 1959). The soils are well-drained, fertile, and deep (MNNHP 1993).

VEGETATION DESCRIPTION

Indiana Dunes National Lakeshore Vegetation: The predominantly broad-leaved, cold-deciduous tree canopy of this forest community is moderately dense with a diversity of canopy trees. *Tilia americana* is the most prevalent tree species, but other common tree species include *Acer saccharum, Carya cordiformis, Carya ovata, Fraxinus americana* and/or *Fraxinus pennsylvanica, Pinus strobus, Quercus rubra, Quercus alba, Quercus palustris, Quercus velutina*, and *Ulmus rubra*; *Prunus serotina* and *Morus rubra* may also be present. Young canopy trees along with *Sassafras albidum* are prevalent in the understory. *Sassafras albidum, Amelanchier arborea*, and *Hamamelis virginiana* usually comprise the shrub layer. Herbaceous species include *Arisaema triphyllum, Cardamine* spp., *Geum* spp., *Maianthemum* spp., *Solidago caesia, Polygonum virginianum*, spring ephemerals, and vines such as *Parthenocissus quinquefolia, Smilax* spp., and *Toxicodendron radicans*. Exotic species include *Alliaria petiolata, Celastrus orbiculata, Berberis thunbergii*, and *Rosa multiflora*. This community also supports state-imperiled *Pinus strobus* and *Rhus aromatica var. arenaria*.
Global Vegetation: The tree canopy of this community is moderately dense to dense and greatly affects the composition of the understory. Only shade-tolerant species are able to persist (Curtis 1959). *Acer saccharum* and *Tilia americana* are the most prevalent tree species. Other common tree species include *Carpinus caroliniana, Carya cordiformis, Carya ovata, Fraxinus pennsylvanica, Juglans nigra, Ostrya virginiana, Quercus alba, Quercus rubra,* and *Ulmus* spp. The scattered shrub layer contains species such as *Cornus alternifolia, Ribes* spp., *Sambucus* spp., and *Zanthoxylum americanum*. Spring ephemerals are a distinctive part of the herbaceous layer. Common herbaceous species include *Anemone quinquefolia, Claytonia* spp., *Dicentra cucullaria, Erythronium* spp., *Polygonatum pubescens, Sanicula odorata (= Sanicula gregaria), Trillium grandiflorum,* and *Uvularia grandiflora* (Curtis 1959, MNNHP 1993). In more disturbed examples of this association such as those found at Effigy Mounds National Monument in Iowa, *Laportea canadensis* can range from moderate to very dense and can almost exclusively dominate the understory in some examples.
Global Dynamics:

INDIANA DUNES NATIONAL LAKESHORE FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform
Acer saccharum	Tree canopy	Broad-leaved deciduous tree
Fraxinus americana	Tree canopy	Broad-leaved deciduous tree
Fraxinus pennsylvanica	Tree canopy	Broad-leaved deciduous tree

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Quercus rubra	Tree canopy	Broad-leaved deciduous tree
Tilia americana	Tree canopy	Broad-leaved deciduous tree
Ulmus rubra	Tree canopy	Broad-leaved deciduous tree
Amelanchier arborea	Tall shrub/sapling	Broad-leaved deciduous shrub
Parthenocissus quinquefolia	Herb (field)	Vine/Liana
Toxicodendron radicans	Herb (field)	Vine/Liana
Arisaema triphyllum	Herb (field)	Forb
Solidago caesia	Herb (field)	Forb

GLOBAL FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform

INDIANA DUNES NATIONAL LAKESHORE OTHER NOTEWORTHY SPECIES

Alliaria petiolata, *Berberis thunbergii*, *Celastrus orbiculata*, *Pinus strobus*, *Rhus aromatica* var. *arenaria*, *Rosa multiflora*, *Vinca minor*

GLOBAL OTHER NOTEWORTHY SPECIES

CONSERVATION STATUS RANK

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

RELATED CONCEPTS

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

Global Related Concepts:
- *Acer* Forest (Cahayla-Wynne and Glenn-Lewis 1978) F
- *Tilia* Forest (Cahayla-Wynne and Glenn-Lewis 1978) F
- Southern Mesic Forest (Curtis 1959) B

CLASSIFICATION & OTHER COMMENTS

Indiana Dunes National Lakeshore Classification Comments: Stands at Indiana Dune NL that are placed in this association are somewhat different from the average expression of this type in that they often occur on poorer soils (dune sands) and they have more *Tilia americana*. This association seems to be the best fit for them.

Indiana Dunes National Lakeshore Other Comments:

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

ELEMENT DISTRIBUTION

Indiana Dunes National Lakeshore Range: This forest community is scattered throughout the lakeshore in sites with loamy soils, such as protected dune slopes and morainal areas.

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

Nations: US

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

USFS Ecoregions: 212Hd:CCC, 212Jl:CCC, 212Kb:CCC, 212Nc:CCC, 222Ga:CCC, 222Hf:CCC, 222Jj:CCC, 222Ke:CCC, 222Kf:CCC, 222Kg:CCC, 222Kh:CCC, 222Kj:CCC, 222Lc:CCC, 222Ld:CCC, 222Le:CCC, 222Lf:CCC, 222Ma:CCC, 222Mb:CCC, 222Mc:CCC, 222Md:CCC, 222Me:CCC, 251Aa:CCC, 251Ba:CCC, 251Bb:CCC, 251Be:CCC, 251Cf:CCC, 251De:CCC, 251Df:CCC

Federal Lands: NPS (Effigy Mounds, Indiana Dunes, Saint Croix)

ELEMENT SOURCES

Indiana Dunes National Lakeshore Map Units Summary:

Indiana Dunes National Lakeshore Inventory Notes:

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Indiana Dunes National Lakeshore Plots: INDU.VP007, INDU.VP009, INDU.VP010, INDU.VP112, INDU.AA170, INDU.AA364, INDU.AA494, INDU.AA644, INDU.AA710.
Local Description Author(s): N. Lehmann
Global Description Author(s): J. Drake
References: Cahayla-Wynne and Glenn-Lewis 1978, Curtis 1959, Daubenmire 1936, Grimm 1984, INAI unpubl. data., Lindsey et al. 1969, MNNHP 1993, Midwestern Ecology Working Group n.d., WNHIP unpubl. data

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I.B.2.N.a. Lowland or submontane cold-deciduous forest

A.227 *Fagus grandifolia - Acer saccharum* - (*Liriodendron tulipifera*) Forest Alliance

American Beech - Sugar Maple - (Tuliptree) Forest Alliance

[CEGL005013] *Fagus grandifolia - Acer saccharum* Glaciated Midwest Forest

Translated Name: **American Beech - Sugar Maple Glaciated Midwest Forest**
Common Name: **Beech - Maple Glaciated Forest**
Ecological System(s):
- North-Central Interior Beech-Maple Forest (CES202.693)
- Southern and Central Appalachian Cove Forest (CES202.373)

Circumscription Confidence: 1 - Strong
Concept Author(s): J. Drake

ELEMENT CONCEPT

Global Summary: This upland forest is found in the southern Great Lakes area of the United States and Canada. Stands occur on flat to rolling topography. In the southern parts of its range, it is more likely to be found on steeper slopes than in the northern portion. The soils are predominantly silt loam, loam, or sandy loam and develop over glacial till of Wisconsin age. The community is characterized by a dense to moderately dense canopy of deciduous trees, an absent to sparse shrub layer, and a moderately to well-developed herbaceous layer. The canopy is composed primarily of *Acer saccharum* and *Fagus grandifolia*. *Liriodendron tulipifera* is sometimes codominant, and *Carpinus caroliniana, Fraxinus americana, Ostrya virginiana, Quercus rubra, Tilia americana*, and *Ulmus americana* are often present in the canopy or subcanopy. *Diervilla lonicera, Euonymus obovatus, Lonicera canadensis, Sambucus racemosa var. racemosa (= Sambucus pubens),* and *Viburnum* spp. are typical shrubs. The herbaceous layer is often diverse, typically including spring ephemerals. Common species include *Arisaema triphyllum (= Arisaema atrorubens), Dryopteris intermedia, Galium aparine, Maianthemum canadense* (in northern stands), *Maianthemum racemosum, Osmorhiza claytonii, Podophyllum peltatum, Polygonatum biflorum, Trillium grandiflorum*, and *Viola* spp.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Terrestrial
Indiana Dunes National Lakeshore Environment: This beech - maple forest is found in interdunal lowlands and near riverbends and channels. The soils are silty loams or loamy sands with noticeable litter and humus. In general, fire is excluded from this environment, but human disturbance (soil and hydrologic) is notable.
Global Environment: This community is found on flat to rolling topography (Braun 1950, Pell and Mack 1977). In the southern parts of its range, it is more likely to be found on steeper slopes than in the northern portion (Braun 1950). The soils are predominantly silt loam, loam, or sandy loam and develop over glacial till of Wisconsin age (Braun 1950, Dodge and Harman 1985). This community was found to develop on sites with till 0.4-4.0 m thick in southern Michigan (Dodge and Harman 1985).

VEGETATION DESCRIPTION

Indiana Dunes National Lakeshore Vegetation: This broad-leaved, cold-deciduous forest community is characterized by a dense canopy periodically opened by treefall. Spring ephemerals dominate the herbaceous layer. The canopy is composed primarily of *Acer saccharum* and *Fagus grandifolia*. *Quercus rubra, Acer rubrum, Tilia americana, Carya ovata*, and *Prunus serotina* may also be present. Young canopy species, as well as *Nyssa sylvatica, Carpinus caroliniana*, and *Hamamelis virginiana*, form the subcanopy and tall-shrub layers. *Lindera benzoin* dominates the short-shrub layer, which varies from sparse to quite dense. Herbaceous species include diverse spring ephemerals, *Podophyllum peltatum, Caulophyllum thalictroides, Sanguinaria canadensis, Trillium grandiflorum, Euonymus obovatus, Viola* spp., *Allium tricoccum, Maianthemum racemosum, Geranium maculatum, Arisaema triphyllum, Carex communis,* and *Polystichum acrostichoides.* This community also supports state-imperiled *Carex pedunculata.*
Global Vegetation: This community is characterized by a dense to moderately dense canopy of deciduous trees, an absent to sparse shrub layer, and a moderately to well-developed herbaceous layer. The canopy formed by the overstory trees and smaller saplings greatly reduces the amount of light that reaches lower vegetation strata. This canopy is composed primarily of *Acer saccharum* and *Fagus grandifolia*. *Liriodendron tulipifera* is sometimes codominant and *Carpinus caroliniana, Fraxinus americana, Ostrya virginiana, Quercus rubra, Tilia americana*, and *Ulmus americana* are often present in the canopy or subcanopy. *Diervilla lonicera, Euonymus obovatus, Lonicera canadensis, Sambucus racemosa var. racemosa (= Sambucus pubens),* and *Viburnum* spp. are typical shrubs. The herbaceous layer is often diverse, typically including spring ephemerals. Common species include *Arisaema triphyllum (= Arisaema atrorubens), Dryopteris intermedia, Galium aparine, Maianthemum canadense* (in northern stands), *Maianthemum racemosum, Osmorhiza claytonii, Podophyllum peltatum, Polygonatum biflorum, Trillium grandiflorum*, and *Viola* spp.
Global Dynamics:

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INDIANA DUNES NATIONAL LAKESHORE FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform
Acer rubrum	Tree canopy	Broad-leaved deciduous tree
Acer saccharum	Tree canopy	Broad-leaved deciduous tree
Carpinus caroliniana	Tree canopy	Broad-leaved deciduous tree
Fagus grandifolia	Tree canopy	Broad-leaved deciduous tree
Nyssa sylvatica	Tree canopy	Broad-leaved deciduous tree
Quercus rubra	Tree canopy	Broad-leaved deciduous tree
Hamamelis virginiana	Tall shrub/sapling	Broad-leaved deciduous shrub
Lindera benzoin	Tall shrub/sapling	Broad-leaved deciduous shrub
Toxicodendron radicans	Herb (field)	Vine/Liana
Arisaema triphyllum	Herb (field)	Forb
Podophyllum peltatum	Herb (field)	Forb

GLOBAL FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform

INDIANA DUNES NATIONAL LAKESHORE OTHER NOTEWORTHY SPECIES

Alliaria petiolata, *Carex pedunculata*, *Rosa multiflora*

GLOBAL OTHER NOTEWORTHY SPECIES

CONSERVATION STATUS RANK

Global Rank & Reasons: G2G3 (13-Nov-2006). There have been 155 occurrences documented: 3 in Illinois (where the community is ranked S4) (but beech-maple is only a small part of the Illinois type to which this global type is crosswalked), 86 in Indiana (S3), 36 in Michigan (S3), and 30 in Ohio (S3). Although no other occurrences have been documented, the community is also reported in Ontario and New York. Sizes of 129 occurrences total 8895 acres. This type was once a widespread matrix forest that now occupies small remnants, often less than 500 acres in size.

RELATED CONCEPTS

Global Similar Associations:

- *Acer saccharum - Fagus grandifolia - Betula* spp. / *Maianthemum canadense* Forest (CEGL005004)
- *Fagus grandifolia - Acer saccharum - Liriodendron tulipifera* Unglaciated Forest (CEGL002411)
- *Fagus grandifolia - Betula lenta - Liriodendron tulipifera - Acer saccharum* Forest (CEGL006296)
- *Quercus alba - Fagus grandifolia* Western Allegheny Plateau Forest (CEGL006144)

Global Related Concepts:

- *Fagus grandifolia - Acer saccharum - Podophyllum peltatum* association (Pell and Mack 1977) =
- Beech - Maple Forest Region (Braun 1950) I
- Mesic Southern Forest - Beech-Sugar Maple-Basswood (Chapman et al. 1989) =
- Warren's Woods (Cain 1935) =

CLASSIFICATION & OTHER COMMENTS

Indiana Dunes National Lakeshore Classification Comments: This association is similar to *Acer saccharum - Tilia americana / Ostrya virginiana - Carpinus caroliniana* Forest [CEGL002062] but is distinguished by having >20% *Fagus grandifolia* in the canopy.

Indiana Dunes National Lakeshore Other Comments:

Global Classification Comments: Wisconsin glaciation history is used to define the southern limits of this type, and further work is needed to determine how floristically distinct these glaciated stands are from southern unglaciated stands, which are placed in *Fagus grandifolia - Acer saccharum - Liriodendron tulipifera* Unglaciated Forest (CEGL002411). *Liriodendron tulipifera* and other southern hardwoods, such as *Liquidambar styraciflua*, are much less constant in this type compared to the unglaciated stands, as is, perhaps, *Asimina triloba*. Northward *Betula alleghaniensis* and *Betula papyrifera* are very infrequent compared to *Acer saccharum - Fagus grandifolia - Betula* spp. / *Maianthemum canadense* Forest (CEGL005004). In New York and Pennsylvania this type may cover both the glaciated lake till plain and perhaps some parts of the glaciated Allegheny Plateau, consistent with its distribution in Ohio. Arguing for this is the low dominance to absence of *Liriodendron tulipifera*, low dominance of *Betula* spp., and the high dominance of *Tilia americana*. On the other hand, the presence of *Betula lenta*, and perhaps that of *Tsuga canadensis*, in that region are somewhat unusual for this type, indicating the more Allegheny influence. And the inclusion of both glaciated till plain and plateau habitats in the type would broaden the environmental parameters. This type may be in east-central Illinois (Vermillion County, near Danville), but is largely extirpated (B. McClain pers. comm. 1999). Stands still occur across the stateline in Indiana.

ELEMENT DISTRIBUTION

Indiana Dunes National Lakeshore Range: This forest community is found at Heron Rookery, Bailly and Keiser units.

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Global Range: This upland forest is found in the southern Great Lakes area of the United States and Canada, ranging from Illinois, Indiana, and Michigan, east to Ontario and western New York. Range extent is minimally estimated at 70,000 square km and may extend over 200,000 square km.
Nations: CA, US
States/Provinces: IL, IN, MI, NY, OH, ON
USFS Ecoregions: 212Fa:PP?, 212Fb:PPP, 221Bc:CCC, 221Ef:CCC, 221Fa:CCC, 221Fb:CCC, 221Fc:CCC, 222De:CCC, 222Ga:CCC, 222Gc:CCC, 222Gd:CCC, 222Ha:CCC, 222Hb:CCC, 222Hc:CCC, 222Hd:CCC, 222Hf:CCC, 222Ia:CC?, 222Ib:CCC, 222Ic:CC?, 222Id:CCP, 222If:CCC, 222Ja:CCC, 222Jb:CCC, 222Jc:CCC, 222Jd:CCC, 222Jg:CCC, 222Jh:CCC, 222Ji:CCC, 222Jj:CCC, 222Kj:CCC, 251De:CCC
Federal Lands: NPS (Indiana Dunes, Saratoga); USFS (Finger Lakes); USFWS (Iroquois)

ELEMENT SOURCES

Indiana Dunes National Lakeshore Map Units Summary: Heron Rookery, Pinhook Bog, Bailly and Keiser units.
Indiana Dunes National Lakeshore Inventory Notes:
Indiana Dunes National Lakeshore Plots: INDU.VP080, INDU.VP122, INDU.AA076, INDU.AA131, INDU.AA220, INDU.AA274, INDU.AA371, INDU.AA628, INDU.AA634, INDU.AA668, INDU.AA719, INDU.AA737.
Local Description Author(s): N. Lehmann
Global Description Author(s): J. Drake
References: Braun 1950, Cain 1935, Chapman et al. 1989, Crumpacker et al. 1988, Dodge and Harman 1985, Edinger et al. 2002, Kuchler 1964, Midwestern Ecology, Working Group n.d., NRCS 2004, Pell and Mack 1977

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I.B.2.N.a. Lowland or submontane cold-deciduous forest

A.237 *Prunus serotina - Acer rubrum - Amelanchier canadensis - Quercus* spp. Forest Alliance

Black Cherry - Red Maple - Canada Serviceberry - Oak species Forest Alliance

[CEGL006599] *Prunus serotina - Liriodendron tulipifera - Acer rubrum - Fraxinus americana* - (*Robinia pseudoacacia*) Forest

Translated Name: **Black Cherry - Tuliptree - Red Maple - White Ash - (Black Locust) Forest**
Common Name: **Northeastern Modified Successional Forest**
Ecological System(s):
- Semi-natural / Altered Vegetation and Conifer Plantations (CES203.074)

Circumscription Confidence: 2 - Moderate
Concept Author(s): S. Perles (PNDI) and L.A. Sneddon

ELEMENT CONCEPT

Global Summary: This early-successional woody vegetation of the northeastern United States occurs on sites that are becoming reforested after having been cleared for agriculture. Environmental setting varies, but generally sites are dry-mesic to mesic, with small seepage inclusions in some examples. Physiognomy of this vegetation is highly variable, ranging from closed forest, open forest, tall dense shrubland, to more open tall shrubland. Early-successional woody species dominate the canopy in a widely variable mix, depending on geographic location. In the Central Appalachians and Mid-Atlantic Piedmont, many stands represent decadent forests that were once dominated by *Robinia pseudoacacia* but are now mixed with various mid-successional hardwoods; other stands in this region regenerated as mixed stands. Tree species often include some combination of *Prunus serotina, Liriodendron tulipifera, Fraxinus americana, Robinia pseudoacacia,* and *Acer rubrum.* Other associates can include *Juglans nigra, Sassafras albidum, Betula populifolia, Juniperus virginiana, Acer negundo, Acer saccharinum, Ailanthus altissima, Ulmus americana, Quercus* spp., *Betula lenta, Amelanchier* spp., *Pinus strobus*, and *Populus grandidentata*. Other woody species may contribute to the canopy or form a tall-shrub layer, including *Lindera benzoin* and *Carpinus caroliniana*. The low-shrub layer, if present, is usually characterized by the presence of *Rubus* spp. such as *Rubus flagellaris, Rubus allegheniensis, Rubus phoenicolasius,* or *Rubus hispidus*. This layer is often dominated by exotic species such as *Lonicera tatarica, Lonicera morrowii, Rhamnus cathartica, Crataegus* spp., *Rosa multiflora,* and *Berberis thunbergii*. The herbaceous layer is variable, often containing grasses and forbs of both native and exotic origin. Common species include *Ageratina altissima var. altissima, Polygonum persicaria, Impatiens capensis, Glechoma hederacea, Polystichum acrostichoides, Calystegia sepium ssp. sepium, Galium aparine, Oxalis stricta, Polygonum virginianum, Dennstaedtia punctilobula, Arisaema triphyllum, Allium vineale,* and *Veronica officinalis,* among many others. The invasive species *Alliaria petiolata, Microstegium vimineum,* and *Polygonum caespitosum* can be abundant in this disturbed forest type. Vines can be absent or abundant. In stands with high vine cover, the vegetation structure can be altered by the weight of the vines pulling down trees and shrubs. Common vines include *Parthenocissus quinquefolia, Toxicodendron radicans, Vitis labrusca*, and the invasive vines *Celastrus orbiculata* and *Lonicera japonica*. These forests are often young and resulted from the colonization of old agricultural fields by woody species. Recent disturbance or abundant invasive species give these forest stands a weedy character. It is unlikely that these stands will succeed to a natural plant community dominated by native species.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Terrestrial
Indiana Dunes National Lakeshore Environment: This maple - ash forest occurs on level upland areas and level, drained bottomlands. The soil is usually highly disturbed loamy sand to sandy loam.
Global Environment: This vegetation occurs on sites that have been cleared for agriculture or otherwise heavily modified in the past. Generally sites are dry-mesic and may have small seepage inclusions in some examples. Occasionally this type may occur in formerly agricultural bottomlands, in which case the soils may be temporarily flooded or saturated.

VEGETATION DESCRIPTION

Indiana Dunes National Lakeshore Vegetation: This maple - ash forest is a secondary successional community that has formed on old fields or former homesites and consists of diverse assemblages of native and nonnative species. The canopy ranges from open to closed and has a wide variety of native and nonnative trees, some of which have been planted, while others are adventive. *Acer rubrum* and *Fraxinus* spp. dominate. The shrub layer usually covers about 50% and is composed of young *Acer* spp., *Fraxinus* spp. and a variety of native (*Cornus* spp., *Lindera benzoin, Rubus* spp.) and nonnative (*Rosa multiflora, Berberis thunbergii*) shrubs. The herbaceous layer is usually dominated by *Alliaria petiolata*. *Toxicodendron radicans, Parthenocissus quinquefolia,* and *Polygonum virginianum* are frequently found. The invasive vine *Celastrus orbiculata* is notable because it often dominates any or all strata of this community. In addition, this community sometimes supports state-imperiled *Carex bebbii, Catalpa speciosa,* and *Pinus strobus,* and state-vulnerable *Ammophila breviligulata*.

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Global Vegetation: Early-successional woody species dominate the canopy in a widely variable mix, depending on geographic location. In the Central Appalachians and Mid-Atlantic Piedmont, many stands represent decadent forests that were once dominated by *Robinia pseudoacacia* but are now mixed with various mid-successional hardwoods; other stands in this region regenerated as mixed stands. Tree species often include some combination of *Prunus serotina, Liriodendron tulipifera, Fraxinus americana, Robinia pseudoacacia,* and *Acer rubrum*. Other associates can include *Juglans nigra, Sassafras albidum, Betula populifolia, Juniperus virginiana, Acer negundo, Acer saccharinum, Ailanthus altissima, Ulmus americana, Quercus* spp., *Betula lenta, Amelanchier* spp., *Pinus strobus*, and *Populus grandidentata*. Other woody species may contribute to the canopy or form a tall-shrub layer, including *Lindera benzoin* and *Carpinus caroliniana*. The low-shrub layer, if present, is usually characterized by the presence of *Rubus* spp. such as *Rubus flagellaris, Rubus allegheniensis, Rubus phoenicolasius,* or *Rubus hispidus*. This layer is often dominated by exotic species such as *Lonicera tatarica, Lonicera morrowii, Rhamnus cathartica, Crataegus* spp., *Rosa multiflora*, and *Berberis thunbergii*. The herbaceous layer is variable, often containing grasses and forbs of both native and exotic origin. Common species include *Ageratina altissima var. altissima, Polygonum persicaria, Impatiens capensis, Glechoma hederacea, Polystichum acrostichoides, Calystegia sepium ssp. sepium, Galium aparine, Oxalis stricta, Polygonum virginianum, Dennstaedtia punctilobula, Arisaema triphyllum, Allium vineale,* and *Veronica officinalis*, among many others. The invasive species *Alliaria petiolata, Microstegium vimineum*, and *Polygonum caespitosum* can be abundant in this disturbed forest type. Vines can be absent or abundant. In stands with high vine cover, the vegetation structure can be altered by the weight of the vines pulling down trees and shrubs. Common vines include *Parthenocissus quinquefolia, Toxicodendron radicans, Vitis labrusca*, and the invasive vines *Celastrus orbiculata* and *Lonicera japonica*.

Global Dynamics: These forests are often young and resulted from the colonization of old agricultural fields by woody species. Recent disturbance or abundant invasive species give these forest stands a weedy character. It is unlikely that these stands will succeed to a natural plant community dominated by native species.

INDIANA DUNES NATIONAL LAKESHORE FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform
Acer rubrum	Tree canopy	Broad-leaved deciduous tree
Acer saccharum	Tree canopy	Broad-leaved deciduous tree
Amelanchier laevis	Tree canopy	Broad-leaved deciduous tree
Fraxinus americana	Tree canopy	Broad-leaved deciduous tree
Prunus serotina	Tree canopy	Broad-leaved deciduous tree
Robinia pseudoacacia	Tree canopy	Broad-leaved deciduous tree
Fraxinus americana	Tall shrub/sapling	Broad-leaved deciduous tree
Fraxinus pennsylvanica	Tall shrub/sapling	Broad-leaved deciduous tree
Lindera benzoin	Tall shrub/sapling	Broad-leaved deciduous shrub
Rosa multiflora	Tall shrub/sapling	Broad-leaved deciduous shrub
Celastrus orbiculata	Herb (field)	Vine/Liana
Parthenocissus quinquefolia	Herb (field)	Vine/Liana
Toxicodendron radicans	Herb (field)	Vine/Liana
Alliaria petiolata	Herb (field)	Forb
Arisaema triphyllum	Herb (field)	Forb
Carex pensylvanica	Herb (field)	Graminoid

Higher Taxon Name	Note

GLOBAL FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform
Acer rubrum	Tree canopy	Broad-leaved deciduous tree
Fraxinus americana	Tree canopy	Broad-leaved deciduous tree
Juglans nigra	Tree canopy	Broad-leaved deciduous tree
Liriodendron tulipifera	Tree canopy	Broad-leaved deciduous tree
Prunus serotina	Tree canopy	Broad-leaved deciduous tree
Robinia pseudoacacia	Tree canopy	Broad-leaved deciduous tree
Acer rubrum	Tree subcanopy	Broad-leaved deciduous tree
Carpinus caroliniana	Tall shrub/sapling	Broad-leaved deciduous tree
Elaeagnus umbellata	Tall shrub/sapling	Broad-leaved deciduous shrub
Lindera benzoin	Tall shrub/sapling	Broad-leaved deciduous shrub
Rosa multiflora	Tall shrub/sapling	Broad-leaved deciduous shrub
Berberis thunbergii	Short shrub/sapling	Broad-leaved deciduous shrub
Rubus allegheniensis	Short shrub/sapling	Broad-leaved deciduous shrub
Alliaria petiolata	Herb (field)	Forb
Polygonum persicaria	Herb (field)	Forb
Microstegium vimineum	Herb (field)	Graminoid

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INDIANA DUNES NATIONAL LAKESHORE OTHER NOTEWORTHY SPECIES

Ailanthus altissima, Alliaria petiolata, Ammophila breviligulata, Berberis thunbergii, Carex bebbii, Catalpa speciosa, Celastrus orbiculata, Cynoglossum officinale, Elaeagnus angustifolia, Glechoma hederacea, Hesperis matronalis, Hieracium caespitosum, Leucanthemum vulgare, Ligustrum vulgare, Lonicera tatarica, Lonicera x *bella, Morus alba, Pinus strobus, Pinus sylvestris, Poa compressa, Polygonum cuspidatum, Rosa multiflora, Taraxacum officinale, Thymus praecox* ssp. *arcticus, Ulmus pumila*

GLOBAL OTHER NOTEWORTHY SPECIES

CONSERVATION STATUS RANK

Global Rank & Reasons: GNA (ruderal) This vegetation is modified by human activity and not of conservation concern.

RELATED CONCEPTS

Global Similar Associations:

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

Global Related Concepts:

CLASSIFICATION & OTHER COMMENTS

Indiana Dunes National Lakeshore Classification Comments:

Indiana Dunes National Lakeshore Other Comments: The proliferation of *Celastrus orbiculata* in the Bailly unit is astonishing.

Global Classification Comments: This vegetation is broadly defined and varies widely in composition across its range, presenting a classification challenge at the alliance level.

ELEMENT DISTRIBUTION

Indiana Dunes National Lakeshore Range: This forest occurs on or near old homesites in the Bailly, Visitor Center, and Keiser units.

Global Range: This vegetation is currently described from Pennsylvania, New York, and New Jersey but is of broader distribution in the northeastern U.S.

Nations: US

States/Provinces: CT, DE, IN, MA, NJ, NY, PA, VA

USFS Ecoregions: 212Fc:CCC, 212G:C?, 221Aa:CCC, 221Ae:CCC, 221Af:CCC, 221Ag:CCC, 221Ah:CCC, 221Ai:CCC, 221Al:CCC, 221Am:CCC, 221Ba:CCC, 221Bb:CCC, 221Bc:CCC, 221Bd:CCC, 221Da:CCC, 221Db:CCC, 221Dc:CCC, 221Fa:CCC, 222Ic:CCC, 222Jj:CCC, 231A:??, 232Aa:CCC, 232Ac:CCC, 232B:C?, 232C:C?, M212Bc:CCC, M212Bd:CCC, M212Cb:CCC, M212E:C?, M221Aa:CCC, M221Ab:CCC, M221Ac:CCC, M221Ad:CCC, M221Ba:CCC, M221Bb:CCC, M221Bc:CCC, M221Bd:CCC, M221Da:CCC

Federal Lands: NPS (Allegheny Portage Railroad, Boston Harbor Islands, Delaware Water Gap, Fort Necessity, Friendship Hill, Gateway, George Washington Parkway?, Gettysburg, Indiana Dunes, Johnstown Flood, Morristown, Sagamore Hill, Saratoga, Saugus Iron Works, Shenandoah, Upper Delaware, Valley Forge, Weir Farm); USFWS (Erie, Great Meadows?, Montezuma, Prime Hook)

ELEMENT SOURCES

Indiana Dunes National Lakeshore Map Units Summary:

Indiana Dunes National Lakeshore Inventory Notes:

Indiana Dunes National Lakeshore Plots: INDU.VP001, INDU.VP015, INDU.VP019, INDU.VP020, INDU.VP041, INDU.VP069, INDU.VP070, INDU.VP078, INDU.VP171, INDU.AA022, INDU.AA037, INDU.AA049, INDU.AA113, INDU.AA136, INDU.AA158, INDU.AA190, INDU.AA197, INDU.AA254, INDU.AA309, INDU.AA324, INDU.AA342, INDU.AA376, INDU.AA406, INDU.AA413, INDU.AA414, INDU.AA451, INDU.AA475, INDU.AA505, INDU.AA543, INDU.AA627, INDU.AA676, INDU.AA714.

Local Description Author(s): N. Lehmann

Global Description Author(s): L.A. Sneddon, mod. S.C. Gawler, E. Largay, G.P. Fleming

References: Eastern Ecology Working Group n.d., Ehrenfeld 1977, Fike 1999a, NRCS 2001b, NRCS 2004, Perles et al. 2006c, Perles et al. 2007, Soil Conservation Service 1987, Young et al. 2006

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I.B.2.N.a. Lowland or submontane cold-deciduous forest

A.239 *Quercus alba - (Quercus rubra, Carya* spp.) Forest Alliance

White Oak - (Northern Red Oak, Hickory species) Forest Alliance

[CEGL002068] *Quercus alba - Quercus rubra - Carya ovata* Glaciated Forest

Translated Name: **White Oak - Northern Red Oak - Shagbark Hickory Glaciated Forest**
Common Name: **Midwestern White Oak - Red Oak Forest**
Ecological System(s):

- Northeastern Interior Dry-Mesic Oak Forest (CES202.592)
- North-Central Interior Dry-Mesic Oak Forest and Woodland (CES202.046)
- North-Central Interior Floodplain (CES202.694)

Circumscription Confidence: 1 - Strong
Concept Author(s): D. Faber-Langendoen

ELEMENT CONCEPT

Global Summary: This oak forest community is widespread in the north-central United States. Stands occur primarily on glaciated, rolling topography on a wide variety of soils that have a dry-mesic moisture condition. The canopy is variable but typically closed (>80%). *Quercus alba* and *Quercus rubra* are the leading dominants, but *Quercus ellipsoidalis, Quercus macrocarpa, Quercus velutina*, and *Carya ovata* can also be codominant. Typical associates include *Juglans nigra* and, more south or east, *Carya alba* and *Carya glabra*. The subcanopy contains *Ostrya virginiana, Prunus serotina, Sassafras albidum*, and, increasingly, *Acer rubrum* or *Acer saccharum*. The shrub layer is quite variable but can include *Cornus alternifolia, Cornus florida* (southward), *Cornus foemina, Corylus americana* (northward), *Parthenocissus quinquefolia, Ribes cynosbati*, and *Zanthoxylum americanum*. The herbaceous layer includes *Amphicarpaea bracteata, Anemone virginiana, Symphyotrichum cordifolium (= Aster cordifolius var. sagittifolius), Botrychium virginianum, Brachyelytrum erectum, Circaea lutetiana ssp. canadensis, Desmodium glutinosum, Galium concinnum, Geranium maculatum, Osmorhiza claytonii, Sanicula odorata*, and *Maianthemum racemosum*.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Terrestrial
Indiana Dunes National Lakeshore Environment: This oak-hickory forest is found on moderately well-drained loamy sand, silty loam, or silty clay loam soil. This forest is often disturbed by the presence of abandoned roads, trails and homesites.
Global Environment: This community is found primarily on glaciated, rolling topography on a wide variety of soils that have a dry-mesic moisture condition. It is also found in the unglaciated Driftless Area of the upper Midwest.

VEGETATION DESCRIPTION

Indiana Dunes National Lakeshore Vegetation: This oak-hickory forest has a closed broad-leaved, cold-deciduous canopy with *Quercus alba* dominant in drier habitats and *Quercus rubra* increasingly present in moister areas. *Carya ovata* or *Quercus palustris* are often codominant. Common associates include *Juglans nigra, Quercus velutina, Prunus serotina, Tilia americana, Ulmus rubra, Fraxinus americana*, and *Fraxinus pennsylvanica*. The subcanopy and tall-shrub layers often contain *Hamamelis virginiana, Amelanchier arborea, Crataegus* spp., and *Acer rubrum*. *Carpinus caroliniana, Ostrya virginiana*, and *Cornus florida* also occur. Shorter shrubs include *Lindera benzoin, Corylus americana, Cornus racemosa, Ribes cynosbati*, and *Vaccinium* spp. The herbaceous layer is diverse, but relatively sparse, particularly after spring ephemerals go dormant. *Arisaema triphyllum, Geum* spp., *Galium* spp., *Podophyllum peltatum, Sanicula odorata*, and *Maianthemum racemosum* can be present. *Parthenocissus quinquefolia* and *Toxicodendron radicans* are also often present. Exotics such as *Alliaria petiolata, Rosa multiflora, Celastrus orbiculata, Lonicera* spp., and *Ulmus pumila* are common and can dominate in spots. This community also supports state-imperiled *Pinus strobus*.
Global Vegetation: The canopy is variable but typically closed (>80%). *Quercus alba* and *Quercus rubra* are the leading dominants, but *Quercus ellipsoidalis, Quercus macrocarpa, Quercus velutina*, and *Carya ovata* can also be codominant. Typical associates include *Juglans nigra*, and more south or east, *Carya alba* and *Carya glabra*. The subcanopy contains *Ostrya virginiana, Prunus serotina, Sassafras albidum*, and, increasingly, *Acer rubrum* or *Acer saccharum*. The shrub layer is quite variable but can include *Cornus alternifolia, Cornus florida* (southward), *Cornus foemina, Corylus americana* (northward), *Parthenocissus quinquefolia, Ribes cynosbati*, and *Zanthoxylum americanum*. The herbaceous layer includes *Amphicarpaea bracteata, Anemone virginiana, Symphyotrichum cordifolium (= Aster sagittifolius), Botrychium virginianum, Brachyelytrum erectum, Circaea lutetiana ssp. canadensis (= Circaea quadrisulcata), Desmodium glutinosum, Galium concinnum, Geranium maculatum, Osmorhiza claytonii, Sanicula odorata (= Sanicula gregaria)*, and *Maianthemum racemosum (= Smilacina racemosa)* (Curtis 1959, Nelson 1985, MNNHP 1993, Anderson 1996).
Global Dynamics: See Abrams (1992) for a review of fire dynamics in oak forests.

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INDIANA DUNES NATIONAL LAKESHORE FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform
Carya ovata	Tree canopy	Broad-leaved deciduous tree
Fraxinus americana	Tree canopy	Broad-leaved deciduous tree
Fraxinus pennsylvanica	Tree canopy	Broad-leaved deciduous tree
Quercus alba	Tree canopy	Broad-leaved deciduous tree
Quercus palustris	Tree canopy	Broad-leaved deciduous tree
Quercus rubra	Tree canopy	Broad-leaved deciduous tree
Sassafras albidum	Tree canopy	Broad-leaved deciduous tree
Ulmus rubra	Tree canopy	Broad-leaved deciduous tree
Fraxinus pennsylvanica	Tall shrub/sapling	Broad-leaved deciduous tree
Hamamelis virginiana	Tall shrub/sapling	Broad-leaved deciduous tree
Lindera benzoin	Tall shrub/sapling	Broad-leaved deciduous shrub
Rosa multiflora	Tall shrub/sapling	Broad-leaved deciduous shrub
Toxicodendron radicans	Herb (field)	Vine/Liana
Alliaria petiolata	Herb (field)	Forb
Arisaema triphyllum	Herb (field)	Forb
Osmorhiza claytonii	Herb (field)	Forb
Sanicula odorata	Herb (field)	Forb
Solidago caesia	Herb (field)	Forb
Quercus alba	Herb (field)	Other herbaceous

GLOBAL FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform

INDIANA DUNES NATIONAL LAKESHORE OTHER NOTEWORTHY SPECIES

Ailanthus altissima, Alliaria petiolata, Berberis thunbergii, Celastrus orbiculata, Cynoglossum officinale, Euonymus alatus, Hesperis matronalis, Lonicera tatarica, Lonicera x *bella, Morus alba, Pinus strobus, Poa pratensis, Prunus avium, Rosa multiflora, Ulmus pumila, Vinca minor*

GLOBAL OTHER NOTEWORTHY SPECIES

CONSERVATION STATUS RANK

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

RELATED CONCEPTS

Global Similar Associations:

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

Global Related Concepts:

- Dry-Mesic Forest (Nelson 1985) B
- Dry-Mesic Southern Forest - White Oak (Red Oak)-Hickory (Chapman et al. 1989) B
- Oak-Hickory Forests (Anderson 1996) =
- Southern Dry-Mesic Forest (Curtis 1959) =

CLASSIFICATION & OTHER COMMENTS

Indiana Dunes National Lakeshore Classification Comments:
Indiana Dunes National Lakeshore Other Comments:

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Global Classification Comments: This type rarely has any other oak species in it beyond *Quercus alba, Quercus rubra, Quercus velutina*, and occasional *Quercus macrocarpa* or *Quercus ellipsoidalis*, unlike stands farther south with southern oak species. This type is primarily found on glaciated terrain, including Wisconsinan through Kansan, but its distribution may extend beyond that. Where stands have either *Acer rubrum* or *Acer saccharum* at >20% canopy coverage or basal area, they should be placed in *Quercus rubra - (Acer saccharum, Quercus alba)* Forest (CEGL005017), an oak-maple type. Also compare to *Quercus alba - (Quercus rubra, Acer saccharum, Fagus grandifolia) / Aesculus flava* Forest (CEGL007233) of the southeastern states.

ELEMENT DISTRIBUTION

Indiana Dunes National Lakeshore Range: This oak-hickory forest is found on mesic uplands in the older dune and morainal areas of the national lakeshore.

Global Range: This oak forest community is widespread in the north-central United States, ranging from Ohio west to Minnesota, south to Iowa, and east to Indiana.

Nations: CA, US

States/Provinces: IA, IL, IN, MI, MN, MO, NY, OH, ON, WI

USFS Ecoregions: 212Fb:PPP, 212Jj:P??, 212Ka:P??, 221Ea:CCC, 221Ec:CCC, 221Ee:CCC, 221Ef:CCC, 221Eg:CCC, 221Fa:CCC, 221Fb:CCP, 221Fc:CCC, 222Aa:CCC, 222Ak:CCC, 222Ao:CCC, 222Aq:CCC, 222Fe:CCC, 222Ga:CCC, 222Gb:CCC, 222Gc:CCC, 222Ha:CCC, 222Hb:CCC, 222Hf:CCC, 222Id:CCP, 222If:CCC, 222Ja:CCC, 222Jb:CCC, 222Jg:CCC, 222Jh:CCC, 222Ji:CCC, 222Jj:CCC, 222Ke:CCC, 222Kf:CCC, 222Kg:CCC, 222Kh:CCC, 222Kj:CCC, 222Lb:CCC, 222Lc:CCC, 222Qb:CCC, 251Be:CCC, 251Cb:CCC, 251Cc:CCC, 251Cd:CCC, 251Ce:CCC, 251Cf:CCC, 251Cg:CCC, 251Cj:CCC, 251Ck:CCC, 251Dc:CCC, 251Dd:CCC, 251De:CCC, 251Df:CCC, 251Dh:CCP

Federal Lands: NPS (Effigy Mounds, Indiana Dunes, Saint Croix); USFS (Finger Lakes)

ELEMENT SOURCES

Indiana Dunes National Lakeshore Map Units Summary: Bailly, Cowles Bog, Visitor Center, Pinhook Bog, Hobart Prairie, and Dunes State Park units.

Indiana Dunes National Lakeshore Inventory Notes:

Indiana Dunes National Lakeshore Plots: INDU.VP008, INDU.VP012, INDU.VP017, INDU.VP022, INDU.VP042, INDU.VP130, INDU.VP150, INDU.VP159, INDU.AA001, INDU.AA015, INDU.AA056, INDU.AA072, INDU.AA118, INDU.AA171, INDU.AA280, INDU.AA281, INDU.AA287, INDU.AA325, INDU.AA326, INDU.AA357, INDU.AA366, INDU.AA432, INDU.AA443, INDU.AA518, INDU.AA560, INDU.AA576, INDU.AA584, INDU.AA621, INDU.AA626, INDU.AA637, INDU.AA687, INDU.AA718, INDU.AA736.

Local Description Author(s): N. Lehmann

Global Description Author(s): D. Faber-Langendoen

References: Abrams 1992, Anderson 1996, Chapman et al. 1989, Curtis 1959, INAI unpubl. data, MNNHP 1993, Midwestern Ecology Working Group n.d., Nelson 1985, WNHIP unpubl. data

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I.B.2.N.a. Lowland or submontane cold-deciduous forest

A.251 *Quercus rubra* - (*Acer saccharum*) Forest Alliance

Northern Red Oak - (Sugar Maple) Forest Alliance

[CEGL005017] *Quercus rubra* - (*Acer saccharum, Quercus alba*) Forest

Translated Name: **Northern Red Oak - (Sugar Maple, White Oak) Forest**
Common Name: **Red Oak - Sugar Maple - Elm Forest**
Ecological System(s):
- North-Central Interior Maple-Basswood Forest (CES202.696)
- Southern Interior Low Plateau Dry-Mesic Oak Forest (CES202.898)

Circumscription Confidence: 3 - Weak
Concept Author(s): D. Faber-Langendoen

ELEMENT CONCEPT

Global Summary: This community is found in the northern prairie-forest border region of the United States and farther east to Ohio. Tree canopy dominance is variable, but the major dominant present is *Quercus rubra*. Other associates may include *Acer saccharum, Quercus alba*, and *Ulmus americana*. The subcanopy and sapling layers often contain *Prunus virginiana* or *Prunus serotina*. This type is poorly understood, but may represent a successional type in the prairie-forest border region shifting from oak dominance to maple, basswood and elm dominance. The type is restricted to the central midwestern region and extreme southern Ontario, and is not found in northern Minnesota, northern Wisconsin, northern Michigan, or central Ontario.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Terrestrial
Indiana Dunes National Lakeshore Environment: This red oak forest is found in mesic, fire-protected areas with soil that ranges from loamy sand to sandy clay that is moderately to somewhat poorly drained. This forest may be affected by changes in fire frequency and hydrology, resulting in the broad mix of species. The community is also very highly impacted by nonnative invasive species.
Global Environment: The oak stands generally are found on either mesic sites protected from fire or on drier slopes, where, historically, fires could sweep through, but where fire protection is creating more mesic conditions.

VEGETATION DESCRIPTION

Indiana Dunes National Lakeshore Vegetation: This forest community has a broad-leaved, cold-deciduous closed canopy. *Quercus rubra* is a dominant canopy species, but associates are diverse and include *Prunus serotina, Fraxinus americana, Acer rubrum, Acer saccharum, Quercus alba, Quercus velutina, Sassafras albidum, Ulmus rubra*, and *Tilia americana*. The shrub layer is not dense and often contains *Lindera benzoin, Corylus americana*, or *Viburnum prunifolium*. The herbaceous layer is sparse and includes *Polygonum virginianum* and *Allium canadense*. Exotics such as *Rosa multiflora, Berberis thunbergii*, and *Alliaria petiolata* are common.
Global Vegetation: The vegetation is comprised of a closed-canopy tree layer. The major tree dominant is *Quercus rubra*. Other associates may include *Acer saccharum, Quercus alba*, and *Ulmus americana*. The subcanopy and sapling layers often contain *Prunus virginiana* or *Prunus serotina*. Further characterization of this type is needed.
Global Dynamics: This type may occur where, historically, fires were more prevalent; current stands may represent both mesic stands protected from fire, and somewhat more dry-mesic stands protected from fire that are shifting from oak dominance to maple, basswood and elm dominance.

INDIANA DUNES NATIONAL LAKESHORE FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform
Acer rubrum	Tree canopy	Broad-leaved deciduous tree
Acer saccharum	Tree canopy	Broad-leaved deciduous tree
Fraxinus americana	Tree canopy	Broad-leaved deciduous tree
Juglans nigra	Tree canopy	Broad-leaved deciduous tree
Quercus alba	Tree canopy	Broad-leaved deciduous tree
Quercus rubra	Tree canopy	Broad-leaved deciduous tree
Ulmus rubra	Tree canopy	Broad-leaved deciduous tree
Prunus serotina	Tall shrub/sapling	Broad-leaved deciduous tree
Berberis thunbergii	Tall shrub/sapling	Broad-leaved deciduous shrub
Corylus americana	Tall shrub/sapling	Broad-leaved deciduous shrub
Lindera benzoin	Tall shrub/sapling	Broad-leaved deciduous shrub
Ribes cynosbati	Tall shrub/sapling	Broad-leaved deciduous shrub

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Rosa multiflora	Tall shrub/sapling	Broad-leaved deciduous shrub
Viburnum prunifolium	Tall shrub/sapling	Broad-leaved deciduous shrub
Celastrus orbiculata	Herb (field)	Vine/Liana
Parthenocissus quinquefolia	Herb (field)	Vine/Liana
Smilax rotundifolia	Herb (field)	Vine/Liana
Toxicodendron radicans	Herb (field)	Vine/Liana
Vitis riparia	Herb (field)	Vine/Liana
Alliaria petiolata	Herb (field)	Forb
Allium canadense	Herb (field)	Forb
Arisaema triphyllum	Herb (field)	Forb
Galium aparine	Herb (field)	Forb
Geranium maculatum	Herb (field)	Forb
Geum canadense	Herb (field)	Forb
Impatiens capensis	Herb (field)	Forb
Osmorhiza claytonii	Herb (field)	Forb
Podophyllum peltatum	Herb (field)	Forb
Polygonum virginianum	Herb (field)	Forb

GLOBAL FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform

INDIANA DUNES NATIONAL LAKESHORE OTHER NOTEWORTHY SPECIES

Alliaria petiolata, *Berberis thunbergii*, *Celastrus orbiculata*, *Fagus sylvatica*, *Lonicera* x *bella*, *Poa pratensis*, *Rosa multiflora*, *Taraxacum officinale*, *Ulmus pumila*

GLOBAL OTHER NOTEWORTHY SPECIES

CONSERVATION STATUS RANK

Global Rank & Reasons: GNRQ

RELATED CONCEPTS

Global Similar Associations:

- *Quercus alba - Quercus rubra - Carya ovata* Glaciated Forest (CEGL002068)--This type is typically found in dry-mesic sites with a mixed oak canopy, typically with *Quercus alba* as a significant component.
- *Quercus rubra - Acer saccharum* Forest (CEGL002461)--is another red oak type, but is generally north of the prairie-forest border in Province 212.
- *Quercus rubra - Quercus alba - (Quercus velutina, Acer rubrum) / Viburnum acerifolium* Forest (CEGL002462)--is another red oak type, in Province 212.

Global Related Concepts:

CLASSIFICATION & OTHER COMMENTS

Indiana Dunes National Lakeshore Classification Comments:

Indiana Dunes National Lakeshore Other Comments:

Global Classification Comments: This type is poorly understood; current stands may represent both mesic stands protected from fire, and somewhat more dry-mesic stands represent a successional type shifting from oak dominance to maple, basswood and elm dominance. The type concept should probably be restricted to be south of Province 212 (Bailey et al. 1994), and north of the limits of glaciation. Stands in Ohio may differ from those further west. See also Kline and Cottam (1979) where a white oak - maple forest type is described in the prairie - forest border. Stands in southern Indiana need to be compared with other red oak-maple types in the alliance as well as *Acer saccharum - Carya cordiformis* Temporarily Flooded Forest Alliance (A.302).

ELEMENT DISTRIBUTION

Indiana Dunes National Lakeshore Range: This red oak forest is found in the Bailly, Visitor Center, Keiser, and Pinhook Bog units, and perhaps on slopes of the Hobart Prairie unit.

Global Range: This community is found in the northern prairie-forest border and central midwestern region of the United States, ranging from western Ohio, west to southern Minnesota, south to Iowa, and east to Indiana.

Nations: CA, US

States/Provinces: IA?, IL, IN, OH, ON, WI

USFS Ecoregions: 222Aq:CCC, 222Fd:CCC, 222Ga:CCC, 222Ha:CCC, 222Hb:CCC, 222Hc:CCC, 222Jb:CCC, 222Jc:CCC, 222Jg:CCC, 222Jj:CCC, 222Kg:CCC, 222L:CP, 222M:CP, 251Cf:CCC, 251Ci:CCC, 251Cj:CCC, 251Dc:CCC, 251De:CCC, 251Dg:CCC

Federal Lands: NPS (Indiana Dunes)

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ELEMENT SOURCES

Indiana Dunes National Lakeshore Map Units Summary:

Indiana Dunes National Lakeshore Inventory Notes:

Indiana Dunes National Lakeshore Plots: INDU.VP011, INDU.VP013, INDU.VP016, INDU.VP046, INDU.VP047, INDU.VP066, INDU.VP091, INDU.AA107, INDU.AA257, INDU.AA336, INDU.AA392, INDU.AA489, INDU.AA577, INDU.AA686, INDU.AA712.

Local Description Author(s): N. Lehmann

Global Description Author(s): D. Faber-Langendoen

References: Bailey et al. 1994, INAI unpubl. data, Kline and Cottam 1979, Midwestern Ecology Working Group n.d., WNHIP unpubl. Data

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I.B.2.N.a. Lowland or submontane cold-deciduous forest

A.1911 *Quercus velutina - Quercus alba* - (*Quercus coccinea*) Forest Alliance

Black Oak - White Oak - (Scarlet Oak) Forest Alliance

[CEGL002078] *Quercus velutina* / *Carex pensylvanica* Forest

Translated Name: **Black Oak / Pennsylvania Sedge Forest**
Common Name: **Black Oak Forest**
Ecological System(s):
- North-Central Interior Dry Oak Forest and Woodland (CES202.047)

Circumscription Confidence: 2 - Moderate
Concept Author(s): D. Faber-Langendoen

ELEMENT CONCEPT

Global Summary: This black oak forest community is found in the upper midwestern United States. Stands are found on sandy, well-drained to excessively well-drained soils. These develop from glacial outwash, glaciofluvial deposits, alluvial sediments, and dunes. The soils are relatively infertile and acidic. The tree canopy is moderately closed, occasionally scrubby, and with typically 70-80% cover. The more open stands tend to have well-developed shrub layers while closed canopy stands have fewer shrubs. Some stands, especially those in which fire has been excluded for long periods, can have tree densities up to several hundred trees per ha. *Quercus velutina* is the dominant tree species and makes up the great majority of the canopy in most stands. Other common tree species include *Acer rubrum* and *Prunus serotina*. Shrubs such as *Cornus racemosa, Corylus cornuta*, and *Vaccinium* spp. are typical. The ground layer contains species such as *Amphicarpaea bracteata*, Asteraceae spp., *Carex pensylvanica, Geranium maculatum, Maianthemum racemosum*, and *Pteridium aquilinum*.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Terrestrial
Indiana Dunes National Lakeshore Environment: This black oak forest is found on dry-mesic, well-drained slopes and terraces with loamy sand.
Global Environment: Stands are found on sandy, well-drained to excessively well-drained soils. These develop from glacial outwash, glaciofluvial deposits, alluvial sediments, and dunes. The soils are relatively infertile and acidic and free of mottling (Eyre 1980). Stands can be found on flat to moderately sloping sites.

VEGETATION DESCRIPTION

Indiana Dunes National Lakeshore Vegetation: The broad-leaved, cold-deciduous, moderately closed canopy is dominated by *Quercus velutina*. *Quercus alba* and *Prunus serotina* are common associates. The subcanopy coverage is usually sparse, containing younger canopy species as well as *Sassafras albidum* (in drier sites) and *Populus tremuloides, Asimina triloba, Acer rubrum*, and *Nyssa sylvatica* in moister sites. Numerous grubs of *Quercus velutina* are found where fires have been frequent and/or severe. Other shrubs include *Vaccinium* spp., especially *Vaccinium pallidum*, as well as *Sassafras albidum, Rosa carolina, Cornus racemosa, Hamamelis virginiana*, and *Rubus* spp. *Osmunda regalis* var. *spectabilis* or *Populus tremuloides* may be present in moister sites. Common species in the diverse herbaceous layer include *Aquilegia canadensis, Carex pensylvanica, Euphorbia corollata, Fragaria virginiana, Galium* spp., *Helianthus divaricatus, Koeleria macrantha, Lupinus perennis, Maianthemum racemosum, Maianthemum stellatum, Opuntia humifusa, Pteridium aquilinum, Solidago speciosa, Tephrosia virginiana*, and *Tradescantia ohiensis*. Vines such as *Amphicarpaea bracteata, Parthenocissus quinquefolia, Smilax* spp. (especially *Smilax rotundifolia*), and *Vitis riparia* are also common. Exotic species include *Robinia pseudoacacia, Rosa multiflora* and *Lonicera* spp., especially *Lonicera tatarica*. This community also supports state-critically imperiled *Uvularia perfoliata*, state-imperiled *Pinus banksiana* and *Pinus strobus*, and state-vulnerable *Alnus incana* ssp. *rugosa* and *Comptonia peregrina*.
Global Vegetation: The tree canopy is moderately closed, with typically 70-80% cover (White and Madany 1978, MNNHP 1993). The more open stands tend to have well-developed shrub layers, while closed-canopy stands have fewer shrubs. Some stands, especially those in which fire has been excluded for long periods, can have tree densities up to several hundred trees per hectare (Curtis 1959). *Quercus velutina* is the dominant tree species and comprises the great majority of the canopy in most stands. Other common tree species include *Acer rubrum* and *Prunus serotina*. Typical shrubs include *Cornus racemosa, Corylus cornuta, Vaccinium angustifolium*, and *Vaccinium myrtilloides*. The ground layer contains species such as *Amphicarpaea bracteata*, Asteraceae spp., *Carex pensylvanica, Geranium maculatum, Maianthemum racemosum*, and *Pteridium aquilinum*. Where *Carex pensylvanica* forms dense sods, it may exclude shrub or sapling cover (E. Epstein pers. comm. 1999).
Global Dynamics: This forest community often occurs on sites that could support woodland or savanna communities. The forests develop where natural firebreaks have limited burning frequency (White and Madany 1978).

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INDIANA DUNES NATIONAL LAKESHORE FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform
Asimina triloba	Tree canopy	Broad-leaved deciduous tree
Populus tremuloides	Tree canopy	Broad-leaved deciduous tree
Prunus serotina	Tree canopy	Broad-leaved deciduous tree
Quercus alba	Tree canopy	Broad-leaved deciduous tree
Quercus rubra	Tree canopy	Broad-leaved deciduous tree
Quercus velutina	Tree canopy	Broad-leaved deciduous tree
Populus tremuloides	Tall shrub/sapling	Broad-leaved deciduous tree
Quercus velutina	Tall shrub/sapling	Broad-leaved deciduous tree
Asimina triloba	Tall shrub/sapling	Broad-leaved deciduous shrub
Cornus racemosa	Tall shrub/sapling	Broad-leaved deciduous shrub
Hamamelis virginiana	Tall shrub/sapling	Broad-leaved deciduous shrub
Lonicera tatarica	Tall shrub/sapling	Broad-leaved deciduous shrub
Rhus copallinum	Tall shrub/sapling	Broad-leaved deciduous shrub
Rosa carolina	Tall shrub/sapling	Broad-leaved deciduous shrub
Rubus flagellaris	Tall shrub/sapling	Broad-leaved deciduous shrub
Rubus pensilvanicus	Tall shrub/sapling	Broad-leaved deciduous shrub
Salix humilis	Tall shrub/sapling	Broad-leaved deciduous shrub
Vaccinium angustifolium	Tall shrub/sapling	Broad-leaved deciduous shrub
Vaccinium pallidum	Tall shrub/sapling	Broad-leaved deciduous shrub
Osmunda regalis var. *spectabilis*	Tall shrub/sapling	Fern or fern ally
Acer rubrum	Herb (field)	Broad-leaved deciduous tree
Opuntia humifusa	Herb (field)	Succulent shrub
Parthenocissus quinquefolia	Herb (field)	Vine/Liana
Smilax rotundifolia	Herb (field)	Vine/Liana
Toxicodendron radicans	Herb (field)	Vine/Liana
Vitis riparia	Herb (field)	Vine/Liana
Aquilegia canadensis	Herb (field)	Forb
Euphorbia corollata	Herb (field)	Forb
Fragaria virginiana	Herb (field)	Forb
Galium circaezans	Herb (field)	Forb
Helianthus divaricatus	Herb (field)	Forb
Ionactis linariifolius	Herb (field)	Forb
Lithospermum caroliniense var. *croceum*	Herb (field)	Forb
Lupinus perennis	Herb (field)	Forb
Maianthemum canadense	Herb (field)	Forb
Maianthemum stellatum	Herb (field)	Forb
Monarda fistulosa	Herb (field)	Forb
Solidago speciosa	Herb (field)	Forb
Tephrosia virginiana	Herb (field)	Forb
Tradescantia ohiensis	Herb (field)	Forb
Carex pensylvanica	Herb (field)	Graminoid
Koeleria macrantha	Herb (field)	Graminoid
Pteridium aquilinum	Herb (field)	Fern or fern ally
Populus tremuloides	Herb (field)	Other herbaceous
Prunus serotina	Herb (field)	Other herbaceous
Quercus velutina	Herb (field)	Other herbaceous
Sassafras albidum	Herb (field)	Other herbaceous

GLOBAL FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform

INDIANA DUNES NATIONAL LAKESHORE OTHER NOTEWORTHY SPECIES

Ailanthus altissima, Alliaria petiolata, Alnus incana ssp. r*ugosa, Asparagus officinalis, Berberis thunbergii, Celastrus orbiculata, Comptonia peregrine, Convallaria majalis, Daucus carota, Dianthus armeria, Frangula alnus, Leonurus cardiaca, Lonicera tatarica, Pinus banksiana, Pinus strobus, Poa compressa, Potentilla recta, Rosa multiflora, Solanum dulcamara, Uvularia perfoliata, Vinca minor*

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GLOBAL OTHER NOTEWORTHY SPECIES

CONSERVATION STATUS RANK

Global Rank & Reasons: G4?

RELATED CONCEPTS

Global Similar Associations:

- *Quercus (alba, rubra, velutina) / Cornus florida / Viburnum acerifolium* Forest (CEGL006336)
- *Quercus alba - Quercus macrocarpa - Quercus rubra / Corylus americana* Woodland (CEGL002142)
- *Quercus ellipsoidalis - (Quercus macrocarpa)* Forest (CEGL002077)--This type is dominated by *Quercus ellipsoidalis*. In Wisconsin, these two species hybridize and traditionally *Quercus velutina* is treated as occurring south of the tension zone and *Quercus ellipsoidalis* north of it.
- *Quercus velutina - Quercus alba - Carya (glabra, ovata)* Forest (CEGL002076)
- *Quercus velutina - Quercus alba / Vaccinium (angustifolium, pallidum) / Carex pensylvanica* Forest (CEGL005030)--contains a mix of *Quercus velutina* and *Quercus alba*, is also on sand, but is more dry-mesic.

Global Related Concepts:

- Northern Pin Oak: 14 (Eyre 1980) B

CLASSIFICATION & OTHER COMMENTS

Indiana Dunes National Lakeshore Classification Comments: Included in this *Quercus velutina* forest are small areas that are more open-canopied. These areas have the tree canopy cover of a woodland but are still included in this association due to overall floristic composition.. Also included are some areas that are wetter than the environmental circumscription, but they are within the vegetation circumscription of this community.

Indiana Dunes National Lakeshore Other Comments: The dominance of *Maianthemum canadense* may be misleading due to an uncertainty in a positive identification. The plants observed may have been seedlings of *Maianthemum stellatum*.

Global Classification Comments: Stands of this community contain at least 70% cover or basal area of *Quercus velutina* and are found on well-drained, sandy soils.

ELEMENT DISTRIBUTION

Indiana Dunes National Lakeshore Range: This black oak forest is found in upland areas throughout the park and is particularly well-developed in the park's West units, as well as Cowles Bog, Dunes State Park, and Tamarack in the park's East units.

Global Range: This community is found in the upper midwestern United States, ranging from northern Indiana to possibly southeastern Minnesota.

Nations: US

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

USFS Ecoregions: 222Jj:CCC, 222Kg:CPP, 222Lc:CCC, 222Lf:CCC, 222Md:CCC, 222Me:CCC, 251Cf:CCC, 251Df:CCC, 251Dg:CCC

Federal Lands: NPS (Indiana Dunes)

ELEMENT SOURCES

Indiana Dunes National Lakeshore Map Units Summary:

Indiana Dunes National Lakeshore Inventory Notes:

Indiana Dunes National Lakeshore Plots: INDU.VP006, INDU.VP031, INDU.VP040, INDU.VP056, INDU.VP060, INDU.VP067, INDU.VP068, INDU.VP086, INDU.VP092, INDU.VP105, INDU.VP125, INDU.VP126, INDU.VP136, INDU.VP137, INDU.VP168, INDU.VP169, INDU.VP170, INDU.AA010, INDU.AA024, INDU.AA069, INDU.AA082, INDU.AA099, INDU.AA110, INDU.AA125, INDU.AA129, INDU.AA260, INDU.AA278, INDU.AA283, INDU.AA347, INDU.AA379, INDU.AA411, INDU.AA425, INDU.AA465, INDU.AA514, INDU.AA536a, INDU.AA537, INDU.AA565, INDU.AA610, INDU.AA654, INDU.AA666, INDU.AA674, INDU.AA680, INDU.AA705.

Local Description Author(s): N. Lehmann

Global Description Author(s): D. Faber-Langendoen

References: Curtis 1959, Epstein pers. comm., Eyre 1980, INAI unpubl. data, MNNHP 1993, Midwestern Ecology Working Group n.d., WNHIP unpubl. data, White and Madany 1978

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I.B.2.N.d. Temporarily flooded cold-deciduous forest

A.279 *Acer saccharinum* Temporarily Flooded Forest Alliance

Silver Maple Temporarily Flooded Forest Alliance

[CEGL002586] *Acer saccharinum - Ulmus americana* Forest

Translated Name: **Silver Maple - American Elm Forest**
Common Name: **Silver Maple - Elm Forest**
Ecological System(s):

- Laurentian-Acadian Floodplain Forest (CES201.587)
- Central Appalachian River Floodplain (CES202.608)
- Mississippi River Riparian Forest (CES203.190)
- North-Central Interior Floodplain (CES202.694)
- South-Central Interior Large Floodplain (CES202.705)

Circumscription Confidence: 2 - Moderate
Concept Author(s): D. Faber-Langendoen, mod. G. Fleming and P. Coulling

ELEMENT CONCEPT

Global Summary: This silver maple - elm - cottonwood forest is found throughout the midwestern United States and parts of the eastern United States. Stands occur on large, regularly flooded floodplains. The canopy cover is more-or-less closed and dominated by *Acer saccharinum*. Codominants may include *Platanus occidentalis, Betula nigra*, and rarely *Acer saccharum*. Associated species may include *Ulmus americana, Ulmus rubra, Acer negundo, Salix nigra, Celtis occidentalis, Carya cordiformis, Juglans nigra*, and *Fraxinus pennsylvanica*. The shrub and sapling layer is often open (<25% cover). Species that may be present include *Sambucus canadensis, Rubus occidentalis*, or *Lindera benzoin*. Woody and herbaceous vines can be prominent, including among the woody vines *Parthenocissus quinquefolia, Toxicodendron radicans*, and *Vitis riparia*. Herbaceous vine species include *Apios americana, Amphicarpaea bracteata*, and *Echinocystis lobata*. Herbaceous grasses, forbs, and ferns dominate the ground layer, including *Symphyotrichum lateriflorum (= Aster lateriflorus), Boehmeria cylindrica, Erythronium americanum, Solidago gigantea, Cinna arundinacea, Leersia virginica, Elymus virginicus, Impatiens pallida, Laportea canadensis, Matteuccia struthiopteris, Onoclea sensibilis, Pilea pumila, Urtica dioica*, and others. A variety of exotics may be present, including *Lysimachia* spp., *Microstegium vimineum, Polygonum cuspidatum, Rosa multiflora*, and *Lonicera japonica*.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Palustrine
Indiana Dunes National Lakeshore Environment: This silver maple - elm forest is found on temporarily flooded areas including floodplains, stream terraces, and lakeplains. Soils are wet-mesic to saturated and range from somewhat poorly drained loamy sand and muck to well-drained silt loam.
Global Environment: This community occurs on temporarily flooded soils along major rivers and smaller perennial streams. Soils may be well-drained and sandy, more loamy on infrequently flooded bottomlands and levees, or deep silts on stabilized sites along larger rivers. It appears to be favored by deposition of deep sandy sediments by low-energy floodwaters. The community may form small linear patches among other floodplain associations or be locally extensive. The structure and composition of the type is influenced by the flooding regime. Floods leave river-deposited debris on the forest floor, ice scars on trees, and abandoned channels that retain water at or above the level of the main river channel.

VEGETATION DESCRIPTION

Indiana Dunes National Lakeshore Vegetation: The moderate to very dense canopy and subcanopy layers are domined by *Acer saccharinum*; associates include *Acer rubrum, Fraxinus* spp., *Populus deltoides, Populus tremuloides, Prunus virginiana*, and *Ulmus americana*. The sparse to very dense tall- and short-shrub layers are dominated by *Lindera benzoin* and may include *Asimina triloba, Cornus amomum, Crataegus punctata, Ostrya virginiana, Rubus occidentalis, Staphylea trifolia*, and *Viburnum recognitum (= Viburnum dentatum var. lucidum)*. Herbs are generally sparse under the dense upper layers, however, cover as high as 90% can occur. Common and/or dominant species include *Asarum canadense, Boehmeria cylindrica, Calamagrostis canadensis, Onoclea sensibilis, Pilea pumila, Polygonum virginianum, Rudbeckia laciniata*, and *Urtica dioica ssp. gracilis* (exotic).
Global Vegetation: The canopy cover is more-or-less closed and dominated by *Acer saccharinum*. Codominants may include *Platanus occidentalis, Betula nigra*, and rarely *Acer saccharum*. Associated species may include *Ulmus americana, Ulmus rubra, Acer negundo, Salix nigra, Celtis occidentalis, Carya cordiformis, Juglans nigra, Fraxinus pennsylvanica*, and occasionally *Halesia tetraptera*. The shrub and sapling layer is often open (<25% cover). Species that may be present include *Sambucus canadensis, Rubus occidentalis*, or *Lindera benzoin*. Woody and herbaceous vines can be prominent, including among the woody vines *Parthenocissus quinquefolia, Toxicodendron radicans*, and *Vitis riparia*. Herbaceous vine species include *Apios americana, Amphicarpaea bracteata*, and *Echinocystis lobata*. Grasses, forbs, and ferns dominate the ground layer, including various combinations of *Symphyotrichum*

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lateriflorum (= Aster lateriflorus), Boehmeria cylindrica, Chasmanthium latifolium, Cryptotaenia canadensis, Erythronium americanum, Solidago gigantea, Cinna arundinacea, Leersia virginica, Elymus virginicus, Helianthus sp., *Impatiens capensis, Impatiens pallida, Laportea canadensis, Matteuccia struthiopteris, Menispermum canadense, Onoclea sensibilis, Pilea pumila, Polygonum virginianum, Rudbeckia laciniata, Verbesina alternifolia, Urtica dioica*, and others. A variety of exotics may be present, including *Lysimachia* spp., *Microstegium vimineum, Glechoma hederacea, Polygonum cuspidatum, Rosa multiflora*, and *Lonicera japonica*.

Global Dynamics: The structure and composition of the type is influenced by the flooding regime, which is typically an annual flooding of relatively brief duration, but may be absent in dry years or extensive during flash-flood years. Floods leave river-deposited debris on the forest floor, ice scars on trees, and abandoned channels that retain water at or above the level of the main river channel.

INDIANA DUNES NATIONAL LAKESHORE FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform
Acer saccharinum	Tree (canopy & subcanopy)	Broad-leaved deciduous tree
Populus deltoides	Tree canopy	Broad-leaved deciduous tree
Populus tremuloides	Tree canopy	Broad-leaved deciduous tree
Ulmus americana	Tree canopy	Broad-leaved deciduous tree
Lindera benzoin	Shrub/sapling (tall & short)	Broad-leaved deciduous shrub
Boehmeria cylindrica	Herb (field)	Forb
Pilea pumila	Herb (field)	Forb
Onoclea sensibilis	Herb (field)	Fern or fern ally

GLOBAL FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform
Acer negundo	Tree canopy	Broad-leaved deciduous tree
Acer saccharinum	Tree canopy	Broad-leaved deciduous tree
Populus deltoides	Tree canopy	Broad-leaved deciduous tree
Humulus japonicus	Shrub/sapling (tall & short)	Vine/Liana
Parthenocissus quinquefolia	Herb (field)	Vine/Liana
Toxicodendron radicans	Herb (field)	Vine/Liana
Alliaria petiolata	Herb (field)	Forb
Conium maculatum	Herb (field)	Forb
Glechoma hederacea	Herb (field)	Forb
Urtica dioica ssp. *gracilis*	Herb (field)	Forb
Elymus virginicus	Herb (field)	Graminoid
Leersia virginica	Herb (field)	Graminoid
Matteuccia struthiopteris	Herb (field)	Fern or fern ally

INDIANA DUNES NATIONAL LAKESHORE OTHER NOTEWORTHY SPECIES

Alliaria petiolata, Frangula alnus, Lonicera tatarica, Lonicera x *bella, Poa trivialis,Rosa multiflora,Urtica dioica, Viburnum opulus*

GLOBAL OTHER NOTEWORTHY SPECIES

Glechoma hederacea, Lonicera japonica, Microstegium vimineum, Polygonum cuspidatum, Rosa multiflora

CONSERVATION STATUS RANK

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

RELATED CONCEPTS

Global Similar Associations:

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

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- *Platanus occidentalis - Acer saccharinum - Juglans nigra - Ulmus rubra* Forest (CEGL007334)--may overlap in southern parts of the range of CEGL002586.
- *Populus deltoides - Salix nigra* Forest (CEGL002018)--grades into this community on the wetter side.
- *Quercus macrocarpa - Quercus bicolor - Carya laciniosa / Leersia* spp. - *Cinna* spp. Forest (CEGL002098)

Global Related Concepts:

- Silver Maple - American Elm: 62 (Eyre 1980) B
- Silver maple-American elm-cottonwood floodplain forest (CAP pers. comm. 1998) ?
- Southern Floodplain Forest (Chapman et al. 1989) B

CLASSIFICATION & OTHER COMMENTS

Indiana Dunes National Lakeshore Classification Comments:

Indiana Dunes National Lakeshore Other Comments:

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

ELEMENT DISTRIBUTION

Indiana Dunes National Lakeshore Range: This community is found in along rivers in the Bailly, Heron Rookery, Hobart Prairie, Calumet Prairie, the State Park, and Tamarack areas of the park.

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

Nations: CA, US

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

USFS Ecoregions: 212Fc:CCC, 212Hb:CCC, 212He:CCC, 212Hm:CCC, 212Ht:CCP, 212Hv:CCC, 212Hw:CCP, 212Hx:CCP, 212Hy:CCP, 212Ja:CCC, 212Je:CCC, 212Jf:CCC, 212Jj:CC?, 212Jl:CCC, 212Js:CCC, 212Ka:CC?, 212Kb:CCC, 212Mb:CPP, 212Na:CC?, 212Nb:CCP, 212Nc:CCC, 212Nd:CCC, 221Bd:CCC, 221Da:CCC, 221Db:CCC, 221Ea:CCC, 221Ec:CCC, 221Ed:CCC, 221Ef:CCC, 221Fa:CCC, 222Aj:CCC, 222An:CCC, 222Ap:CCC, 222Aq:CCC, 222Ch:CCC, 222Db:CCC, 222Dc:CCP, 222De:CCC, 222Df:CCP, 222Ei:CPP, 222Ek:CPP, 222El:CPP, 222Em:CPP, 222Fa:CCP, 222Fb:CCC, 222Fc:CCP, 222Fd:CCP, 222Fe:CCP, 222Ff:CCP, 222Ga:CCC, 222Gb:CCC, 222Gc:CCC, 222Gd:CCP, 222Ge:CCC, 222Ha:CCC, 222Hb:CCC, 222Hc:CCC, 222Hf:CCC, 222If:CCC, 222Jb:CCC, 222Jh:CCC, 222Ji:CCC, 222Jj:CCC, 222Ka:CCC, 222Kb:CCC, 222Kd:CCC, 222Kf:CCC, 222Kg:CCC, 222Kh:CCC, 222Kj:CCP, 222Lc:CCC, 222Ld:CCC, 222Lf:CCC, 222Ma:CCC, 222Mb:CCC, 222Mc:CCC, 222Md:CCC, 222Me:CCC, 232Ac:CCC, 234Aa:CC?, 234Am:CCC, 234An:CCC, 251Ba:CCC, 251Be:CCC, 251Cc:CCC, 251Cd:CCC, 251Cf:CCC, 251Dd:CCP, 251De:CCC, 251Df:CCC, 251Dg:CCC, 251Dh:CCC, 251Eb:CCC, M221Cb:CCC

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

ELEMENT SOURCES

Indiana Dunes National Lakeshore Map Units Summary:

Indiana Dunes National Lakeshore Inventory Notes:

Indiana Dunes National Lakeshore Plots: INDU.VP065, INDU.VP079, INDU.VP153, INDU.VP184, INDU.AA227, INDU.AA297, INDU.AA362, INDU.AA446, INDU.AA503, INDU.AA533, INDU.AA603, INDU.AA732.

Local Description Author(s): M.J. Russo

Global Description Author(s): D. Faber-Langendoen, mod. L.A. Sneddon, E. Largay, S.C. Gawler

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

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I.B.2.N.d. Temporarily flooded cold-deciduous forest

A.280 *Betula nigra* - (*Platanus occidentalis*) Temporarily Flooded Forest Alliance

River Birch – (Sycamore) Temporarily Flooded Forest Alliance

[A.280] *Betula nigra* - (*Platanus occidentalis*) Temporarily Flooded Forest Alliance
Translated Name: **River Birch - (Sycamore) Temporarily Flooded Forest Alliance**
Common Name:
Ecological System(s):
Circumscription Confidence:
Concept Author(s): J. Drake

ELEMENT CONCEPT

Global Summary: Forests in this alliance occur on riverfronts in areas with repeated, frequent, natural disturbance in the form of flooding. These forests occur more frequently on sandy soils than on heavier soils and their most characteristic location is on levees. The soils are deep and well-drained with low organic matter content and are most commonly of the Orders Inceptisol and Entisol. This is a wide ranging alliance that occurs throughout most of the southeastern and midwestern United States. In addition to the codominants *Betula nigra* and *Platanus occidentalis*, a variety of canopy species occur in these forests, including *Acer negundo, Populus deltoides, Acer saccharinum, Salix nigra, Celtis laevigata, Quercus laurifolia, Liriodendron tulipifera*, and *Liquidambar styraciflua*. The subcanopy or tall-shrub strata may include *Cornus florida* and *Carpinus caroliniana*, along with *Acer rubrum, Ilex opaca, Ulmus alata, Prunus serotina*, and *Carya* spp. The shrub layer is often sparse with such species as *Asimina triloba, Lindera benzoin, Crataegus marshallii*, and *Crataegus viridis* present. The herbaceous and vine components may be lush and diverse, and species of these strata include *Boehmeria cylindrica, Campsis radicans, Elymus hystrix, Stellaria pubera, Impatiens capensis, Pilea pumila, Bignonia capreolata, Toxicodendron radicans, Berchemia scandens, Campsis radicans, Parthenocissus quinquefolia, Vitis rotundifolia, Chasmanthium latifolium (= Uniola latifolia), Arundinaria gigantea*, and *Podophyllum peltatum*.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Palustrine
Indiana Dunes National Lakeshore Environment: This community was observed during field reconnaissance but did not have enough data to characterize it at Indiana Dunes NL.
Global Environment: Stands of this alliance usually are found on the natural levees of watercourses and, therefore, are slightly elevated from the flats behind the levee. They are more common along small streams and blackwater streams than along alluvial floodplains, mostly because of the higher sustained flow rates of these larger rivers. The soils are deep, nearly level, well-drained, and moderately well-drained on bottomlands along streams. They have low organic matter content, moderate permeability, and moderate to high available water capacity. A layer of sand is often deposited at the surface when streams overflow their banks during flash floods. Little or no clay is present in soils which support stands of this alliance. Flooding is seasonal and/or occasional and shallow, but never prolonged. Most of the short-duration flooding takes place in early spring.

VEGETATION DESCRIPTION

Indiana Dunes National Lakeshore Vegetation: This community was observed during field reconnaissance but did not have enough data to characterize it at Indiana Dunes NL.
Global Vegetation: This alliance, found in the central and southern United States and southern Canada, occurs on riverfronts in areas with repeated, frequent, natural disturbance in the form of flooding. A wide range of canopy species are present, but *Betula nigra* and *Platanus occidentalis* are prevalent. *Betula nigra* tends to have a greater number of stems but *Platanus occidentalis* may be more conspicuous because of its larger size (Fowells 1965). Along with common bottomland species, such as *Ulmus americana, Acer rubrum, Acer negundo, Quercus* spp., and *Celtis laevigata*, mesophytic species from nearby uplands and terraces, like *Liriodendron tulipifera* and *Liquidambar styraciflua*, may be found (Eyre 1980). The subcanopy or tall-shrub strata may include *Cornus florida* and *Carpinus caroliniana*, along with *Acer rubrum, Ilex opaca, Ulmus alata, Prunus serotina*, and *Carya* spp. The shrub layer usually is not well-developed but, due to the openness of the canopy, the herb layer can be quite diverse and dense. It contains species such as *Asimina triloba, Lindera benzoin, Crataegus marshallii*, and *Crataegus viridis* present. Commonly encountered herbaceous species include *Arisaema dracontium, Symphyotrichum ontarionis (= Aster ontarionis), Impatiens capensis, Pilea pumila*, and *Saururus cernuus*. This forest harbors a number of ubiquitous species and tends to extend into and mix with adjacent communities, resulting in numerous transitional variants. Occurrences may have a rather high percentage of standing dead trees, including remnant snags from earlier successional communities.
Global Dynamics: Occurrences may have a rather high percentage of standing dead trees, including remnant snags from earlier successional communities. A layer of sand is often deposited at the surface when streams overflow their banks during flash floods. Little or no clay is present in soils which support stands of this alliance. Flooding is seasonal and/or occasional and shallow, but never prolonged. Most of the short-duration flooding takes place in early spring.

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INDIANA DUNES NATIONAL LAKESHORE FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform

GLOBAL FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform

INDIANA DUNES NATIONAL LAKESHORE OTHER NOTEWORTHY SPECIES

GLOBAL OTHER NOTEWORTHY SPECIES

CONSERVATION STATUS RANK

Global Rank & Reasons: GNR

RELATED CONCEPTS

Global Similar Associations:
Global Related Concepts:

CLASSIFICATION & OTHER COMMENTS

Indiana Dunes National Lakeshore Classification Comments: This vegetation type was observed in two places in the project area but did not have any field samples (plots or accuracy assessment points). Thus, data are limited for the characteristics of this type at INDU.
Indiana Dunes National Lakeshore Other Comments:
Global Classification Comments:

ELEMENT DISTRIBUTION

Indiana Dunes National Lakeshore Range: This alliance is found in the Heron Rookery, Little Calumet River, and Dunes Creek.
Global Range: This is a wide-ranging alliance that occurs throughout most of the southeastern and midwestern United States. It may also be found in Canada in southern Ontario.
Nations: CA, US
States/Provinces: AL, AR, DE, FL, GA, IA, IL, IN, KY, LA, MD, MO, MS, NC, NJ, NY, OH, OK, ON, PA, SC, TN, TX, VA, WV
USFS Ecoregions: 222Jj:CCC
Federal Lands: NPS (Indiana Dunes)

ELEMENT SOURCES

Indiana Dunes National Lakeshore Map Units Summary:
Indiana Dunes National Lakeshore Inventory Notes:
Indiana Dunes National Lakeshore Plots:
Local Description Author(s):
Global Description Author(s): D.J. Allard

References: Allard 1990, Burns and Honkala 1990a, Campbell 1988, Campbell 1989b, Evans 1991, Eyre 1980, Faber-Langendoen et al. 1996, Fike 1999, Foti et al 1994, Foti 1994b, Fowells 1965, Gettman 1974, Hoagland 1998a, Klimas et al. 1981, Smith 1991, Southeastern Ecology Working Group No date, Wharton 1978, Wharton et al. 1982

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I.B.2.N.d. Temporarily flooded cold-deciduous forest

A.290 *Populus deltoides* Temporarily Flooded Forest Alliance

Eastern Cottonwood Temporarily Flooded Forest Alliance

[CEGL002018] *Populus deltoides - Salix nigra* Forest

Translated Name: **Eastern Cottonwood - Black Willow Forest**
Common Name: **Midwestern Cottonwood - Black Willow Forest**
Ecological System(s):

- Mississippi River Riparian Forest (CES203.190)
- North-Central Interior Floodplain (CES202.694)
- East Gulf Coastal Plain Large River Floodplain Forest (CES203.489)
- South-Central Interior Large Floodplain (CES202.705)

Circumscription Confidence: 2 - Moderate
Concept Author(s): M. Guetersloh, mod. D. Faber-Langendoen

ELEMENT CONCEPT

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

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Palustrine
Indiana Dunes National Lakeshore Environment: This cottonwood - black willow forest occurs in seasonally flooded/saturated lowlands with mucky soils.
Global Environment: This community is quick to colonize newly deposited substrates adjacent to rivers, lakes, streams, and in frequently flooded, low, wet depressions in floodplains. Dynamic substrate availability caused by frequent flooding encourages the establishment and maintenance of this community type.

VEGETATION DESCRIPTION

Indiana Dunes National Lakeshore Vegetation: The canopy of this forest ranges from relatively open (about 30%) to closed. The dominant trees are *Populus deltoides* and *Salix nigra*. *Parthenocissus quinquefolia, Celastrus orbiculata,* and especially *Vitis riparia* are common vines. When present, *Salix sericea* can dominate the tall-shrub layer. The herbaceous layer consists mostly of graminoids such as *Calamagrostis canadensis*, and stands of *Phragmites australis* and/or *Typha latifolia* can be extensive. The nonnative invasives *Celastrus orbiculata* and *Rosa multiflora* are often present.
Global Vegetation: This community is dominated by broadleaf deciduous trees. Canopy closure is complete, or nearly so, with few shrubs and limited tree species found in the type. The tree canopy is tall (to 30 m) and dominated by *Populus deltoides* and *Salix nigra*, although *Fraxinus pennsylvanica, Acer saccharinum, Acer negundo, Platanus occidentalis*, and *Ulmus americana* are also commonly encountered. Tree diversity is limited due to the dynamics of flooding and deposition/scouring of sediments. The subcanopy is almost exclusively *Salix nigra*. The shrub layer is conspicuously absent in many parts of the range. Herbaceous growth can be thick and lush but is often patchy and sparse due to frequent inundation. Species most often encountered in the ground layer include *Carex* spp., *Leersia oryzoides, Bidens* spp., and Asteraceae spp. (TNC 1995a).
Global Dynamics: Prolonged flooding and storms (wind, lightning) are the most significant contributor to natural disturbance in this natural community. This is an aggressive pioneer forest element which quickly colonizes moist soils in banks along rivers, streams, lakes, and floodplain depressions. Cottonwood and black willow display phenomenal growth under favorable conditions in this forest.

INDIANA DUNES NATIONAL LAKESHORE FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform
Populus deltoides	Tree canopy	Broad-leaved deciduous tree

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Salix nigra	Tree canopy	Broad-leaved deciduous tree
Vitis riparia	Herb (field)	Vine/Liana
Calamagrostis canadensis	Herb (field)	Graminoid
Phragmites australis	Herb (field)	Graminoid
Typha latifolia	Herb (field)	Graminoid

GLOBAL FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform
Populus deltoides	Tree canopy	Broad-leaved deciduous tree
Salix nigra	Tree canopy	Broad-leaved deciduous tree
Salix nigra	Tree subcanopy	Broad-leaved deciduous tree
Toxicodendron radicans	Shrub/sapling (tall & short)	Vine/Liana
Spermacoce glabra	Herb (field)	Semi-shrub
Bidens aristosa	Herb (field)	Forb
Symphyotrichum lanceolatum var. *lanceolatum*	Herb (field)	Forb
Symphyotrichum lateriflorum var. *lateriflorum*	Herb (field)	Forb
Carex typhina	Herb (field)	Graminoid
Leersia oryzoides	Herb (field)	Graminoid

INDIANA DUNES NATIONAL LAKESHORE OTHER NOTEWORTHY SPECIES

Alliaria petiolata, Celastrus orbiculata, Cirsium arvense, Impatiens balsamina, Lonicera tatarica, Lonicera x *bella, Lythrum salicaria, Rosa multiflora, Solanum dulcamara, Viburnum opulus,Vinca minor*

GLOBAL OTHER NOTEWORTHY SPECIES

Acris gryllus, Agkistrodon piscivorus, Aix sponsa, Ambystoma maculatum, Ardea alba, Ardea herodias, Butorides virescens, Coccyzus americanus, Dendroica dominica, Didelphis virginiana, Egretta caerulea, Euphagus carolinus, Gallinago gallinago, Lontra canadensis,Macrochelys temminckii, Megaceryle alcyon, Melanerpes carolinus, Melanerpes erythrocephalus, Mniotilta varia, Mycteria americana, Myiarchus crinitus, Neovison vison, Nyctanassa violacea, Nycticorax nycticorax, Nymphalis antiopa, Odocoileus virginianus, Oryzomys palustris, Parula americana, Peromyscus gossypinus, Phalacrocorax auritus, Polioptila caerulea, Procyon lotor, Quiscalus quiscula, Rana sphenocephala, Reithrodontomys humulis, Scolopax minor, Setophaga ruticilla, Sigmodon hispidus, Strix vari,, Vermivora bachmanii

CONSERVATION STATUS RANK

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

RELATED CONCEPTS

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

Global Related Concepts:
- *Populus deltoides - Salix nigra / Leersia* community (Voigt and Mohlenbrock 1964) =
- Black Willow: 95 (Eyre 1980) B
- Cottonwood: 63 (Eyre 1980) B
- Eastern Broadleaf Forests: 98: Northern Floodplain Forest (*Populus-Salix-Ulmus*) (Kuchler 1964) B
- Eastern Broadleaf and Needleleaf Forests (Kuchler 1964) B
- Palustrine: Palustrine Forested Wetland (Cowardin et al. 1979) F
- Terrestrial: Forest: Hardwood (TNC 1985) B
- UNESCO FORMATION CODE: I.B.3d (UNESCO 1973) B

CLASSIFICATION & OTHER COMMENTS

Indiana Dunes National Lakeshore Classification Comments: *Typha latifolia* may in fact be *Typha X glauca*.

Indiana Dunes National Lakeshore Other Comments:

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

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ELEMENT DISTRIBUTION

Indiana Dunes National Lakeshore Range: The cottonwood - black willow forest is found at the Cowles Bog and Tamarack units.
Global Range: This cottonwood - black willow forest is characteristic of the fronts and banks of most major rivers and streams throughout the Central Forest Region, extending into the northern forest particularly within the Mississippi, Ohio, and Missouri River systems, extending from Ohio west to Minnesota, southward to Oklahoma, and east to Kentucky. This community once occupied vast tracts of land along river fronts and floodplain depressions. Land clearing, ditching and draining for conversion to cropland, and logging have eliminated much of the presettlement stands of this natural community.
Nations: US
States/Provinces: AR?, IA, IL, IN, KS, KY, MN, MO, OH, OK, WI
USFS Ecoregions: 222Ad:CP?, 222Ae:CP?, 222C:CP, 222D:CP, 222E:CP, 222F:CP, 222G:CP, 222H:CP, 222I:CP, 222Jj:CCC, 222K:CC, 222Lf:CCC, 222Mb:CCC, 222Me:CCC, 231A:PP, 231B:PP, 231E:PP, 231F:PP, 231G:PP, 232B:PP, 232C:PP, 234A:PP, 251Ba:CCC, 251Bb:CCC, 251Cd:CC?, 251Cg:CCC, 251D:CP
Federal Lands: NPS (Effigy Mounds?, Indiana Dunes); USFS (St. Francis?)

ELEMENT SOURCES

Indiana Dunes National Lakeshore Map Units Summary:
Indiana Dunes National Lakeshore Inventory Notes:
Indiana Dunes National Lakeshore Plots: INDU.VP061, INDU.VP075, INDU.VP152, INDU.VP185, INDU.VP186, INDU.AA466, INDU.AA511, INDU.AA517, INDU.AA586.
Local Description Author(s): N. Lehmann
Global Description Author(s): M. Guetersloh, mod. D. Faber-Langendoen
References: Braun 1950, Bruner 1931, Collins et al. 1981, Cowardin et al. 1979, Evans 1991, Eyre 1980, Galloway 1963, Galloway 1964, Hefley 1937, Hoagland 2000, INAI unpubl. data, Kuchler 1964, Lauver et al. 1999, Midwestern Ecology Working Group n.d., Nelson 1985, Rogers 1953, SAF 1967, TDNH unpubl. data, TNC 1985, TNC 1995a, UNESCO 1973, Voigt and Mohlenbrock 1964, WNHIP unpubl. data, Ware and Penfound 1949, White and Madany 1978, Zanoni et al. 1979

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I.B.2.N.d. Temporarily flooded cold-deciduous forest

A.300 *Populus tremuloides* Temporarily Flooded Forest Alliance

Quaking Aspen Temporarily Flooded Forest Alliance

[A.300] *Populus tremuloides* Temporarily Flooded Forest Alliance
Translated Name: **Quaking Aspen Temporarily Flooded Forest Alliance**
Common Name:
Ecological System(s):
Circumscription Confidence:
Concept Author(s): J. Drake

ELEMENT CONCEPT

Global Summary: This alliance contains a number of communities found from the Great Lakes to the western and southwestern United States, with an outlier in the Central Appalachians. Most stands of this alliance are found in riparian zones. Some may be near lakes where the ground is flooded or saturated for a short time in the spring. The moderate to closed tree canopy is dominated by *Populus tremuloides*, sometimes with *Populus balsamifera* codominant. More open stands have a prominent shrub layer containing species such as *Alnus incana*, *Cornus sericea*, and *Salix* spp. The sole reference cited for *Populus tremuloides* Canyon Formation Forest (CEGL000576) does not mention *Populus tremuloides*.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Palustrine
Indiana Dunes National Lakeshore Environment: This quaking aspen forest is found in wet lowlands and depressions. Soils range from mesic to wet sandy loams to poorly drained soils with pockets of standing water. The unvegetated surface is dominated by leaf litter with some wood and bare soil.
Global Environment: Forests included in this alliance occur extensively in the western U.S., northern Great Plains and extend into the western Great Lakes, with outliers in the Central Appalachians. Elevations range from 600 to 3230 m. Climate is temperate with a relatively long growing season, typically cold winters and often deep snow. Mean annual precipitation is greater than 38 cm and typically greater than 50 cm, except in semi-arid environments. Most of these temporarily flooded stands are found in riparian zones. Some may occur near lakes where the ground is flooded or saturated for a short time in the spring or on upland slopes below seepage areas. Distribution of these forests is primarily limited by adequate soil moisture required to meet its high evapotranspiration demand (Mueggler 1988). Secondarily, its range is limited by the length of the growing season or low temperatures (Mueggler 1988). Topography is variable. Sites are typically gently sloping but also include steep slopes near upland seeps. Aspect varies according to the limiting factors. Stands at high elevations or northern latitudes are restricted by cold temperatures and found on warmer southern aspects. At lower elevations and southern latitudes, stands are restricted by lack of moisture and are found on cooler northern aspects and mesic microsites. The soils are typically deep and well-developed, with rock often absent from the soil. Soils are typically mesic or hydric, poorly drained, and fine-textured, consisting of silts and clays, often with an organic surface layer. Many are gleyed and would be classified as wetland soils. However, some of the alluvial soils are coarser, so soil texture ranges from clay to sandy loams. Parent materials are variable and may include sedimentary, metamorphic or igneous rocks, but these forests appear to grow best on limestone, basalt, and calcareous or neutral shales (Mueggler 1988).

VEGETATION DESCRIPTION

Indiana Dunes National Lakeshore Vegetation: The sparse to moderately dense canopy and subcanopy layers are dominated by *Populus tremuloides*; additional species may include *Quercus alba, Quercus palustris*, and *Quercus velutina*. Tall and/or short shrubs form a sparse to dense layer that may include *Cephalanthus occidentalis, Lonicera tatarica, Populus tremuloides, Rhus glabra, Rubus occidentalis, Sassafras albidum*, and *Diervilla lonicera* (state-imperiled), among others. The herbaceous layer is typically dense and commonly dominated by *Calamagrostis canadensis*; additional herbs include *Agrimonia parviflora, Carex stricta, Eupatorium serotinum, Onoclea sensibilis, Phalaris arundinacea, Pteridium aquilinum, Solidago* spp., and other ferns and grasses.
Global Vegetation: Vegetation included in this widespread forest alliance occurs in temporarily flooded sites in the western U.S. to the western Great Lakes area. Stands have a somewhat closed to closed canopy of trees to 5-20 m tall that is dominated or codominated by the cold-deciduous broad-leaved tree *Populus tremuloides*. Other broad-leaved trees, such as *Populus balsamifera ssp. trichocarpa, Populus balsamifera ssp. balsamifera, Quercus macrocarpa*, and *Betula papyrifera*, may be present to codominant depending on geography and topography. Several species of conifer trees may also be present in the tree canopy. Conifers include *Abies concolor, Abies lasiocarpa, Picea engelmannii, Picea pungens, Pinus contorta, Pinus ponderosa*, and *Pseudotsuga menziesii*. Conifer species may contribute up to 25% of the tree canopy before the stand is reclassified as a mixed stand. Because of the open growth form of *Populus tremuloides*, enough light can penetrate for lush understory development depending on available soil moisture and other factors. The understory structure may be complex with multiple shrub and herbaceous layers, or simple with just an herbaceous layer.

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In the western U.S., common tree associates include *Populus balsamifera ssp. trichocarpa* in the northern Rocky Mountains (Cooper and Heidel 1997). One or more of the conifer trees listed above are often scattered in the canopy or understory of stands occurring in the montane and subalpine zones. If present, the tall-shrub layer may be dominated by *Quercus gambelii, Amelanchier alnifolia, Alnus incana, Betula occidentalis, Betula nana, Prunus virginiana,* or *Salix* species such as *Salix bebbiana, Salix drummondiana, Salix monticola*, or many others. Common short shrubs include *Cornus sericea, Ribes montigenum, Rosa woodsii, Symphoricarpos albus*, and *Symphoricarpos oreophilus*. The dwarf-shrubs *Mahonia repens* and *Vaccinium myrtillus* are common. The herbaceous layer may be lush and diverse, dominated by graminoids or tall forbs. Common graminoids may include *Bromus ciliatus, Bromus carinatus, Calamagrostis canadensis, Carex siccata (= Carex foenea), Carex hoodii, Elymus glaucus, Elymus trachycaulus*, and *Festuca thurberi*. Forbs may include *Achillea millefolium, Eucephalus engelmannii (= Aster engelmannii), Delphinium X occidentale, Equisetum arvense, Fragaria virginiana, Geranium richardsonii, Ligusticum porteri, Maianthemum stellatum, Mertensia arizonica, Osmorhiza occidentalis, Senecio bigelovii var. bigelovii, Thalictrum occidentale, Veratrum californicum,* and many others. Exotic grasses such as the perennial *Poa pratensis* and the annual *Bromus tectorum* are often common in stands disturbed by grazing.

In the northern Great Plains and western Great Lakes areas, these stands have a moderate to closed tree canopy that is dominated by *Populus tremuloides* with *Populus balsamifera* codominant. More open stands have a prominent shrub layer containing species such as *Alnus incana, Cornus sericea,* and *Salix* spp. Little information is available for stands in the northern Great Plains and midwestern U.S.

Global Dynamics: Stands in this alliance often originate and likely are maintained by stand-replacing disturbances such as crown fire, disease and windthrow, or clearcutting by man and beaver. The stems of these thin-barked, clonal trees are easily killed by ground fires. They can quickly and vigorously resprout in densities of up to 30,000 stems per hectare (Knight 1994). Stands are favored by fire in the conifer zone (Mueggler 1988). The stems are relatively short-lived (100-150 years) and individual stands will be succeed to longer-lived conifer forest if undisturbed. With adequate disturbance a clone may live many centuries. Although *Populus tremuloides* produces abundant seeds, seedling survival is rare because the long warm, moist conditions required to establish are rare in the habitats where it occurs.

INDIANA DUNES NATIONAL LAKESHORE FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform
Populus tremuloides	Tree (canopy & subcanopy)	Broad-leaved deciduous tree
Quercus velutina	Tree (canopy & subcanopy)	Broad-leaved deciduous tree
Quercus alba	Tree canopy	Broad-leaved deciduous tree
Quercus palustris	Tree canopy	Broad-leaved deciduous tree
Sassafras albidum	Shrub/sapling (tall & short)	Broad-leaved deciduous shrub
Cephalanthus occidentalis	Tall shrub/sapling	Broad-leaved deciduous shrub
Lonicera tatarica	Tall shrub/sapling	Broad-leaved deciduous shrub
Rhus glabra	Tall shrub/sapling	Broad-leaved deciduous shrub
Diervilla lonicera	Short shrub/sapling	Broad-leaved deciduous shrub
Rubus occidentalis	Short shrub/sapling	Broad-leaved deciduous shrub
Agrimonia parviflora	Herb (field)	Forb
Eupatorium serotinum	Herb (field)	Forb
Calamagrostis canadensis	Herb (field)	Graminoid
Carex stricta	Herb (field)	Graminoid
Phalaris arundinacea	Herb (field)	Graminoid
Onoclea sensibilis	Herb (field)	Fern or fern ally
Pteridium aquilinum	Herb (field)	Fern or fern ally

GLOBAL FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform

INDIANA DUNES NATIONAL LAKESHORE OTHER NOTEWORTHY SPECIES

Diervilla lonicera, Lonicera tatarica, Rosa multiflora, Solanum dulcamara, Urtica dioica

GLOBAL OTHER NOTEWORTHY SPECIES

CONSERVATION STATUS RANK

Global Rank & Reasons: GNR

RELATED CONCEPTS

Global Similar Associations:
Global Related Concepts:

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CLASSIFICATION & OTHER COMMENTS

Indiana Dunes National Lakeshore Classification Comments:
Indiana Dunes National Lakeshore Other Comments:
Global Classification Comments:

ELEMENT DISTRIBUTION

Indiana Dunes National Lakeshore Range: This community is found in scattered low-lying areas in Cowles Bog, Grand Boulevard, Inland Marsh, Calumet Prairie, and Tolleston Dunes.
Global Range: Forests included in this alliance have been described from across the western and southwestern U.S., northern Great Plains, and extend into the western Great Lakes, with outliers in the Central Appalachians, from California to Michigan and West Virginia. Its northern extent is in Saskatchewan, Manitoba, and Ontario, Canada.
Nations: CA, US
States/Provinces: AB, CA, CO, ID, IN, MB, ME, MI, MN, MT, NB, ND, NH?, NM, NV, ON, OR, QC, SK, UT, VT?, WA, WI, WV, WY
USFS Ecoregions: 222Jj:CCC
Federal Lands: NPS (Indiana Dunes)

ELEMENT SOURCES

Indiana Dunes National Lakeshore Map Units Summary:
Indiana Dunes National Lakeshore Inventory Notes:
Indiana Dunes National Lakeshore Plots: INDU.AA062, INDU.AA075, INDU.AA081, INDU.AA139, INDU.AA163, INDU.AA173, INDU.AA238, INDU.AA270, INDU.AA485, INDU.AA536, INDU.AA573, INDU.AA624, INDU.AA720.
Local Description Author(s): M.J. Russo
Global Description Author(s): K. Schulz
References: Midwestern Ecology Working Group n.d.

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I.B.2.N.e. Seasonally flooded cold-deciduous forest

A.316 *Acer rubrum - Fraxinus pennsylvanica* Seasonally Flooded Forest Alliance

Red Maple - Green Ash Seasonally Flooded Forest Alliance

[CEGL005038] *Acer* (*rubrum, saccharinum*) - *Fraxinus* spp. - *Ulmus americana* Forest

Translated Name: **(Red Maple, Silver Maple) - Ash species - American Elm Forest**
Common Name: **Maple - Ash - Elm Swamp Forest**
Ecological System(s):
- North-Central Interior and Appalachian Rich Swamp (CES202.605)

Circumscription Confidence: 2 - Moderate
Concept Author(s): M. Guetersloh

ELEMENT CONCEPT

Global Summary: This silver and red maple forest swamp community type occurs in the east-central United States and adjacent Canada. Stands occur in moist, deep (>100 cm), hydric soils associated with wetland depressions on level plains and floodplain backswamps. Soils are saturated for a few months of the growing season, but often are dry by late summer. Canopy cover is complete and dominated by *Acer rubrum, Acer saccharinum* (in parts of the range), *Fraxinus pennsylvanica*, and *Ulmus americana*. *Ulmus americana* was probably the dominant species in the type prior to the introduction of Dutch elm disease (*Ceratostomella ulmi*). *Quercus palustris* and *Nyssa sylvatica* are also commonly encountered. The subcanopy consists primarily of *Acer rubrum* and *Ulmus americana* underlain by a shrub layer which may contain a mixture of *Carpinus caroliniana, Ilex verticillata, Lindera benzoin, Sambucus canadensis, Toxicodendron radicans, Viburnum recognitum (= Viburnum dentatum var. lucidum)*, and *Alnus incana (ssp. rugosa* in parts of its range). The depth and duration of flooding and light penetrating the forest canopy regulate density and diversity found in the herbaceous layer. *Impatiens capensis, Arisaema triphyllum, Glyceria striata*, and a variety of *Juncus* spp. and *Carex* spp. are among the most common species encountered. *Arundinaria gigantea* can form dense thickets within this forest in the southern parts of the range.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Palustrine
Indiana Dunes National Lakeshore Environment: This maple - ash- elm forest is found in low-lying, wet-mesic environments that are either interdunal or near a stream or river that floods intermittently but, in summers with low rainfall, may dry out seasonally. The soil is primarily silt, ranging from silty loams to silty clays. The water table is near the surface and ponding is common. Heavy deer browse, as well as tree planting and removal near former homesites probably affect the species composition and cover in particular sites.
Global Environment: Stands occur in wetland depressions on level or undulating topography or in backwater sloughs away from direct flooding on the floodplain. Soils can be deep (>100 cm) silt loam, silty clay loam, to clay loam. The water table is at or near the surface for at least a few months of the year, and ponding is common. During the summer the soils can become quite dry.

VEGETATION DESCRIPTION

Indiana Dunes National Lakeshore Vegetation: This is a wet, bottomland, cold-deciduous hardwood forest. The canopy cover is variable but can be very dense. *Fraxinus americana, Acer rubrum*, or *Acer saccharinum* dominate the canopy. *Acer rubrum* and *Fraxinus americana* dominate the subcanopy. Other trees that may be present include *Juglans nigra, Populus deltoides, Prunus serotina, Quercus alba, Quercus bicolor, Quercus rubra, Quercus velutina, Ulmus rubra*, and *Salix nigra*. The tall-shrub layer is dominated by *Fraxinus americana, Acer rubrum, Crataegus* spp., and sometimes *Asimina triloba*. *Cephalanthus occidentalis, Lindera benzoin*, and *Cornus racemosa* are common shrubs. The herbaceous layer is variable, but *Boehmeria cylindrica, Arisaema dracontium, Carex lupulina, Cryptotaenia canadensis, Glyceria canadensis, Impatiens capensis, Iris virginica, Laportea canadensis, Onoclea sensibilis, Osmorhiza claytonii, Pilea pumila, Polygonum virginianum, Sanicula odorata, Symplocarpus foetidus*, and *Toxicodendron radicans* are frequently encountered. Exotic species include *Berberis thunbergii, Rosa multiflora*, and *Poa pratensis*. This community also supports state-vulnerable *Alnus incana ssp. rugosa*.
Global Vegetation: This community is a wet bottomland deciduous hardwood forest. Canopy cover is complete and dominated by *Acer rubrum, Acer saccharinum* (in parts of the range), *Fraxinus pennsylvanica*, and *Ulmus americana*. *Ulmus americana* was probably the dominant species in the type prior to the introduction of Dutch elm disease (*Ceratostomella ulmi*) around 1930. *Quercus palustris, Quercus bicolor, Quercus macrocarpa*, and *Nyssa sylvatica* are also commonly encountered. The subcanopy consists primarily of *Acer rubrum* and *Ulmus americana* underlain by a shrub layer which may contain a mixture of *Carpinus caroliniana, Ilex verticillata, Lindera benzoin, Sambucus canadensis, Viburnum recognitum*, and *Alnus incana ssp. rugosa (= Alnus rugosa)* (in the northern parts of its range). Vines often dominate the forest understory including *Parthenocissus quinquefolia* and *Toxicodendron radicans*. The depth and duration of flooding and light penetrating the forest canopy regulate density and diversity found in the herbaceous layer. *Impatiens capensis, Arisaema triphyllum, Glyceria striata*, and a variety of *Juncus* spp. and *Carex* spp. are among

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the most common species encountered (see Anderson 1996 for a more comprehensive list). *Arundinaria gigantea* can form dense thickets within this forest at its southern limits (TNC 1995a).

Global Dynamics: The stress of prolonged saturation contributes to high vegetative mortality. Pioneer species are quick to colonize any openings as soon as conditions are favorable.

INDIANA DUNES NATIONAL LAKESHORE FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform
Acer rubrum	Tree canopy	Broad-leaved deciduous tree
Acer saccharinum	Tree canopy	Broad-leaved deciduous tree
Asimina triloba	Tree canopy	Broad-leaved deciduous tree
Fraxinus americana	Tree canopy	Broad-leaved deciduous tree
Quercus alba	Tree canopy	Broad-leaved deciduous tree
Cornus racemosa	Tall shrub/sapling	Broad-leaved deciduous shrub
Toxicodendron radicans	Herb (field)	Vine/Liana
Boehmeria cylindrica	Herb (field)	Forb
Cryptotaenia canadensis	Herb (field)	Forb
Impatiens capensis	Herb (field)	Forb
Iris virginica	Herb (field)	Forb
Laportea canadensis	Herb (field)	Forb
Osmorhiza claytonii	Herb (field)	Forb
Pilea pumila	Herb (field)	Forb
Polygonum virginianum	Herb (field)	Forb
Sanicula odorata	Herb (field)	Forb
Symplocarpus foetidus	Herb (field)	Forb
Carex lupulina	Herb (field)	Graminoid
Onoclea sensibilis	Herb (field)	Fern or fern ally

GLOBAL FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform
Acer rubrum	Tree canopy	Broad-leaved deciduous tree
Acer saccharinum	Tree canopy	Broad-leaved deciduous tree
Fraxinus pennsylvanica	Tree canopy	Broad-leaved deciduous tree
Acer rubrum	Tree subcanopy	Broad-leaved deciduous tree
Acer saccharinum	Tree subcanopy	Broad-leaved deciduous tree
Ulmus americana	Tree subcanopy	Broad-leaved deciduous tree
Ampelopsis cordata	Shrub/sapling (tall & short)	Vine/Liana
Parthenocissus quinquefolia	Shrub/sapling (tall & short)	Vine/Liana
Toxicodendron radicans	Shrub/sapling (tall & short)	Vine/Liana
Vitis aestivalis	Shrub/sapling (tall & short)	Vine/Liana
Vitis cinerea	Shrub/sapling (tall & short)	Vine/Liana
Carpinus caroliniana	Tall shrub/sapling	Broad-leaved deciduous tree
Ilex decidua	Tall shrub/sapling	Broad-leaved deciduous tree
Lindera benzoin	Tall shrub/sapling	Broad-leaved deciduous tree
Boehmeria cylindrica	Herb (field)	Forb
Impatiens capensis	Herb (field)	Forb
Impatiens pallida	Herb (field)	Forb
Laportea canadensis	Herb (field)	Forb
Pilea pumila	Herb (field)	Forb

INDIANA DUNES NATIONAL LAKESHORE OTHER NOTEWORTHY SPECIES

Alliaria petiolata, Alnus incana ssp. *rugosa, Berberis thunbergii, Impatiens balsamina, Lonicera tatarica, Poa pratensis, Rosa multiflora, Rubus laciniatus*

GLOBAL OTHER NOTEWORTHY SPECIES

Aristolochia serpentaria, Cocculus carolinus, Heliotropium indicum, Zizia aurea

CONSERVATION STATUS RANK

Global Rank & Reasons: G4? Few good EOs remain in southern Wisconsin (E. Epstein pers. comm. 1999).

RELATED CONCEPTS

Global Similar Associations:

- *Acer rubrum - Gleditsia aquatica - Planera aquatica - Fraxinus profunda* Forest (CEGL002422)--Distinctions need to be resolved.
- *Acer saccharinum - Ulmus americana* Forest (CEGL002586)

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- *Fraxinus pennsylvanica - Ulmus americana - Celtis laevigata / Ilex decidua* Forest (CEGL002427)
- *Fraxinus pennsylvanica - Ulmus* spp. - *Celtis occidentalis* Forest (CEGL002014)--is another similar wet-mesic forest, but lacks red maple as a dominant canopy species, and is more typically found in floodplain systems.
- *Larix laricina - Acer rubrum / (Rhamnus alnifolia, Vaccinium corymbosum)* Forest (CEGL005232)

Global Related Concepts:

- Black Ash - American Elm - Red Maple: 39 (Eyre 1980) B
- Eastern Broadleaf Forests: 101: Elm-Ash Forest (*Ulmus-Fraxinus*) (Kuchler 1964) B
- Maple-Ash-Oak Swamps (Anderson 1996) =
- Palustrine: Palustrine Forested Wetland (Cowardin et al. 1979) F
- Red Maple: 108 (Eyre 1980) B
- Southern Swamp (Chapman et al. 1989) B
- Terrestrial: Forest: Hardwood (TNC 1985) B
- UNESCO FORMATION CODE: I.B.3d (UNESCO 1973) B

CLASSIFICATION & OTHER COMMENTS

Indiana Dunes National Lakeshore Classification Comments:

Indiana Dunes National Lakeshore Other Comments:

Global Classification Comments: Golet et al. (1993) describe regional variation in northeastern United States red maple swamps. Subtypes or separate types may need to be recognized. *Ulmus americana* is no longer a dominant canopy component of this natural community due to the ravages of Dutch elm disease. *Phalaris arundinacea* can become a serious problem in this type, due to grazing, ditching, and the open canopy caused by Dutch elm disease. This type is primarily found in the glaciated portions of the northeastern United States. The distribution limits toward the south are not yet well defined, but it does not occur in southern Illinois or Indiana. Concept and distribution of this association in the Southeast needs assessment.

ELEMENT DISTRIBUTION

Indiana Dunes National Lakeshore Range: This community is found in the Bailly, Keiser, Hobart Prairie, and Pinhook Bog units.

Global Range: This silver and red maple forest swamp community type occurs in the east-central United States and adjacent Canada, ranging from Wisconsin east to central Pennsylvania, northward to Ontario, and possibly elsewhere in eastern Canada. This type is primarily found in the glaciated portions of the eastern Midwest on wet alluvial bottomlands and occasionally on mesic lower slopes. The present range of this element has been greatly reduced due to ditching, draining, and clearing of forestland for conversion to cropland.

Nations: CA, US

States/Provinces: IL, IN, MI, OH, ON, PA, QC?, WI

USFS Ecoregions: 212Fb:CPP, 212Hb:CCP, 212Hd:CCC, 212He:CCC, 212Je:CPP, 212Ka:CPP, 221Ed:CC?, 221Ef:CCC, 221Fa:CCC, 221Fb:CCC, 222Ga:CCC, 222Ha:CCC, 222Hb:CCC, 222Ia:CCC, 222Id:CCP, 222If:CCC, 222Ig:CCC, 222Ja:CC?, 222Je:CCC, 222Jg:CCC, 222Jh:CCC, 222Ji:CCC, 222Jj:CCC, 222Ke:CCC, 222Kf:CCC, 251Dg:CCC, M221:?, M222A:??

Federal Lands: NPS (Indiana Dunes); USFS (Chequamegon, Chequamegon-Nicolet, Nicolet?, Ottawa?, Wayne?); USFWS (Erie)

ELEMENT SOURCES

Indiana Dunes National Lakeshore Map Units Summary:

Indiana Dunes National Lakeshore Inventory Notes:

Indiana Dunes National Lakeshore Plots: INDU.VP024, INDU.VP073, INDU.VP090, INDU.VP141, INDU.VP160, INDU.VP161, INDU.AA013, INDU.AA088, INDU.AA100, INDU.AA172, INDU.AA204, INDU.AA217, INDU.AA229, INDU.AA277, INDU.AA292, INDU.AA399, INDU.AA430, INDU.AA546, INDU.AA570, INDU.AA578, INDU.AA582, INDU.AA629, INDU.AA641, INDU.AA661.

Local Description Author(s): N. Lehmann

Global Description Author(s): M. Guetersloh

References: Anderson 1996, Behler 1988, Benyus 1989, Braun 1950, Bull and Farrand 1977, Chapman et al. 1989, Clark and Hutchinson 1994, Cowardin et al. 1979, Craighead 1949, Duncan and Duncan 1988, Epstein pers. comm., Eyre 1980, Fike 1999, Fralish 1987, Fralish 1988b, Fralish et al. 1991, Golet et al. 1993, Illinois Nature Preserve Commission 1973, Kuchler 1964, Little 1980a, Midwestern Ecology Working Group n.d., Miller and Tehon 1929, Mohlenbrock 1986, Mohlenbrock and Voigt 1959, Nelson 1985, Niering 1979, Powell 1985, SAF 1967, Schwartz and Schwartz 1959, TDNH unpubl. data, TNC 1985, TNC 1995a, Thornbury 1965, UNESCO 1973, Voigt and Mohlenbrock 1964, WNHIP unpubl. data, White and Madany 1978

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I.B.2.N.e. Seasonally flooded cold-deciduous forest

A.329 *Quercus palustris* - (*Quercus bicolor*) Seasonally Flooded Forest Alliance

Pin Oak - (Swamp White Oak) Seasonally Flooded Forest Alliance

[CEGL005037] *Quercus palustris - Quercus bicolor - Acer rubrum* Flatwoods Forest

Translated Name: **Pin Oak - Swamp White Oak - Red Maple Flatwoods Forest**
Common Name: **Northern (Great Lakes) Flatwoods**
Ecological System(s):
- North-Central Interior Wet Flatwoods (CES202.700)

Circumscription Confidence: 2 - Moderate
Concept Author(s): J. Drake, D. Faber-Langendoen, and D. Ambrose

ELEMENT CONCEPT

Global Summary: This pin oak - swamp white oak flatwoods is found in the midwestern United States and adjacent Canada near Lake Michigan and Lake Erie. Stands occur on poorly drained uplands or in depressions on level glacial lakeplains or outwash plains. There is a layer of acidic sand over a layer of impermeable or nearly impermeable clay resulting in a shallow, perched water table. Ponding is common during the wet seasons and droughts in the summer, leading to a complex of forest upland and wetland species. Deciduous hardwoods and softwoods predominate. Diagnostic species include *Quercus bicolor, Quercus ellipsoidalis, Quercus palustris*, and *Acer rubrum*. Other associates include *Ilex verticillata* and *Ulmus americana*. The herbaceous layer, which can be sparse, contains *Carex muskingumensis, Glyceria striata, Maianthemum canadense, Mitchella repens*, and *Osmunda cinnamomea*.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Palustrine
Indiana Dunes National Lakeshore Environment: This swamp white oak forest is found in low-lying areas where muck soil is saturated and semipermanently flooded.
Global Environment: This type is found on glaciated plains in the midwestern United States. This community occurs on poorly drained uplands or in depressions on level glacial lakeplains or outwash plains. There is a layer of acidic sand over a layer of impermeable or nearly impermeable clay resulting in a shallow, perched water table. Ponding is common during the wet seasons. In the dry months, the clay layer prevents water from moving up to the surface by capillary action from deeper, more moist soil. Thus, the soil moisture fluctuates widely over the year (White and Madany 1978, Homoya et al. 1988).

VEGETATION DESCRIPTION

Indiana Dunes National Lakeshore Vegetation: Canopy is dominated by *Quercus bicolor* with about 70% cover. *Fraxinus* spp. can be codominant. The shrub layer is dominated by *Lindera benzoin* with variable coverage. The herbaceous layer is dominated by ferns and tree seedlings (especially *Fraxinus* sp.), and *Boehmeria cylindrica* is a common forb.
Global Vegetation: Deciduous hardwoods and softwoods predominate. Diagnostic species include *Quercus bicolor, Quercus ellipsoidalis, Quercus palustris*, and *Acer rubrum*. Other associates include *Ilex verticillata* and *Ulmus americana*. The herbaceous layer, which can be sparse, contains *Carex muskingumensis, Glyceria striata, Maianthemum canadense, Mitchella repens*, and *Osmunda cinnamomea* (White and Madany 1978, Homoya et al. 1988, Pat Comer pers. comm. 1997).
Global Dynamics: Given that fire was probably common in adjacent landscapes, flatwoods may have experienced fire during drought periods and contained a more open canopy. Some may have supported a prairie flora prior to the onset of fire suppression (White and Madany 1978).

INDIANA DUNES NATIONAL LAKESHORE FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform
Quercus bicolor	Tree canopy	Broad-leaved deciduous tree
Fraxinus pennsylvanica	Tall shrub/sapling	Broad-leaved deciduous tree
Fraxinus quadrangulata	Tall shrub/sapling	Broad-leaved deciduous tree
Lindera benzoin	Tall shrub/sapling	Broad-leaved deciduous shrub
Boehmeria cylindrica	Herb (field)	Forb
Thelypteris palustris	Herb (field)	Fern or fern ally

GLOBAL FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform
Acer rubrum	Tree canopy	Broad-leaved deciduous tree
Fraxinus pennsylvanica	Tree canopy	Broad-leaved deciduous tree
Ilex verticillata	Tree canopy	Broad-leaved deciduous tree
Populus deltoides	Tree canopy	Broad-leaved deciduous tree

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Quercus bicolor	Tree canopy	Broad-leaved deciduous tree
Quercus ellipsoidalis	Tree canopy	Broad-leaved deciduous tree
Quercus palustris	Tree canopy	Broad-leaved deciduous tree
Cephalanthus occidentalis	Shrub/sapling (tall & short)	Broad-leaved deciduous tree
Cornus sericea ssp. *sericea*	Shrub/sapling (tall & short)	Broad-leaved deciduous tree
Cornus racemosa	Shrub/sapling (tall & short)	Broad-leaved deciduous shrub
Photinia melanocarpa	Shrub/sapling (tall & short)	Broad-leaved deciduous shrub
Salix humilis	Short shrub/sapling	Broad-leaved deciduous shrub

INDIANA DUNES NATIONAL LAKESHORE OTHER NOTEWORTHY SPECIES

Alliaria petiolata, Frangula alnus, Lonicera x *bella, Rosa multiflora*

GLOBAL OTHER NOTEWORTHY SPECIES

CONSERVATION STATUS RANK

Global Rank & Reasons: G2G3 There are probably fewer than 100 occurrences of this community rangewide. It is reported from Ohio (where it is ranked S3), Indiana (S2), Illinois (S2), Ontario (S?), and Michigan (S?). Currently there are 19 occurrences documented from Illinois, Indiana, Ohio, and Michigan. This community has moderately restricted environmental requirements. Many sites of this community have been drained or cleared.

RELATED CONCEPTS

Global Similar Associations:

- *Fagus grandifolia - Acer saccharum - Quercus bicolor - Acer rubrum* Flatwoods Forest (CEGL005173)--contains beech and extends into central Indiana and western Ohio.
- *Quercus macrocarpa - Quercus palustris - Quercus bicolor / Calamagrostis canadensis* Wooded Herbaceous Vegetation (CEGL005120)
- *Quercus palustris - (Quercus stellata) - Quercus pagoda / Isoetes* spp. Forest (CEGL002101)
- *Quercus palustris - Quercus bicolor - (Liquidambar styraciflua)* Mixed Hardwood Forest (CEGL002432)
- *Quercus palustris - Quercus bicolor - Nyssa sylvatica - Acer rubrum* Sand Flatwoods Forest (CEGL002100)--is a sand flatwoods.
- *Quercus phellos - (Quercus lyrata) / Carex* spp. - *Leersia* spp. Forest (CEGL002102)

Global Related Concepts:

- Palustrine (Cowardin et al. 1979) B

CLASSIFICATION & OTHER COMMENTS

Indiana Dunes National Lakeshore Classification Comments:

Indiana Dunes National Lakeshore Other Comments:

Global Classification Comments: This type is found on glaciated plains in the Midwest. The terms "swamp" and "flatwoods" may overlap (see e.g., Lee et al. 1998, who include flatwoods types in their swamp category). These terms need clarification. In Indiana, stands may also be related to the lakeplain oak opening type, *Quercus macrocarpa - Quercus palustris - Quercus bicolor / Calamagrostis canadensis* Wooded Herbaceous Vegetation (CEGL005120). In Michigan this type occurs only in Calhoun County. Ontario sands on the clayplain of the Niagara Peninsula should be compared with *Fagus grandifolia - Acer saccharum - Quercus bicolor - Acer rubrum* Flatwoods Forest (CEGL005173).

ELEMENT DISTRIBUTION

Indiana Dunes National Lakeshore Range: This swamp white oak forest is found in wet, low-lying, forest openings in the Dunes State Park, Visitor Center, and Keiser units.

Global Range: This pin oak - swamp white oak flatwoods is found in the midwestern United States and Canada near Lake Michigan and Lake Erie, ranging from northern Illinois, northern Indiana, northern Ohio, and southeastern Michigan, to southern Ontario.

Nations: CA, US

States/Provinces: IL, IN, MI, OH, ON

USFS Ecoregions: 221Fb:CCC, 222Ha:CCC, 222Hb:CCC, 222Ia:CCC, 222If:CCC, 222Jb:CCC, 222Jh:CCC, 222Ji:CCC, 222Jj:CCC, 222Kf:CCC, 222Kg:CCC, 222Kj:CCC

Federal Lands: NPS (Indiana Dunes)

ELEMENT SOURCES

Indiana Dunes National Lakeshore Map Units Summary:

Indiana Dunes National Lakeshore Inventory Notes:

Indiana Dunes National Lakeshore Plots: INDU.VP187, INDU.VP188, INDU.VP189, INDU.VP190, INDU.AA073, INDU.AA147, INDU.AA159, INDU.AA223, INDU.AA240, INDU.AA246, INDU.AA265, INDU.AA275, INDU.AA341, INDU.AA345, INDU.AA417, INDU.AA437, INDU.AA455, INDU.AA481, INDU.AA556, INDU.AA716, INDU.AA730.

Local Description Author(s): N. Lehmann

Global Description Author(s): J. Drake, D. Faber-Langendoen, and D. Ambrose

References: Comer pers. comm., Cowardin et al. 1979, Homoya et al. 1988, Madany 1981, Midwestern Ecology Working Group n.d., White and Madany 1978

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I.B.2.N.g. Saturated cold-deciduous forest

A.3035 *Acer rubrum - Fraxinus pennsylvanica* Saturated Forest Alliance

Red Maple - Green Ash Saturated Forest Alliance

[CEGL006406] *Acer rubrum - Fraxinus* (*pennsylvanica, americana*) / *Lindera benzoin* / *Symplocarpus foetidus* Forest

Translated Name: **Red Maple - (Green Ash, White Ash) / Northern Spicebush / Skunk-cabbage Forest**
Common Name: **Southern New England Red Maple Seepage Swamp**
Ecological System(s):

- North-Central Appalachian Acidic Swamp (CES202.604)
- Central Appalachian Stream and Riparian (CES202.609)
- Northern Atlantic Coastal Plain Stream and River (CES203.070)

Circumscription Confidence: 1 - Strong
Concept Author(s): Eastern Ecology Group

ELEMENT CONCEPT

Global Summary: This association is a seepage swamp dominated by *Acer rubrum* and ranging from southern New England to Virginia. It generally occurs in saturated situations on slightly sloping hillsides, along small streams, or in basins that receive overland flooding in addition to groundwater influence. In general, these swamps are moderately acidic to moderately basic and have some seepage indicators but are not particularly species-rich. Soils are shallow to moderately deep mucks over mineral soils. *Acer rubrum* dominates the canopy; *Fraxinus pennsylvanica* or *Fraxinus americana* are usually also found in the canopy. *Fraxinus nigra* is not generally associated with this type and, if present, occurs only as scattered individuals. Other canopy or subcanopy associates may include *Liriodendron tulipifera, Quercus bicolor, Quercus palustris, Prunus serotina, Fagus grandifolia, Betula lenta, Ulmus americana*, and *Ulmus rubra*. Conifers such as *Tsuga canadensis* or *Pinus strobus* are generally absent or occur in very low abundance. The shrub layer may be fairly open to quite dense, depending on the amount of canopy closure. Shrub species commonly include *Ilex verticillata, Rhododendron viscosum, Clethra alnifolia, Lindera benzoin, Cornus amomum, Alnus serrulata*, and less commonly *Vaccinium corymbosum, Lyonia ligustrina, Ilex montana, Toxicodendron vernix, Viburnum dentatum*, and *Viburnum nudum var. cassinoides (= Viburnum cassinoides)*. The herbaceous layer is variable in cover; *Symplocarpus foetidus* and *Osmunda cinnamomea* are nearly always present. In some areas, tall ferns (*Osmunda cinnamomea, Onoclea sensibilis, Osmunda regalis, Thelypteris palustris, Thelypteris noveboracensis*) form an herbaceous canopy within which other species are scattered. Microtopography is generally pronounced, resulting from tip-ups. Tree seedlings and *Sphagnum* mosses are common on hummocks but do not in general form extensive carpets. Additional nonvascular species can include *Plagiomnium cuspidatum (= Mnium cuspidatum)* and *Calliergon* spp. Invasive shrubs and herbs, including *Berberis thunbergii, Rosa multiflora, Lonicera morrowii, Alliaria petiolata*, and *Microstegium vimineum*, may be abundant.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Palustrine
Indiana Dunes National Lakeshore Environment: This red maple - ash forest occurs in saturated/seasonally flooded lowland depressions with somewhat poorly to very poorly drained, sandy muck soils.
Global Environment: This association is a seepage swamp dominated by *Acer rubrum* and ranging from southern New England to Virginia. It generally occurs in saturated soils on slightly sloping hillsides, along small headwater streams, or in depressions at the edges of floodplains that receive overland flooding in addition to groundwater inputs. In general, these swamps are moderately acidic to moderately basic and have some seepage indicators but are not particularly species-rich. Soils are shallow to moderately deep mucks over mineral soils. Microtopography is generally pronounced, resulting from tip-ups and the braided character of the drainage. Soil samples collected from 18 Maryland and Virginia plot samples are "intermediate" in chemistry, i.e., mean pH = 5.2, mean Ca = 1071 ppm, mean Mg = 195 ppm, mean total base saturation = 57%, but are more "basic" than "acidic" in their calcium and magnesium content.

VEGETATION DESCRIPTION

Indiana Dunes National Lakeshore Vegetation: This forest has a relatively closed canopy that is dominated by a number of different tree species, but *Acer rubrum* is always present in the canopy and/or subcanopy. Codominants include *Betula alleghaniensis, Betula papyrifera, Fraxinus americana, Quercus rubra*, and *Ulmus rubra*. *Sassafras albidum* in common in the subcanopy. The shrub layer is frequently composed of young canopy and subcanopy trees, along with *Carpinus caroliniana* and *Lindera benzoin*. The herbaceous layer usually covers about 70% of the ground and is dominated by *Symplocarpus foetidus* and ferns. Other common herbaceous species include seedlings of *Acer rubrum*, along with *Carex stricta, Glyceria striata, Impatiens capensis, Maianthemum canadense*, and *Pilea* spp. Exotic species found here include *Celastrus orbiculata, Berberis thunbergii, Alliaria petiolata*, and

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especially *Rosa multiflora*. In addition, this community supports state-critically imperiled *Myosotis laxa*, state-imperiled *Carex folliculata, Carex seorsa,* and *Pinus strobus*, and state-vulnerable *Betula papyrifera*.

Global Vegetation: *Acer rubrum* dominates the canopy; *Fraxinus pennsylvanica* or *Fraxinus americana* are usually also found in the canopy. *Fraxinus nigra* is not generally associated with this type and, if present, occurs only as scattered individuals. Other canopy or subcanopy associates may include *Liriodendron tulipifera, Quercus bicolor, Quercus palustris, Prunus serotina, Fagus grandifolia, Betula lenta, Ulmus americana,* and *Ulmus rubra*. Conifers such as *Tsuga canadensis* or *Pinus strobus* are generally absent or occur in very low abundance. The shrub layer may be fairly open to quite dense, depending on the amount of canopy closure. Shrub species commonly include *Ilex verticillata, Rhododendron viscosum, Clethra alnifolia, Lindera benzoin, Cornus amomum, Alnus serrulata, Carpinus caroliniana,* and less commonly *Vaccinium corymbosum, Lyonia ligustrina, Ilex montana, Toxicodendron vernix, Viburnum dentatum*, and *Viburnum nudum var. cassinoides (= Viburnum cassinoides).* The herbaceous layer is variable in cover; *Symplocarpus foetidus* and *Osmunda cinnamomea* are nearly always present. In some areas, tall ferns (*Osmunda cinnamomea, Onoclea sensibilis, Osmunda regalis, Thelypteris palustris, Thelypteris noveboracensis*) form an herbaceous canopy within which other species are scattered. These other herbaceous species include *Impatiens capensis, Galium aparine, Geum canadense, Arisaema triphyllum, Carex stricta, Carex gracillima, Carex intumescens, Carex radiata, Carex laevivaginata, Veratrum viride, Boehmeria cylindrica, Chelone glabra, Cardamine pensylvanica, Pilea pumila*, and *Glyceria* spp. At the southern end of the range in Maryland and Virginia, *Symplocarpus foetidus* is usually greatly dominant (>50% cover) early in the growing season, with *Saururus cernuus* frequently assuming patch-dominance during the summer. Tree seedlings and *Sphagnum* mosses are common on hummocks but do not in general form extensive carpets. Additional nonvascular species can include *Plagiomnium cuspidatum (= Mnium cuspidatum)* and *Calliergon* spp. Invasive shrubs and herbs, including *Berberis thunbergii, Rosa multiflora, Lonicera morrowii, Alliaria petiolata*, and *Microstegium vimineum*, may be abundant.

Global Dynamics:

INDIANA DUNES NATIONAL LAKESHORE FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform
Acer rubrum	Tree canopy	Broad-leaved deciduous tree
Betula alleghaniensis	Tree canopy	Broad-leaved deciduous tree
Betula papyrifera	Tree canopy	Broad-leaved deciduous tree
Fraxinus americana	Tree canopy	Broad-leaved deciduous tree
Prunus serotina	Tree canopy	Broad-leaved deciduous tree
Quercus rubra	Tree canopy	Broad-leaved deciduous tree
Ulmus rubra	Tree canopy	Broad-leaved deciduous tree
Sassafras albidum	Tall shrub/sapling	Broad-leaved deciduous tree
Lindera benzoin	Tall shrub/sapling	Broad-leaved deciduous shrub
Symplocarpus foetidus	Herb (field)	Forb
Osmunda regalis var. *spectabilis*	Herb (field)	Fern or fern ally
Acer rubrum	Herb (field)	Other herbaceous

GLOBAL FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform
Acer rubrum	Tree (canopy & subcanopy)	Broad-leaved deciduous tree
Fraxinus americana	Tree (canopy & subcanopy)	Broad-leaved deciduous tree
Fraxinus pennsylvanica	Tree (canopy & subcanopy)	Broad-leaved deciduous tree
Clethra alnifolia	Shrub/sapling (tall & short)	Broad-leaved deciduous shrub
Ilex verticillata	Shrub/sapling (tall & short)	Broad-leaved deciduous shrub
Lindera benzoin	Shrub/sapling (tall & short)	Broad-leaved deciduous shrub
Rhododendron viscosum	Shrub/sapling (tall & short)	Broad-leaved deciduous shrub
Symplocarpus foetidus	Herb (field)	Forb
Osmunda cinnamomea	Herb (field)	Fern or fern ally

INDIANA DUNES NATIONAL LAKESHORE OTHER NOTEWORTHY SPECIES

Agrostis gigantea, Alliaria petiolata, Berberis thunbergii, Betula papyrifera, Carex folliculate, Carex seorsa, Celastrus orbiculata, Myosotis laxa, Pinus strobus, Rosa multiflora, Saponaria officinalis, Solanum dulcamara

GLOBAL OTHER NOTEWORTHY SPECIES

CONSERVATION STATUS RANK

Global Rank & Reasons: G4G5 Although this is a small-patch community, its environmental requirements are quite general, and it occurs where acidic groundwater seepage emerges on the headwaters of stream drainages. The range extent crosses several ecoregions and 10 states. The major threat to this community is housing development, with disruption of groundwater source a lesser threat.

RELATED CONCEPTS

Global Similar Associations:

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- *Acer rubrum - Betula alleghaniensis / Lindera benzoin* Forest (CEGL006936)
- *Acer rubrum - Fraxinus nigra - (Tsuga canadensis) / Tiarella cordifolia* Forest (CEGL006502)
- *Acer rubrum / Nemopanthus mucronatus - Vaccinium corymbosum* Forest (CEGL006220)
- *Acer rubrum / Rhododendron viscosum - Clethra alnifolia* Forest (CEGL006156)

Global Related Concepts:

- Inland Red Maple Swamp (Breden 1989) B
- Palustrine Broad-leaved Deciduous Forested Wetlands (PFO1) (Cowardin et al. 1979) ?
- Red or Silver Maple-Green Ash Swamp (Thompson 1996) ?
- Southern New England stream bottom forest (Rawinski 1984) ?

CLASSIFICATION & OTHER COMMENTS

Indiana Dunes National Lakeshore Classification Comments: This community includes sites that in the past have been classified locally as fens or wooded fens. These sites are currently dominated by red maple.

Indiana Dunes National Lakeshore Other Comments:

Global Classification Comments: Classification of this type at the southern end of the range is supported by analysis of a 1250-plot regional dataset compiled for the NCR and Mid-Atlantic national parks vegetation mapping project. In that analysis, this association was represented a group of 18 Maryland and Virginia plots.

ELEMENT DISTRIBUTION

Indiana Dunes National Lakeshore Range: Red maple swamp communities are often found in the Cowles Bog, Dunes State Park, and Keiser units.

Global Range: This vegetation occurs in southern New England south through the mid-Atlantic states to Virginia.

Nations: US

States/Provinces: CT, DC, DE, IN, MA, MD, NH, NJ, NY, PA, RI, VA, VT

USFS Ecoregions: 212Fa:CCP, 212Fb:CCP, 212Fc:CCC, 212Fd:CCP, 221Aa:CCP, 221Ab:CCC, 221Ac:CCC, 221Ad:CCC, 221Ae:CCC, 221Af:CCC, 221Ag:CCC, 221Ai:CCC, 221Ak:CCC, 221Al:CCC, 221Ba:CCC, 221Bc:CCC, 221Bd:CCC, 221Da:CCC, 221Db:CCC, 221Dc:CCC, 222Ib:CCC, 222Ic:CCC, 222Jj:CCC, 231Ae:CCC, 231Ak:CCC, 232Aa:CCP, 232Br:CCC, M221Ac:CCC

Federal Lands: NPS (Appomattox Court House, C&O Canal, Delaware Water Gap, Fort Necessity, Gateway, George Washington Parkway, Indiana Dunes, Minute Man, Morristown, National Capital-East?, Prince William, Rock Creek, Saratoga, Upper Delaware, Weir Farm, Wolf Trap); USFWS (Great Meadows?, Iroquois, Montezuma)

ELEMENT SOURCES

Indiana Dunes National Lakeshore Map Units Summary:

Indiana Dunes National Lakeshore Inventory Notes:

Indiana Dunes National Lakeshore Plots: INDU.VP052, INDU.VP076, INDU.VP077, INDU.VP093, INDU.VP094, INDU.VP095, INDU.VP096, INDU.VP123, INDU.VP139, INDU.AA018, INDU.AA071, INDU.AA120, INDU.AA176, INDU.AA202, INDU.AA269, INDU.AA410, INDU.AA525, INDU.AA575, INDU.AA632, INDU.AA685, INDU.AA694.

Local Description Author(s): N. Lehmann

Global Description Author(s): L.A. Sneddon, mod. S.C. Gawler and G.P. Fleming

References: Breden 1989, Breden et al. 2001, Cowardin et al. 1979, Eastern Ecology Working Group n.d., Edinger et al. 2002, Ehrenfeld 1977, Enser 1993, Golet et al. 1993, Harrison 2004, Metzler and Barrett 2001, NRCS 2001b, NRCS 2004, Rawinski 1984, Reschke 1990, Sperduto and Nichols 2004, Swain and Kearsley 2001, Thompson 1996, Thompson and Sorenson 2000

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I.B.2.N.g. Saturated cold-deciduous forest

A.349 *Larix laricina* Saturated Forest Alliance

Tamarack Saturated Forest Alliance

[CEGL005232] *Larix laricina - Acer rubrum / (Rhamnus alnifolia, Vaccinium corymbosum)* Forest

Translated Name: **Tamarack - Red Maple / (Alderleaf Buckthorn, Highbush Blueberry) Forest**
Common Name: **Central Tamarack - Red Maple Rich Swamp**
Ecological System(s):
- North-Central Interior and Appalachian Rich Swamp (CES202.605)

Circumscription Confidence: 2 - Moderate
Concept Author(s): D. Faber-Langendoen

ELEMENT CONCEPT

Global Summary: This community is found in the central Great Lakes region, including southern Ontario, Canada and the northern parts of the central United States. Stands occur in minerotrophic conditions on glacial outwash drainages, stream headwaters, and kettle depressions. Tree canopy varies from open to closed canopy (25-100% canopy). *Larix laricina* is the dominant species, with at least 50% cover. Other canopy associates include *Acer rubrum, Fraxinus nigra, Betula alleghaniensis* and *Pinus strobus*. The shrub layer contains a diverse mix of species, including *Photinia melanocarpa (= Aronia melanocarpa), Ilex verticillata, Dasiphora fruticosa ssp. floribunda (= Pentaphylloides floribunda), Rhamnus alnifolia*, and *Vaccinium corymbosum* (in the eastern parts of its range). *Alnus incana, Lindera benzoin, Toxicodendron vernix*, and *Viburnum lentago* may also be present. The herbaceous layer is also diverse, and includes *Carex* spp. (including *Carex stricta*), *Calamagrostis canadensis, Impatiens capensis, Symplocarpus foetidus, Saxifraga pensylvanica, Thelypteris palustris* and others. The *Sphagnum* layer is discontinuous to sparse.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Palustrine
Indiana Dunes National Lakeshore Environment: This tamarack - red maple / blueberry forest occurs in flat wetlands with poorly drained peat soils. Standing water up to 20 inches deep may also be present. The unvegetated surface is dominated by bare soil or leaf litter.
Global Environment: This community is found in minerotrophic conditions on glacial outwash drainages, stream headwaters, and kettle depressions in kettle-kame or coarse end moraine topography, and rarely on sandy glacial lakeplains. In at least part of the range (Michigan), the saturated muck soil is neutral due to groundwater infusion, but surface soil layers may be acid (Chapman et al. 1989).

VEGETATION DESCRIPTION

Indiana Dunes National Lakeshore Vegetation: The moderate (40-60% cover) canopy is dominated by *Larix laricina*; additional species may include *Acer rubrum, Nyssa sylvatica, Pinus strobus, Quercus palustris,* or *Quercus rubra*. *Vaccinium corymbosum* forms a very dense shrub layer which may also include small amounts of *Lindera benzoin, Photinia floribunda*, and *Sassafras albidum*. Few herbs, other than a small quantity of *Carex* sp., are found here.
Global Vegetation: The tree canopy varies from open to closed (25-100% cover). *Larix laricina* is the dominant species, with at least 50% cover. Other canopy associates include *Acer rubrum, Fraxinus nigra, Betula alleghaniensis*, and *Pinus strobus*. The shrub layer contains a diverse mix of species, including *Photinia melanocarpa (= Aronia melanocarpa), Ilex verticillata, Dasiphora fruticosa ssp. floribunda (= Pentaphylloides floribunda), Rhamnus alnifolia*, and *Vaccinium corymbosum* (in the eastern parts of its range). *Alnus incana, Lindera benzoin, Toxicodendron vernix*, and *Viburnum lentago* may also be present. The herbaceous layer is also diverse, and includes *Carex* spp. (including *Carex stricta*), *Calamagrostis canadensis, Impatiens capensis, Symplocarpus foetidus, Saxifraga pensylvanica, Thelypteris palustris*, and others. The *Sphagnum* layer is discontinuous to sparse (Anderson 1982, Chapman et al. 1989, MNNHP 1993).
Global Dynamics: Larch sawfly outbreaks may have periodically opened up the canopy, increasing plant diversity (Chapman et al. 1989). Fires may also have occurred in these stands (E. Epstein pers. comm. 1999).

INDIANA DUNES NATIONAL LAKESHORE FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform
Larix laricina	Tree (canopy & subcanopy)	Needle-leaved tree
Pinus strobus	Tree canopy	Needle-leaved tree
Acer rubrum	Tree canopy	Broad-leaved deciduous tree
Quercus rubra	Tree canopy	Broad-leaved deciduous tree
Vaccinium corymbosum	Tall shrub/sapling	Broad-leaved deciduous shrub

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GLOBAL FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform

INDIANA DUNES NATIONAL LAKESHORE OTHER NOTEWORTHY SPECIES

Larix laricina, Pinus strobus

GLOBAL OTHER NOTEWORTHY SPECIES

CONSERVATION STATUS RANK

Global Rank & Reasons: G2G3 This community occurs in isolated patches across the central Great Lakes region, from southern Minnesota east to south-central Michigan and southern Ontario. It is nowhere extensive in this range, requiring a fairly restricted set of conditions under which it thrives; namely, moderately minerotrophic conditions in wetland depressions on a variety of glacial landscapes. This type may have been more extensive historically, and then converted to other land use by draining the wetlands, but more information is needed to document the extent of such conversion on this specific type. Present day stresses include ongoing alteration of drainage patterns of wetlands in which the type occurs.

RELATED CONCEPTS

Global Similar Associations:

- *Acer (rubrum, saccharinum)* - *Fraxinus* spp. - *Ulmus americana* Forest (CEGL005038)--is a red maple swamp forest which has very little *Larix laricina*.
- *Acer rubrum* - *Fraxinus* spp. - *Betula papyrifera / Cornus canadensis* Forest (CEGL002071)
- *Larix laricina / Alnus incana* Forest (CEGL002471)
- *Larix laricina / Photinia melanocarpa / Sphagnum* spp. Forest (CEGL002472)--contains more acid species, such as *Chamaedaphne calyculata*, and a more continuous *Sphagnum* spp. layer. In Ohio, CEGL005232 is distinguished by the presence of minerotrophic indicators such as *Dasiphora fruticosa ssp. floribunda* and *Rhamnus alnifolia*.

Global Related Concepts:

- Southern Relict Conifer Swamp (tamarack) (Chapman et al. 1989) B
- Wet Northern Forest (Sytsma and Pippen 1981a) ?

CLASSIFICATION & OTHER COMMENTS

Indiana Dunes National Lakeshore Classification Comments:
Indiana Dunes National Lakeshore Other Comments:
Global Classification Comments: The distinction between tamarack-dominated swamps and red maple-dominated swamps needs to be made clear. Cover of tamarack should be at least 25(50?)% to place a stand in this type. If less, see the mixed hardwood swamp type, *Acer rubrum* - *Fraxinus* spp. - *Betula papyrifera / Cornus canadensis* Forest (CEGL002071).

ELEMENT DISTRIBUTION

Indiana Dunes National Lakeshore Range: This uncommon community was found only in Pinhook Bog and Cowles Bog.
Global Range: This community is found in the central Great Lakes region, including southern Ontario, Canada, and the northern parts of the central United States, ranging from southern Minnesota east to southern-central Michigan and southern Ontario.
Nations: CA, US
States/Provinces: IN, MI, MN, OH, ON, WI
USFS Ecoregions: 221F:PP, 222Ha:CCP, 222I:C?, 222Jb:CCC, 222Jg:CCC, 222Jh:CCC, 222Ji:CCC, 222Jj:CCC, 222Ke:CC?, 222Kf:CCC, 222Kj:CCC, 222L:CC, 222Mc:CCC, 222Md:CCP
Federal Lands: NPS (Indiana Dunes)

ELEMENT SOURCES

Indiana Dunes National Lakeshore Map Units Summary:
Indiana Dunes National Lakeshore Inventory Notes:
Indiana Dunes National Lakeshore Plots: INDU.VP149, INDU.AA059, INDU.AA242, INDU.AA534, INDU.AA612.
Local Description Author(s): M.J. Russo
Global Description Author(s): D. Faber-Langendoen
References: Anderson 1982, Chapman et al. 1989, MNNHP 1993, Midwestern Ecology Working Group n.d., Sytsma and Pippen 1981a, Sytsma and Pippen 1981b, WNHIP unpubl. Data

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I.C.3.N.a. Mixed needle-leaved evergreen - cold-deciduous forest

A.391 *Pinus banksiana - Quercus* (*ellipsoidalis, velutina*) Forest Alliance

Jack Pine - (Northern Pin Oak, Black Oak) Forest Alliance

[A.391] *Pinus banksiana - Quercus* (*ellipsoidalis, velutina*) Forest Alliance
Translated Name: **Jack Pine - (Northern Pin Oak, Black Oak) Forest Alliance**
Common Name:
Ecological System(s):
Circumscription Confidence:
Concept Author(s): J. Drake

ELEMENT CONCEPT

Global Summary: This alliance occurs in the western Great Lakes area on dry, sandy sites. The overstory of this forest alliance has a moderately closed to closed canopy. Tree density can be very high (up to several hundred trees/ha). The dominant canopy species are *Pinus banksiana* and *Quercus ellipsoidalis*. In some stands these two species constitute nearly the entire canopy. Where other species are present, they typically include *Acer rubrum, Pinus resinosa*, and *Populus tremuloides*. The shrub layer is sparse to well-defined. *Vaccinium angustifolium* is very common, but *Corylus cornuta, Rosa* spp., and *Rubus* spp. are other common constituents. The herbaceous layer contains species such as *Carex pensylvanica, Fragaria virginiana, Lysimachia quadrifolia*, and *Maianthemum racemosum*.

Stands of this alliance are found on well-drained, sandy, infertile soils. Sites are typically relatively flat and occur on outwash plains or glaciolacustrine beds.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Terrestrial
Indiana Dunes National Lakeshore Environment: This jack pine - black oak woodland is found on north-facing slopes of young dunes south of the foredunes. Soil is very well-drained, slightly loamy sand.
Global Environment: Stands of this alliance are found on well-drained, sandy, infertile soils. Sites are typically relatively flat and occur on outwash plains or glaciolacustrine beds.

VEGETATION DESCRIPTION

Indiana Dunes National Lakeshore Vegetation: This woodland has a sparse canopy (<40% cover) dominated by *Pinus banksiana*. *Quercus velutina* trees less than 10 m tall occur in the canopy and subcanopy. The sparse shrub layer contains *Quercus velutina* saplings, *Hamamelis virginiana*, and *Amelanchier arborea*. Graminoids dominate the herbaceous layer, particularly *Calamovilfa longifolia* and *Dichanthelium* spp., and vines of *Vitis riparia* and *Toxicodendron radicans* are usually present. A variety of sand savanna/sand prairie species may occur. In addition, this community supports state-imperiled *Arctostaphylos uva-ursi, Pinus banksiana, Pinus strobus*, and *Rhus aromatica var. arenaria*.
Global Vegetation: The overstory of this forest alliance has a moderately closed to closed canopy. Tree density can be very high (up to several hundred trees/ha). The dominant canopy species are *Pinus banksiana* and *Quercus ellipsoidalis*. In some stands these two species constitute nearly the entire canopy. Where other species are present, they typically include *Acer rubrum, Pinus resinosa*, and *Populus tremuloides*. The shrub layer is sparse to well-defined. *Vaccinium angustifolium* is very common, but *Corylus cornuta, Rosa* spp., and *Rubus* spp. are other common constituents. The herbaceous layer contains species such as *Carex pensylvanica, Fragaria virginiana, Lysimachia quadrifolia*, and *Maianthemum racemosum*.
Global Dynamics:

INDIANA DUNES NATIONAL LAKESHORE FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform
Pinus banksiana	Tree canopy	Needle-leaved tree
Quercus velutina	Tree canopy	Broad-leaved deciduous tree
Quercus velutina	Tall shrub/sapling	Broad-leaved deciduous tree
Hamamelis virginiana	Tall shrub/sapling	Broad-leaved deciduous shrub
Vitis riparia	Herb (field)	Vine/Liana
Tradescantia ohiensis	Herb (field)	Forb
Calamovilfa longifolia	Herb (field)	Graminoid

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GLOBAL FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform

INDIANA DUNES NATIONAL LAKESHORE OTHER NOTEWORTHY SPECIES

Arctostaphylos uva-ursi, Pinus banksiana, Pinus strobus, Poa compressa, Rhus aromatica var. *arenaria, Verbascum thapsus*

GLOBAL OTHER NOTEWORTHY SPECIES

CONSERVATION STATUS RANK

Global Rank & Reasons: GNR

RELATED CONCEPTS

Global Similar Associations:
Global Related Concepts:

CLASSIFICATION & OTHER COMMENTS

Indiana Dunes National Lakeshore Classification Comments:
Indiana Dunes National Lakeshore Other Comments: *Poa compressa* (nonnative) seems to occupy what would otherwise be a sedge (e.g., *Carex pensylvanica*) niche here.
Global Classification Comments:

ELEMENT DISTRIBUTION

Indiana Dunes National Lakeshore Range: The jack pine - black oak woodland is found at the Cowles Bog and Dunes State Park units.
Global Range: This alliance is found in eastern Minnesota, northern Wisconsin, and northern Michigan with outlier stands in extreme northern Indiana. It also occurs in Canada in southern Ontario.
Nations: CA, US
States/Provinces: MI, MN, IN, WI
USFS Ecoregions: 222Jj:CCC
Federal Lands: NPS (Indiana Dunes)

ELEMENT SOURCES

Indiana Dunes National Lakeshore Map Units Summary:
Indiana Dunes National Lakeshore Inventory Notes:
Indiana Dunes National Lakeshore Plots: INDU.VP025, INDU.VP133, INDU.AA153, INDU.AA452, INDU.AA457, INDU.AA667.
Local Description Author(s): N. Lehmann
Global Description Author(s):
References: Midwestern Ecology Working Group n.d.

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I.C.3.N.a. Mixed needle-leaved evergreen - cold-deciduous forest

A.401 *Pinus strobus - Quercus* (*alba, rubra, velutina*) Forest Alliance

Eastern White Pine - (White Oak, Northern Red Oak, Black Oak) Forest Alliance

[CEGL002481] *Pinus strobus - Quercus alba /* (*Corylus americana, Gaylussacia baccata*) Forest

Translated Name: **Eastern White Pine - White Oak / (American Hazelnut, Black Huckleberry) Forest**
Common Name: **White Pine - White Oak Sand Forest**
Ecological System(s):
- Laurentian-Acadian Pine-Hemlock-Hardwood Forest (CES201.563)

Circumscription Confidence: 2 - Moderate
Concept Author(s): D. Faber-Langendoen

ELEMENT CONCEPT

Global Summary: This white pine - oak forest is found in the upper midwestern United States. Stands occur on dry sandy soils, and in central Minnesota, Wisconsin, and Michigan, are typically formed on sandy outwash or lakeplains. *Pinus strobus* dominates the canopy, or may form a supercanopy over a hardwood canopy. Typical canopy associates include *Pinus resinosa* (in parts of its range), *Quercus alba, Quercus rubra*, and *Acer rubrum*. Where soils are more sandy, *Populus grandidentata* and *Quercus ellipsoidalis* may be important. Shrub species include *Corylus americana* and *Gaylussacia baccata*. The herbaceous layer can contain *Aquilegia canadensis, Aralia nudicaulis, Eurybia macrophylla (= Aster macrophyllus), Symphyotrichum urophyllum (= Aster sagittifolius), Carex pensylvanica, Gaultheria procumbens, Lysimachia quadrifolia, Polygala paucifolia*, and *Pteridium aquilinum*.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Terrestrial
Indiana Dunes National Lakeshore Environment: This white pine - oak forest is found at low levels between dune ridges near the beach. Soils are loamy sand. Extensive logging in the 1850s removed most of the white pine from Indiana Dunes.
Global Environment: Soils are often fine sands, and in central Minnesota, Wisconsin, and Michigan, are typically formed on sandy outwash plains or lakeplains.

VEGETATION DESCRIPTION

Indiana Dunes National Lakeshore Vegetation: The canopy may contain and be dominated by *Quercus alba* or *Quercus velutina* in addition to *Pinus strobus*. The subcanopy is made up of the same three canopy species. *Sassafras albidum, Amelanchier* spp., and *Prunus virginiana* comprise the sparse shrub layer, and the herbaceous layer contains mostly *Carex pensylvanica* or is sparsely vegetated with *Poa compressa, Dichanthelium villosissimum var. villosissimum,* and *Lithospermum caroliniense var. croceum* among others. Exotic species include *Alliaria petiolata* and *Berberis thunbergii*. In addition, this community supports state-imperiled *Juniperus communis, Pinus banksiana,* and *Pinus strobus,* and state-vulnerable *Ammophila breviligulata*.
Global Vegetation: *Pinus strobus* dominates the canopy, or may form a supercanopy over a hardwood canopy. Typical canopy associates include *Pinus resinosa* (in parts of its range), *Quercus alba, Quercus rubra*, and *Acer rubrum*. Where soils are more sandy, *Populus grandidentata* and *Quercus ellipsoidalis* may be important. Shrub species include *Corylus americana* and *Gaylussacia baccata* (rare in Minnesota). The herbaceous layer can contain *Aquilegia canadensis, Aralia nudicaulis, Eurybia macrophylla (= Aster macrophyllus), Symphyotrichum cordifolium (= Aster sagittifolius), Carex pensylvanica, Gaultheria procumbens, Lysimachia quadrifolia, Polygala paucifolia,* and *Pteridium aquilinum* (MNNHP 1993, E. Epstein pers. comm. 1994).
Global Dynamics: A long-interval fire regime (100-200 years) may be the source disturbance of these stands (Eric Epstein pers. comm. 1994).

INDIANA DUNES NATIONAL LAKESHORE FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform
Pinus strobus	Tree canopy	Needle-leaved tree
Quercus alba	Tree canopy	Broad-leaved deciduous tree
Sassafras albidum	Tall shrub/sapling	Broad-leaved deciduous shrub
Toxicodendron radicans	Herb (field)	Vine/Liana
Pteridium aquilinum	Herb (field)	Fern or fern ally

GLOBAL FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform

INDIANA DUNES NATIONAL LAKESHORE OTHER NOTEWORTHY SPECIES

Alliaria petiolata, Ammophila breviligulata, Berberis thunbergii, Juniperus communis, Pinus banksiana, Pinus strobus

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GLOBAL OTHER NOTEWORTHY SPECIES

CONSERVATION STATUS RANK

Global Rank & Reasons: G3 This type is a mature pine - oak forest type on sand plains in the upper Midwest / lower Great Lakes states of the midwestern United States. It has a moderately restricted range and somewhat specific substrate and fire disturbance requirements. Few EOs have been identified, and further investigation is needed to verify the rank status of this type.

RELATED CONCEPTS

Global Similar Associations:

- *Pinus strobus - (Pinus resinosa) - Quercus rubra* Forest (CEGL002480)
- *Quercus rubra - Quercus alba - (Quercus velutina, Acer rubrum) / Viburnum acerifolium* Forest (CEGL002462)

Global Related Concepts:

- Dry-Mesic Northern Forest - White Pine-White Oak (Chapman et al. 1989) =

CLASSIFICATION & OTHER COMMENTS

Indiana Dunes National Lakeshore Classification Comments:

Indiana Dunes National Lakeshore Other Comments:

Global Classification Comments: The concept of the type is a mature pine - oak forest type on sand plains. It may be that Minnesota White Pine Hardwood Forest SE, Dry Subtype is not a good crosswalk to this type if it is found on dry bluffs. Compare this type to *Pinus strobus - (Pinus resinosa) - Quercus rubra* Forest (CEGL002480) (where Minnesota White Pine Hardwood NC type is crosswalked). Indiana and Illinois stands, if not on sand, may best fit with *Pinus strobus - (Pinus resinosa) - Quercus rubra* Forest (CEGL002480).

ELEMENT DISTRIBUTION

Indiana Dunes National Lakeshore Range: The white pine - oak forest is found in the Visitor Center, Cowles Bog, and Dunes State Park units.

Global Range: This white pine - oak forest is found in the upper midwestern United States on dry typically sandy sites. It ranges from east-central Minnesota, central Wisconsin and central Michigan, south to northern Illinois and possibly northern Indiana.

Nations: US

States/Provinces: IL, IN, MI, MN, WI

USFS Ecoregions: 212Hl:CCP, 212Hp:CCP, 212Hr:CCP, 212Ht:CCP, 212Hu:CCC, 212Hv:CCP, 212Hw:CCP, 212Hx:CCP, 212Hy:CCC, 222Ja:CCC, 222Jc:CCC, 222Jj:CCC, 222Ka:CCC, 222Kh:CCC, 222Lc:CCC, 222Lf:CCC, 222Md:CCC, 222Me:CCC

Federal Lands: NPS (Indiana Dunes, Saint Croix); USFS (Huron, Huron-Manistee, Manistee)

ELEMENT SOURCES

Indiana Dunes National Lakeshore Map Units Summary:

Indiana Dunes National Lakeshore Inventory Notes:

Indiana Dunes National Lakeshore Plots: INDU.VP131, INDU.VP132, INDU.AA567, INDU.AA643, INDU.AA723.

Local Description Author(s): N. Lehmann

Global Description Author(s): D. Faber-Langendoen

References: Chapman et al. 1989, Epstein pers. comm., MNNHP 1993, Midwestern Ecology Working Group n.d., WNHIP unpubl. data

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II. Woodland

II.B.2.N.a. Cold-deciduous woodland

A.1493 *Populus deltoides* Woodland Alliance

Eastern Cottonwood Woodland Alliance

[CEGL005119] *Populus deltoides* - (*Juniperus virginiana*) Dune Woodland

Translated Name: **Eastern Cottonwood - (Eastern Red-cedar) Dune Woodland**

Common Name: **Cottonwood Dune Woodland**

Ecological System(s):

- Great Lakes Dune (CES201.026)
- Great Lakes Wooded Dune and Swale (CES201.726)

Circumscription Confidence: 2 - Moderate

Concept Author(s): D. Faber-Langendoen

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*, often in association with *Juniperus virginiana*. *Quercus* spp. (including *Quercus macrocarpa, Quercus rubra*, and *Quercus velutina*) may occur, particularly when there are adjacent oak forests. Shrub and vine species include *Cornus drummondii, Parthenocissus quinquefolia, Rhus typhina, Salix amygdaloides, Salix exigua, Salix fragilis*, and *Vitis riparia*. *Morella pensylvanica (= Myrica pensylvanica)* is common at Presque Isle in Pennsylvania. Herbaceous species are scattered, but include *Asclepias syriaca, Elymus virginicus, Rumex acetosella, Schizachyrium scoparium*, and *Strophostyles helvula*.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Terrestrial

Indiana Dunes National Lakeshore Environment: This cottonwood dune woodland occurs on dune ridges and sand-mined fields that are south of, and more stabilized than, dunes near the beach. These sites are relatively exposed to wind. The soil is well-drained, somewhat loamy sand. In some areas, sand has been removed nearly to the water table.

Global Environment: This community occurs in dune fields and on the most stable dune ridges.

VEGETATION DESCRIPTION

Indiana Dunes National Lakeshore Vegetation: The canopy is open with 30-40% cover. Trees are short (less than 10 m in height) and include *Populus deltoides* or *Populus tremuloides*. *Juniperus virginiana* and/or *Quercus velutina* are very often present, and in areas where sand has been removed nearly to the water table, *Quercus palustris* may occur. Common shrubs and vines include *Juniperus communis, Prunus pumila, Celastrus scandens, Rhus aromatica var. arenaria, Rubus occidentalis, Arctostaphylos uva-ursi*, and *Vitis aestivalis*. The herbaceous layer includes *Schizachyrium scoparium, Solidago simplex var. gillmanii, Dichanthelium sphaerocarpon, Eupatorium serotinum*, and *Opuntia humifusa*. Exotic species found here are *Lonicera X bella, Rosa multiflora*, and *Poa pratensis*. This community also supports state-imperiled *Arctostaphylos uva-ursi, Juniperus communis*, and *Rhus aromatica var. arenaria*.

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*, often in association with *Juniperus virginiana*. *Quercus* spp. (including *Quercus macrocarpa, Quercus rubra*, and *Quercus velutina*) may occur, particularly when there are adjacent oak forests. Shrub and vine species include *Cornus drummondii, Parthenocissus quinquefolia, Rhus typhina, Salix amygdaloides, Salix exigua, Salix fragilis*, and *Vitis riparia*. *Morella pensylvanica (= Myrica pensylvanica)* is common at Presque Isle in Pennsylvania. Herbaceous species are scattered, but include *Asclepias syriaca, Elymus virginicus, Rumex acetosella, Schizachyrium scoparium*, and *Strophostyles helvula* (Anderson 1996, Fike 1999).

Global Dynamics:

INDIANA DUNES NATIONAL LAKESHORE FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform
Juniperus virginiana	Tree canopy	Needle-leaved tree
Populus deltoides	Tree canopy	Broad-leaved deciduous tree
Populus tremuloides	Tree canopy	Broad-leaved deciduous tree
Quercus velutina	Tree canopy	Broad-leaved deciduous tree

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Quercus velutina	Tall shrub/sapling	Broad-leaved deciduous tree
Juniperus communis	Tall shrub/sapling	Needle-leaved shrub
Lonicera x *bella*	Tall shrub/sapling	Broad-leaved deciduous shrub
Photinia floribunda	Tall shrub/sapling	Broad-leaved deciduous shrub
Rubus occidentalis	Tall shrub/sapling	Broad-leaved deciduous shrub
Rubus pensilvanicus	Tall shrub/sapling	Broad-leaved deciduous shrub
Opuntia humifusa	Herb (field)	Succulent shrub
Celastrus scandens	Herb (field)	Vine/Liana
Vitis aestivalis	Herb (field)	Vine/Liana
Eupatorium serotinum	Herb (field)	Forb
Dichanthelium sphaerocarpon	Herb (field)	Graminoid
Poa pratensis	Herb (field)	Graminoid
Schizachyrium scoparium	Herb (field)	Graminoid

GLOBAL FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform

INDIANA DUNES NATIONAL LAKESHORE OTHER NOTEWORTHY SPECIES

Arctostaphylos uva-ursi, Bromus tectorum, Convolvulus arvensis, Juniperus communis, Lonicera x *bella, Morus alba, Nepeta cataria, Rhus aromatica* var. *arenaria, Rosa multiflora, Spartina* x *townsendii*

GLOBAL OTHER NOTEWORTHY SPECIES

Morella pensylvanica

CONSERVATION STATUS RANK

Global Rank & Reasons: G1G2 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.

RELATED CONCEPTS

Global Similar Associations:
Global Related Concepts:
- Sand Dune Community (Thompson 1996) B

CLASSIFICATION & OTHER COMMENTS

Indiana Dunes National Lakeshore Classification Comments:
Indiana Dunes National Lakeshore Other Comments:
Global Classification Comments: *Juniperus virginiana* may form enough of a dominant without *Populus deltoides* that it may deserve its own type (Lee et al. 1998).

ELEMENT DISTRIBUTION

Indiana Dunes National Lakeshore Range: The cottonwood dune woodland is restricted to near the Lake Michigan shoreline in the West Beach, Miller Dunes, and Keiser units.
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
States/Provinces: IN, MI, NY, OH, ON, PA, VT
USFS Ecoregions: 212Hw:CCC, 222Jj:CCC, 222Qa:CCC
Federal Lands: NPS (Indiana Dunes, Sleeping Bear Dunes)

ELEMENT SOURCES

Indiana Dunes National Lakeshore Map Units Summary:
Indiana Dunes National Lakeshore Inventory Notes:
Indiana Dunes National Lakeshore Plots: INDU.VP081, INDU.VP082, INDU.VP172, INDU.AA166, INDU.AA225, INDU.AA669, INDU.AA738.
Local Description Author(s): N. Lehmann
Global Description Author(s): D. Faber-Langendoen
References: Anderson 1996, Fike 1999, Lee et al. 1998, Midwestern Ecology Working Group n.d., Thompson 1996, Thompson and Sorenson 2000

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II.B.2.N.a. Cold-deciduous woodland

A.619 *Quercus macrocarpa - Quercus* (*alba, ellipsoidalis, velutina*) Woodland Alliance

Bur Oak - (White Oak, Northern Pin Oak, Black Oak) Woodland Alliance

[CEGL002142] *Quercus alba - Quercus macrocarpa - Quercus rubra / Corylus americana* Woodland

Translated Name: **White Oak - Bur Oak - Northern Red Oak / American Hazelnut Woodland**
Common Name: **North-central Dry-Mesic Oak Woodland**
Ecological System(s):
- North-Central Interior Oak Savanna (CES202.698)
- North-Central Interior Dry-Mesic Oak Forest and Woodland (CES202.046)

Circumscription Confidence: 2 - Moderate
Concept Author(s): B.W. Pruka, J. Drake and D. Faber-Langendoen

ELEMENT CONCEPT

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

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Terrestrial
Indiana Dunes National Lakeshore Environment: This white oak - bur oak woodland occurs on dry uplands. The unvegetated surface is covered with leaf litter, wood and bare soil.
Global Environment: Stands occur on level to rolling topography on well-drained outwash plains and coarse-textured end moraines, as well as on moderately fire-protected slopes in the Driftless Area. The pH varies from 6.1-7.3. Soils are excessively to moderately well-drained (dry to dry-mesic). Texture ranges range from loams to sandy loams, and include silt loams (loess-derived) close to bedrock in the Driftless Area. This community may develop on a slope of any aspect so long as the topography encourages infrequent but occasional fire. On shallow-to-bedrock slopes, a lower fire frequency is required to maintain Oak Woodland on south-facing slopes. This is because the combination of shallow soils and high evapotranspiration slows the rate of canopy closure by slowing the rate at which trees grow to canopy size.

VEGETATION DESCRIPTION

Indiana Dunes National Lakeshore Vegetation: The moderately dense canopy and subcanopy layers are dominated by *Quercus macrocarpa* along with lesser amounts of *Carya ovata, Quercus alba, Tilia americana*, and *Ulmus americana*. The shrub layer is sparse and made up mostly of saplings of canopy species, as well as *Lindera benzoin*. Herbs include *Agrimonia rostellata, Geranium maculatum, Onoclea sensibilis, Polygonum virginianum, Symphyotrichum lateriflorum*, and *Toxicodendron radicans* (up to 70% cover in one stand).
Global Vegetation: There are three main structural layers - tree canopy, tall-shrub and herbaceous. Tree densities for stems greater than 10 cm dbh may historically have been between 50-200 stems per hectare (Bowles et al. 1994). The tree layer is composed predominantly of *Quercus alba* and *Quercus macrocarpa*, with *Quercus ellipsoidalis* or *Quercus velutina* more common on dry sites, and occasional codominance by *Quercus rubra, Carya* spp., and *Populus* spp. (MNNHP 1993). *Sassafras albidum* can become an important tree layer component in the eastern end of the oak woodland range.
This community may include portions of stands also described as brushland (Grimm 1984, MNNHP 1993) or barrens (Bowles and McBride 1994, White 1994). Shrub cover is usually high (30-50%) with some stands forming impenetrable thickets. Typical shrubs include *Corylus americana* and *Cornus foemina*. Throughout the range of the type, dominant herbs include *Andropogon gerardii, Carex pensylvanica, Desmodium glutinosum, Geranium maculatum*, and many others. These brushlands are dominated by woody species capable of reaching overstory size, but nearly all woody individuals are found in a shrubby state because intense fires are frequent enough to preclude them from reaching overstory size. Other barrens have been described to have scattered woody individuals of canopy size (White 1994).
This community may also include stands described as "closed savanna" or "closed woodland" (Packard 1988, Swink and Wilhelm 1994). These stands experience low-intensity but moderately frequent fires that preclude the establishment of fire-sensitive tree saplings of species such as *Acer saccharum, Tilia americana* and *Fagus grandifolia*, but allow the establishment and growth to canopy

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size of moderately fire-tolerant tree saplings such as *Quercus rubra* and even *Acer nigrum*. Shrub cover is quite low in this subtype due to the high frequency of low-intensity fire. Fuel loads for fires in this community are provided by several cool-season sedges and grasses such as *Carex rosea, Carex pensylvanica, Elymus villosus*, and *Elymus hystrix* (Wilhelm 1991).

Global Dynamics: Occasional, but often intense, fire is the important natural disturbance which encourages woodland formation. Fires must be infrequent enough to allow tree species to occasionally reach tree size yet frequent enough to kill fire-tolerant tree saplings as well as prevent canopy closure.

Because fires are rather infrequent, a large buildup of woody fuels occurs between fires. Woodland understories, shaded by heavier tree and shrub canopies, do not dry out during spring and fall as quickly as prairie and savanna (Stearns 1974) and so are not always dry enough to burn during these seasons. Additionally, these site are often topographically protected from fire by streams or lakes (Bowles et al. 1994). Yet when they do burn, woodlands often burn so intensely that many of the adult trees die, and woodland overstory canopy is temporarily reduced to that of a brushland or brushy oak savanna. With vigorous resprouting of oak grubs and an extended period before another catastrophic fire, these temporal brushlands can recover to a woodland overstory.

Fires were intentionally set by Native Americans in the pre-European settlement era. This may have led to larger expanses of oak woodland than would have occurred without human presence, particularly in the eastern end of the oak woodland range where fire prevented the development of closed forests composed of shade-tolerant tree species (Grimm 1984).

INDIANA DUNES NATIONAL LAKESHORE FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform
Quercus alba	Tree (canopy & subcanopy)	Broad-leaved deciduous tree
Carya ovata	Tree canopy	Broad-leaved deciduous tree
Quercus macrocarpa	Tree canopy	Broad-leaved deciduous tree
Tilia americana	Tree subcanopy	Broad-leaved deciduous tree
Ulmus americana	Tree subcanopy	Broad-leaved deciduous tree
Lindera benzoin	Short shrub/sapling	Broad-leaved deciduous shrub
Polygonum virginianum	Herb (field)	Forb
Symphyotrichum lateriflorum	Herb (field)	Forb
Toxicodendron radicans	Herb (field)	Forb

GLOBAL FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform

INDIANA DUNES NATIONAL LAKESHORE OTHER NOTEWORTHY SPECIES

Alliaria petiolata

GLOBAL OTHER NOTEWORTHY SPECIES

CONSERVATION STATUS RANK

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

RELATED CONCEPTS

Global Similar Associations:

- *Quercus alba - (Carya ovata) / Carex pensylvanica* Glaciated Woodland (CEGL002134)--is a similar type but found in southern Iowa, central Illinois and northern Missouri.
- *Quercus alba - Quercus velutina - Quercus palustris / Carex pensylvanica* Woodland (CEGL005054)--Oak woodlands in southeastern Michigan and southwestern Ontario are currently treated as a separate, more eastern woodland type found on the Great Lakes Lakeplain. More information is needed on this distribution.
- *Quercus ellipsoidalis - (Quercus macrocarpa)* Forest (CEGL002077)--a northern oak forest has a more-or-less closed canopy (canopy >80%). It is found on nutrient-poor, drought-prone soils that preclude establishment of more nutrient-demanding trees like *Acer saccharum*. Northern Oak Forests occur on sites protected from intense fires; otherwise they would be converted to Oak Woodland or *Corylus americana* Shrubland. Even though the canopy is generally closed, the canopy architecture of oaks allows enough sunlight to penetrate to the Oak Forest understory such that Oak Forests and Oak Woodlands share many understory species in common. Oak Forests are dominated by shrubs that are taller, since the shrubs are not consumed by intense fires. These taller shrubs produce enough shade to reduce the herbaceous component of Oak Forests in comparison to Oak Woodlands. Some understory species common in Oak Woodlands appear unable to compete with the shade of shrubs and saplings in Oak Forests.
- *Quercus macrocarpa - (Quercus alba, Quercus velutina) / Andropogon gerardii* Wooded Herbaceous Vegetation (CEGL002020)

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- *Quercus macrocarpa - (Quercus ellipsoidalis) / Schizachyrium scoparium - Koeleria macrantha* Wooded Herbaceous Vegetation (CEGL002160)--northern oak barrens has a wider canopy cover range (10-80%) and is found on sites where fire is more frequent. *Quercus macrocarpa* is of greater importance, shrub cover is generally lower, and graminoid cover is much higher. Understory species shared with Dry-mesic Oak Woodlands but more common in Oak Openings tend to be those that are less shade tolerant or more drought tolerant.
- *Quercus macrocarpa / Corylus americana - Amelanchier alnifolia* Woodland (CEGL000556)--dry oak woodland is somewhat related. Both communities have canopies of 30-80%, but opening woodlands are found on loamier soils and dominated by *Quercus alba*, *Q. macrocarpa*, and *Q. rubra* (*Q. rubra* reaching dominance on more mesic stands only). Dry Oak Woodlands are found on droughty, sandy soils and are dominated by *Quercus ellipsoidalis, Quercus velutina* and *Q. alba*. Their highly droughty, low-fertility soils lead to low fuel loads that often allow for only low intensity fires. Woody individuals which survive the sapling stage generally reach canopy size as the intensities of fire in this community are rarely high enough to kill overstory trees (Anderson 1991). Many understory species are shared in common between Dry-mesic Oak Woodlands and Dry Oak Woodlands. Understory species that are either unique to or more common in Dry Oak Woodlands are those that compete well only in acidic, low-nutrient sandy soils or those that compete well only under more droughty conditions. Conversely, species unique to or more common in Dry-mesic Oak Woodlands tend to be more competitive under lower moisture stress conditions and/or prefer more alkaline conditions.
- *Quercus velutina / Carex pensylvanica* Forest (CEGL002078)--a northern oak forest has a more-or-less closed canopy (canopy >80%). It is found on nutrient-poor, drought-prone soils that preclude establishment of more nutrient-demanding trees like *Acer saccharum*. Northern Oak Forests occur on sites protected from intense fires; otherwise they would be converted to Oak Woodland or *Corylus americana* Shrubland. Even though the canopy is generally closed, the canopy architecture of oaks allows enough sunlight to penetrate to the Oak Forest understory such that Oak Forests and Oak Woodlands share many understory species in common. Oak Forests are dominated by shrubs that are taller, since the shrubs are not consumed by intense fires. These taller shrubs produce enough shade to reduce the herbaceous component of Oak Forests in comparison to Oak Woodlands. Some understory species common in Oak Woodlands appear unable to compete with the shade of shrubs and saplings in Oak Forests.

Global Related Concepts:

CLASSIFICATION & OTHER COMMENTS

Indiana Dunes National Lakeshore Classification Comments:

Indiana Dunes National Lakeshore Other Comments:

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

ELEMENT DISTRIBUTION

Indiana Dunes National Lakeshore Range: This uncommon community was found only on the Heron Rookery and Hobart Prairie.

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

Nations: US

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

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

Federal Lands: NPS (Indiana Dunes, Saint Croix)

ELEMENT SOURCES

Indiana Dunes National Lakeshore Map Units Summary:

Indiana Dunes National Lakeshore Inventory Notes:

Indiana Dunes National Lakeshore Plots: INDU.AA157, INDU.AA434.

Local Description Author(s): M.J. Russo

Global Description Author(s): B.W. Pruka, J. Drake and D. Faber-Langendoen

References: Anderson 1983, Anderson 1991, Bowles and McBride 1994, Bowles et al. 1994, Chapman 1984, Chapman et al. 1994, Curtis 1959, Faber-Langendoen et al. n.d., Grimm 1984, INAI unpubl. data, Kline and Cottam 1979, Leitner et al. 1991, MNNHP

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1993, Midwestern Ecology Working Group n.d., Nowacki et al. 1990, Packard 1988, Packard 1993, Pfannmuller 1991, Pruka 1994, Schwegman and McClain 1985, Swink and Wilhelm 1994, WNHIP unpubl. data, White 1994a, Wilhelm 1991

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II.B.2.N.a. Cold-deciduous woodland

A.612 *Quercus alba* - (*Quercus velutina*) Woodland Alliance

White Oak - (Black Oak) Woodland Alliance

[CEGL005029] *Quercus velutina* - (*Quercus ellipsoidalis*) - *Quercus alba* / *Deschampsia flexuosa* Woodland

Translated Name: **Black Oak - (Northern Pin Oak) - White Oak / Wavy Hairgrass Woodland**
Common Name: **Black Oak - Northern Pin Oak / Common Hairgrass Woodland**
Ecological System(s):
- North-Central Oak Barrens (CES202.727)
- North-Central Interior Dry Oak Forest and Woodland (CES202.047)

Circumscription Confidence: 3 - Weak
Concept Author(s): Don Faber-Langendoen

ELEMENT CONCEPT

Global Summary: This oak woodland type is found in the upper midwestern United States and Canada, particularly in central Michigan and Ontario. Stands occur on excessively well-drained sands of outwash plains. Soil development is minimal, with a thin A horizon (5-10 cm). The canopy is open. Dominant species include *Quercus alba, Quercus ellipsoidalis,* and *Quercus velutina*. *Pinus banksiana* and *Pinus strobus* are common associates. The ground layer consists of a near continuous mat of *Carex pensylvanica* and *Deschampsia flexuosa*. Other species present include *Arctostaphylos uva-ursi, Comptonia peregrina, Chimaphila umbellata,* and *Pteridium aquilinum*. *Andropogon gerardii* and *Schizachyrium scoparium* may occasionally occur in this type.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Terrestrial
Indiana Dunes National Lakeshore Environment: This dry to dry-mesic oak woodland occurs on loamy sands on old dunes. It can occur on any aspect and usually on upper or middle slopes thought rarely it occurs on lower slopes. Litter is usually abundant on the ground.
Global Environment: Stands occur on excessively well-drained sands of outwash plains and, rarely, vegetated sand dunes. Soil development is minimal, with a thin A horizon (5-10 cm) (Cleland et al. 1994).

VEGETATION DESCRIPTION

Indiana Dunes National Lakeshore Vegetation: The tree canopy of this community ranges from 30-60%. It is typically 15-20 m tall. *Quercus velutina* dominates the canopy of most stands though *Quercus alba, Populus tremuloides* and *Tilia americana* can be common in some stands, the latter two usually in disturbed stands. Common species in the shrub strata include young *Quercus velutina, Sassafrass albidum, Rubus* spp., and the dwarf-shrubs *Rosa caroliniana* and *Vaccinium angustifolium*. The herbaceous layer is composed of a mix of woodland species and prairie species. *Carex pensylvanica, Pteridium aquilinum, Schiachyrium scoparium, Koeleria macrantha,* and *Poa pratensis* were common in plots at INDU.
Global Vegetation: Vegetation: The canopy is open. Dominant species include *Quercus alba, Quercus ellipsoidalis,* and *Quercus velutina*. *Pinus banksiana* and *Pinus strobus* are common associates. The ground layer consists of a near continuous mat of *Carex pensylvanica* and *Deschampsia flexuosa*. Other species present include *Arctostaphylos uva-ursi, Comptonia peregrina, Chimaphila umbellata,* and *Pteridium aquilinum*. *Andropogon gerardii* and *Schizachyrium scoparium* may occasionally occur in this type (Cleland et al. 1994).
Global Dynamics: This is a very dry oak woodland type, and historically may have experienced fires. Many of these stands may have been oak or pine-oak barrens prior to European settlement (Cleland et al. 1994).

INDIANA DUNES NATIONAL LAKESHORE FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform
Quercus velutina	Tree stratum	Broad-leaved deciduous tree
Quercus alba	Tree stratum	Broad-leaved deciduous tree
Quercus velutina	Shrub/sapling (tall & short)	Broad-leaved deciduous shrub
Sassafras albidum	Shrub/sapling (tall & short)	Broad-leaved deciduous shrub
Rosa carolina	Short shrub/sapling	Broad-leaved deciduous shrub
Vaccinium angustifolium	Short shrub/sapling	Broad-leaved deciduous shrub
Carex pensylvanica	Herb (field)	Graminoid
Koeleria macrantha	Herb (field)	Graminoid
Poa pratensis	Herb (field)	Graminoid
Schizachyrium scoparium	Herb (field)	Graminoid

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GLOBAL FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform
Quercus velutina	Tree stratum	Broad-leaved deciduous tree
Quercus alba	Tree stratum	Broad-leaved deciduous tree

INDIANA DUNES NATIONAL LAKESHORE OTHER NOTEWORTHY SPECIES

Ailanthus altissima, Hudsonia tomentosa, Lonicera tatarica, Lonicera x *bella, Nepeta cataria, Tragopogon pratensis, Viola pedatifida*

GLOBAL OTHER NOTEWORTHY SPECIES

CONSERVATION STATUS RANK

Global Rank & Reasons: GNR

RELATED CONCEPTS

Global Similar Associations:

- *Pinus banksiana - (Quercus ellipsoidalis) / Schizachyrium scoparium* - Prairie Forbs Wooded Herbaceous Vegetation (CEGL002490)--This is the associated jack pine-oak barrens.
- *Pinus strobus - Quercus alba - (Quercus velutina) / Andropogon gerardii* Wooded Herbaceous Vegetation (CEGL005127)--This is the associated white pine-oak barrens.
- *Quercus rubra - Quercus alba - (Quercus velutina, Acer rubrum) / Viburnum acerifolium* Forest (CEGL002462)

Quercus velutina - (Quercus alba) - Quercus ellipsoidalis / Schizachyrium scoparium - Lupinus perennis Wooded Herbaceous Vegetation (CEGL002492)--This is the associated oak barrens type.

Global Related Concepts:

- ELTP 1 - Northern pin oak - white oak- *Deschampsia* plant association (Cleland et al. 1994) **=**
- Oak Barren (Chapman et al. 1989) **B**

CLASSIFICATION & OTHER COMMENTS

Indiana Dunes National Lakeshore Classification Comments: This association was added to the INDU classification after the main classification and mapping portions of the project were completed. It lays conceptually between *Quercus velutina / Carex pensylvanica* Forest [CEGL002078] and *Quercus velutina - (Quercus alba) - Quercus ellipsoidalis / Schizachyrium scoparium - Lupinus perennis* Wooded Herbaceous Vegetation [CEGL002492] and plots were moved from each of those to this association.

Indiana Dunes National Lakeshore Other Comments:

Global Classification Comments: In southern Michigan and northern Indiana this is on the fringe of oak barrens, *Quercus velutina - (Quercus alba) - Quercus ellipsoidalis / Schizachyrium scoparium - Lupinus perennis* Wooded Herbaceous Vegetation (CEGL002492), and further north, of oak-pine barrens, *Pinus banksiana - (Quercus ellipsoidalis) / Schizachyrium scoparium* - Prairie Forbs Wooded Herbaceous Vegetation (CEGL002490) and *Pinus strobus - Quercus alba - (Quercus velutina) / Andropogon gerardii* Wooded Herbaceous Vegetation (CEGL005127). In Ontario, this type is found at Turkey Point. There, as well, a variant described as "Bur Oak - White Oak - Shagbark Hickory Woodland" is placed with this type (Bakowsky pers. comm. 1998).

ELEMENT DISTRIBUTION

Indiana Dunes National Lakeshore Range: This association is commonly found on old dunes in the East and West Units and in Indiana Dunes State Park.

Global Range: This oak woodland type is found in the upper midwestern United States and Canada, particularly in central Michigan and Ontario with some stands in northern Indiana near Lake Michigan.

Nations: CA, US

States/Provinces: IN, MI, ON

USFS Ecoregions: 212Hp:CPP, 212Hq:CPP, 212Hr:CPP, 212Ht:CPP, 212Hu:CPP, 212Hv:CPP, 212Hw:CPP, 212Hx:CPP, 222J:CC

Federal Lands: NPS (Indiana Dunes), USFS (Huron, Huron-Manistee, Manistee)

ELEMENT SOURCES

Indiana Dunes National Lakeshore Map Units Summary:

Indiana Dunes National Lakeshore Inventory Notes:

Indiana Dunes National Lakeshore Plots: INDU.VP072, INDU.VP104, INDU.VP108, INDU.VP146, INDU.VP173, INDU.VP179, INDU.AA065, INDU.AA090, INDU.AA111, INDU.AA134, INDU.AA272, INDU.AA283a, INDU.AA285, INDU.AA311, INDU.AA340, INDU.AA354, INDU.AA471, INDU.AA522, INDU.AA538, INDU.AA552, INDU.AA571, INDU.AA608, INDU.AA618, INDU.AA640, INDU.AA717.

Local Description Author(s): J. Drake

Global Description Author(s): D. Faber-Langendoen

References: Chapman et al. 1989, Cleland et al. 1994, Midwestern Ecology Working Group n.d.

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III. Shrubland

III.B.2.N.a. Temperate cold-deciduous shrubland

A.897 *Corylus americana* - (*Spiraea tomentosa, Malus ioensis*) Shrubland Alliance

American Hazelnut - (Steeplebush, Prairie Apple) Shrubland Alliance

[CEGL005072] *Corylus americana - Salix humilis / Schizachyrium scoparium* Shrubland

Translated Name: **American Hazelnut - Prairie Willow / Little Bluestem Shrubland**
Common Name: **Hazelnut Sand Barrens**
Ecological System(s):
Circumscription Confidence: 2 - Moderate
Concept Author(s): D. Faber-Langendoen after Steffen and Anderson (1997)

ELEMENT CONCEPT

Global Summary: This hazelnut sand barrens type is found in the tallgrass prairie-forest border region of Illinois and Indiana in the United States. Stands occur on dune slopes and sandy ridges of glacial lakeplains. The vegetation may contain scattered grubs of *Quercus velutina* and copses of *Sassafras albidum* interspersed with sand prairie or sand barrens vegetation. Dominant species in the shrub layer include *Corylus americana* and *Salix humilis*. Dominant herbaceous species include *Schizachyrium scoparium, Sorghastrum nutans*. Other characteristic species include *Asclepias amplexicaulis, Lupinus perennis, Opuntia humifusa, Phlox bifida*, and *Staphylea trifolia*. Open patches of sand may occur, and mosses and lichens may be common.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Terrestrial
Indiana Dunes National Lakeshore Environment: The hazelnut sand barrens shrubland occurs in upland plains between dune ridges and/or wetland depressions. The soil is moderately to somewhat poorly drained loamy sand.
Global Environment: Stands occur on dune slopes and sandy ridges of glacial lakeplains.

VEGETATION DESCRIPTION

Indiana Dunes National Lakeshore Vegetation: This community may be interspersed with prairie vegetation. It contains copses of *Corylus americana, Salix humilis, Populus tremuloides, Sassafras albidum*, and *Cornus racemosa* in combination or isolation.
Global Vegetation: The vegetation may contain scattered grubs of *Quercus velutina* and copses of *Sassafras albidum* interspersed with sand prairie or sand barrens vegetation. Dominant species in the shrub layer include *Corylus americana* and *Salix humilis*. Dominant herbaceous species include *Schizachyrium scoparium, Sorghastrum nutans*. Other characteristic species include *Asclepias amplexicaulis, Lupinus perennis, Opuntia humifusa, Phlox bifida*, and *Staphylea trifolia*. Open patches of sand may occur, and mosses and lichens may be common (Steffen and Anderson 1997).
Global Dynamics: Droughts and fires interacted to maintain the open, scrubby nature of this type (Steffen et al. 1997).

INDIANA DUNES NATIONAL LAKESHORE FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform
Populus tremuloides	Tree canopy	Broad-leaved deciduous tree
Populus tremuloides	Tall shrub/sapling	Broad-leaved deciduous tree
Cornus racemosa	Tall shrub/sapling	Broad-leaved deciduous shrub
Corylus americana	Tall shrub/sapling	Broad-leaved deciduous shrub
Salix humilis	Tall shrub/sapling	Broad-leaved deciduous shrub
Schizachyrium scoparium	Herb (field)	Graminoid
Osmunda regalis var. *spectabilis*	Herb (field)	Fern or fern ally

GLOBAL FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform

INDIANA DUNES NATIONAL LAKESHORE OTHER NOTEWORTHY SPECIES

Lonicera x *bella*

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GLOBAL OTHER NOTEWORTHY SPECIES

CONSERVATION STATUS RANK

Global Rank & Reasons: G1? Little information is currently available about this community. It is reported from Indiana, where it is ranked SH (historical - no extant occurrences known, but some are expected to be found). It is possible this community is also in Illinois. There are no currently documented occurrences. There are probably fewer than 6 occurrences, with a total acreage probably less than 300 acres.

RELATED CONCEPTS

Global Similar Associations:

- *Corylus americana - Malus ioensis - Ceanothus americanus* Shrubland (CEGL005073)
- *Quercus velutina - (Quercus alba) - Quercus ellipsoidalis / Schizachyrium scoparium - Lupinus perennis* Wooded Herbaceous Vegetation (CEGL002492)
- *Schizachyrium scoparium - Carex tonsa var. rugosperma - Carex muehlenbergii - Lithospermum caroliniense - Opuntia humifusa* Herbaceous Vegetation (CEGL005099)
- *Schizachyrium scoparium - Danthonia spicata - Carex pensylvanica - (Viola pedata)* Herbaceous Vegetation (CEGL002318)

Global Related Concepts:

CLASSIFICATION & OTHER COMMENTS

Indiana Dunes National Lakeshore Classification Comments:
Indiana Dunes National Lakeshore Other Comments:
Global Classification Comments: This type is primarily known through historical records, and few stands remain today. This type may be expected on drier, finer-textured and sandy soils. There are serious classification difficulties in applying the concept of this type, as it falls between the black oak barrens type, *Quercus velutina - (Quercus alba) - Quercus ellipsoidalis / Schizachyrium scoparium - Lupinus perennis* Wooded Herbaceous Vegetation (CEGL002492), which can be quite scrubby, and open dry sand prairies, *Schizachyrium scoparium - Danthonia spicata - Carex pensylvanica - (Viola pedata)* Herbaceous Vegetation (CEGL002318), or sand barrens, *Schizachyrium scoparium - Carex tonsa var. rugosperma - Carex muehlenbergii - Lithospermum caroliniense - Opuntia humifusa* Herbaceous Vegetation (CEGL005099). It remains to be determined how necessary a shrubby sand prairie or sand barrens category is. Type may occur in the Kankakee Sands area of Illinois.

ELEMENT DISTRIBUTION

Indiana Dunes National Lakeshore Range: This shrubland occurs at Calumet Prairie, Howes Prairie, and the Mnoke Prairie in the Bailly unit.
Global Range: This type is found in the tallgrass prairie-forest border region of Illinois and Indiana in the United States.
Nations: US
States/Provinces: IL, IN
USFS Ecoregions: 222Jj:CCC, 251:C
Federal Lands: NPS (Indiana Dunes, Saint Croix)

ELEMENT SOURCES

Indiana Dunes National Lakeshore Map Units Summary:
Indiana Dunes National Lakeshore Inventory Notes:
Indiana Dunes National Lakeshore Plots: INDU.VP032, INDU.VP180, INDU.AA068, INDU.AA337, INDU.AA337a, INDU.AA677
Local Description Author(s): N. Lehmann
Global Description Author(s): J. Steffen et al. 1997, mod. D. Faber-Langendoen
References: Midwestern Ecology Working Group n.d., Steffen and Anderson 1997

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III.B.2.N.a. Temperate cold-deciduous shrubland

A.897 *Corylus americana* - (*Spiraea tomentosa, Malus ioensis*) Shrubland Alliance

American Hazelnut - (Steeplebush, Prairie Apple) Shrubland Alliance

[CEGL005069] *Spiraea tomentosa - Salix humilis / Andropogon gerardii - Panicum virgatum* Shrubland

Translated Name: **Steeplebush - Prairie Willow / Big Bluestem - Switchgrass Shrubland**
Common Name: **Hardhack Wet-Mesic Sand Shrub Meadow**
Ecological System(s):

- Eastern Great Plains Wet Meadow, Prairie, and Marsh (CES205.687)
- North-Central Interior Wet Meadow-Shrub Swamp (CES202.701)

Circumscription Confidence: 3 - Weak
Concept Author(s): J. White and M. Madany, mod. D. Faber-Langendoen

ELEMENT CONCEPT

Global Summary: This wet-mesic sand shrub meadow is found in the central tallgrass prairie-forest border region of Illinois in the United States. Stands occur in depressions of glacial lakeplains. Shrub species include the dominants *Spiraea tomentosa, Salix humilis, Rubus hispidus*, and *Gaylussacia baccata*, along with *Photinia floribunda (= Aronia prunifolia)* and *Vaccinium angustifolium*. Herbaceous species include the dominants *Andropogon gerardii* and *Panicum virgatum*, as well as *Bartonia virginica, Osmunda regalis, Parthenium integrifolium, Pedicularis canadensis*, and *Viola lanceolata*.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Palustrine
Indiana Dunes National Lakeshore Environment: This wet meadow community occurs in lowlands with saturated soils. The unvegetated surface is covered by leaf litter, bare soil and wood.
Global Environment: Stands occur in depressions of glacial lakeplains.

VEGETATION DESCRIPTION

Indiana Dunes National Lakeshore Vegetation: Vegetation is dominated by a short-shrub layer of *Spiraea tomentosa* and an herbaceous layer of either *Calamagrostis canadensis* or *Schizachyrium scoparium*. Additional woody species include *Acer rubrum, Nyssa sylvatica*, and *Rubus hispidus*. Other herbs include *Cyperus strigosus, Juncus canadensis, Schoenoplectus tabernaemontani*, and *Thelypteris palustris var. pubescens*. *Sphagnum* spp. may cover up to 40% of the ground surface.
Global Vegetation: Shrub species include the dominants *Spiraea tomentosa, Salix humilis, Rubus hispidus*, and *Gaylussacia baccata*, along with *Photinia floribunda (= Aronia prunifolia)* and *Vaccinium angustifolium*. Herbaceous species include the dominants *Andropogon gerardii* and *Panicum virgatum*, as well as *Bartonia virginica, Osmunda regalis, Parthenium integrifolium, Pedicularis canadensis*, and *Viola lanceolata* (White and Madany 1978, Steffen and Anderson 1997).
Global Dynamics: Fires may have been necessary to maintain open shrub prairie conditions. Many prairie remnants contain patchy shrub prairie thickets, but it is not clear if these have increased due to fire suppression.

INDIANA DUNES NATIONAL LAKESHORE FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform
Acer rubrum	Tree subcanopy	Broad-leaved deciduous tree
Spiraea tomentosa	Short shrub/sapling	Broad-leaved deciduous shrub
Rubus hispidus	Herb (field)	Forb
Calamagrostis canadensis	Herb (field)	Graminoid
Juncus canadensis	Herb (field)	Graminoid
Schizachyrium scoparium	Herb (field)	Graminoid
Thelypteris palustris var. *pubescens*	Herb (field)	Fern or fern ally
Sphagnum spp.	dominant nonvasculars (mosses)	

GLOBAL FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform

INDIANA DUNES NATIONAL LAKESHORE OTHER NOTEWORTHY SPECIES

Frangula alnus

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GLOBAL OTHER NOTEWORTHY SPECIES

CONSERVATION STATUS RANK

Global Rank & Reasons: G1Q There are probably fewer than 20 occurrences of this community rangewide. Currently 5 occurrences are documented from Illinois (where it is ranked S2). It may also occur in Indiana. There are probably fewer than 1000 acres of this community rangewide. Currently over 190 acres have been documented in Illinois. This community is currently reported from two ecoregion subsections in two provinces in northeastern Illinois.

RELATED CONCEPTS

Global Similar Associations:

- *Andropogon gerardii - Calamagrostis canadensis* Sand Herbaceous Vegetation (CEGL005177)--is a wet-mesic sand prairie.
- *Cornus sericea - Salix (bebbiana, discolor, petiolaris) / Calamagrostis stricta* Shrubland (CEGL002187)--is the loamy wet-mesic shrub prairie, and it also appears to be wetter than sites on sand.
- *Corylus americana - Malus ioensis - Ceanothus americanus* Shrubland (CEGL005073)

Global Related Concepts:

CLASSIFICATION & OTHER COMMENTS

Indiana Dunes National Lakeshore Classification Comments: The assignment of this type to Indiana Dunes NL is somewhat uncertain.

Indiana Dunes National Lakeshore Other Comments:

Global Classification Comments: This type concept is taken from the Illinois state type -shrub prairie (White and Madany 1978), and represents the wetter sandy soil type. It probably occurred elsewhere in Indiana and Iowa. Many prairie remnants contain patchy shrub prairie, but it is not clear if these have increased due to fire suppression. Few extensive prairie landscapes remain today, making it difficult to characterize this type.

ELEMENT DISTRIBUTION

Indiana Dunes National Lakeshore Range: This rare community was found in Cowles Bog and Keiser.
Global Range: This community is found in the central midwestern United States in northeastern Illinois.
Nations: US
States/Provinces: IL, IN
USFS Ecoregions: 222Jj:CCC, 251Dg:CCC
Federal Lands: NPS (Indiana Dunes)

ELEMENT SOURCES

Indiana Dunes National Lakeshore Map Units Summary:
Indiana Dunes National Lakeshore Inventory Notes:
Indiana Dunes National Lakeshore Plots: INDU.AA545, INDU.AA655.
Local Description Author(s): M.J. Russo
Global Description Author(s): J. White and M. Madany, mod. D. Faber-Langendoen
References: Midwestern Ecology Working Group n.d., Steffen and Anderson 1997, White and Madany 1978

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III.B.2.N.a. Temperate cold-deciduous shrubland

A.912 *Prunus pumila* Shrubland Alliance

Sand Cherry Shrubland Alliance

[CEGL005075] *Prunus pumila* - (*Ptelea trifoliata*) Dune Shrubland

Translated Name: **Sand Cherry - (Hoptree) Dune Shrubland**
Common Name: **Sand Cherry Dune Shrubland**
Ecological System(s):
- Great Lakes Dune (CES201.026)
- Great Lakes Wooded Dune and Swale (CES201.726)

Circumscription Confidence: 3 - Weak
Concept Author(s): D. Faber-Langendoen

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* is a characteristic dominant, but *Salix cordata, Salix myricoides, Physocarpus opulifolius,* and *Ptelea trifoliata* may also be present. The ground layer may consist of open sand with sparse herbaceous vegetation. Herbaceous species include *Ammophila breviligulata, Schizachyrium scoparium* and others.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Terrestrial
Indiana Dunes National Lakeshore Environment: The sand cherry - hoptree dune shrubland occurs in well-drained sandy soil on stabilized foredunes.
Global Environment: Stands occur on stabilized foredunes.

VEGETATION DESCRIPTION

Indiana Dunes National Lakeshore Vegetation: This community has a sparse canopy that may include *Quercus velutina* and *Populus tremuloides*. *Prunus pumila* and/or *Ptelea trifoliata var. mollis* dominate the tall- and short-shrub layers, and *Salix* spp. also can occur. *Rhus aromatica var. arenaria* may codominate the short-shrub layer. *Celastrus scandens* and *Vitis* spp. are often present. The ground layer is mostly open sand; herbaceous species include *Schizachyrium scoparium, Ammophila breviligulata,* and other species found in very sandy environments. This community also supports state-imperiled *Rhus aromatica var. arenaria* and state-vulnerable *Ammophila breviligulata, Hypericum kalmianum,* and *Platanthera flava var. herbiola*.
Global Vegetation: Stands are dominated by deciduous shrubs, with a relatively open canopy. *Prunus pumila* is a characteristic dominant, but *Salix cordata, Salix myricoides, Physocarpus opulifolius,* and *Ptelea trifoliata* may also be present. The ground layer may consist of open sand with sparse herbaceous vegetation. Herbaceous species include *Ammophila breviligulata, Schizachyrium scoparium* and others (Chapman et al. 1989, Bakowsky and Lee 1996).
Global Dynamics: Disturbances caused by lake storms can bury stands in sand.

INDIANA DUNES NATIONAL LAKESHORE FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform
Quercus velutina	Tree canopy	Broad-leaved deciduous tree
Prunus pumila	Tall shrub/sapling	Broad-leaved deciduous shrub
Ptelea trifoliata var. *mollis*	Tall shrub/sapling	Broad-leaved deciduous shrub
Celastrus scandens	Herb (field)	Vine/Liana
Fragaria virginiana	Herb (field)	Forb
Maianthemum stellatum	Herb (field)	Forb
Oligoneuron rigidum var. *rigidum*	Herb (field)	Forb
Solidago simplex var. *gillmanii*	Herb (field)	Forb
Schizachyrium scoparium	Herb (field)	Graminoid

GLOBAL FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform

INDIANA DUNES NATIONAL LAKESHORE OTHER NOTEWORTHY SPECIES

Ammophila breviligulata, Hypericum kalmianum, Lythrum salicaria, Platanthera flava var. *Herbiola, Rhus aromatica* var. *arenaria*

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GLOBAL OTHER NOTEWORTHY SPECIES

CONSERVATION STATUS RANK

Global Rank & Reasons: G2Q 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.

RELATED CONCEPTS

Global Similar Associations:

- *Ammophila breviligulata - (Schizachyrium scoparium)* Herbaceous Vegetation (CEGL005098)
- *Juniperus horizontalis - Arctostaphylos uva-ursi - Juniperus communis* Dune Dwarf-shrubland (CEGL005064)

Global Related Concepts:

- Open Dune (Chapman et al. 1989) ?

CLASSIFICATION & OTHER COMMENTS

Indiana Dunes National Lakeshore Classification Comments:

Indiana Dunes National Lakeshore Other Comments:

Global Classification 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, Juniperus communis*, and/or *Arctostaphylos uva-ursi* are placed in *Juniperus horizontalis - Arctostaphylos uva-ursi - Juniperus communis* Dune Dwarf-shrubland (CEGL005064).

ELEMENT DISTRIBUTION

Indiana Dunes National Lakeshore Range: The sand cherry - hoptree dune shrubland is found on foredunes in the West Beach, Miller Dunes, Dunes State Park, and Keiser units.

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

USFS Ecoregions: 212Hi:CCC, 212Hw:CCC, 222Ja:CCC, 222Jj:CCC, 222K:C?

Federal Lands: NPS (Indiana Dunes, Pictured Rocks, Sleeping Bear Dunes)

ELEMENT SOURCES

ndiana Dunes National Lakeshore Map Units Summary:

Indiana Dunes National Lakeshore Inventory Notes: One edge of Plot 85 is very wet, so species such as *Lythrum salicaria, Salix eriocephala*, and *Hypericum kalmianum* that are found there were omitted from the local description.

Indiana Dunes National Lakeshore Plots: INDU.VP085, INDU.VP103.

Local Description Author(s): N. Lehmann

Global Description Author(s): 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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III.B.2.N.e. Seasonally flooded cold-deciduous shrubland

A.986 Alnus incana Seasonally Flooded Shrubland Alliance

Speckled Alder Seasonally Flooded Shrubland Alliance

[CEGL002381] *Alnus incana* Swamp Shrubland

Translated Name: **Speckled Alder Swamp Shrubland**
Common Name: **Speckled Alder Swamp**
Ecological System(s):
Circumscription Confidence: 2 - Moderate
Concept Author(s): D. Faber-Langendoen, mod. S.C. Gawler

ELEMENT CONCEPT

Global Summary: This alder swamp community type 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,* but in the more southeastern portions of this type's range, *Alnus serrulata* can occur with *Alnus incana*. Where alder is not as dominant, other shrubs, such as *Cornus sericea, Ilex verticillata, Rubus idaeus, Salix* spp., *Spiraea alba, Spiraea tomentosa*, and *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*. The herbaceous layer contains species such as *Symphyotrichum lanceolatum var. lanceolatum (= Aster simplex), Symphyotrichum puniceum (= Aster puniceus), Calamagrostis canadensis, Caltha palustris, Carex lacustris, Carex prairea, Carex trisperma, Doellingeria umbellata (= Aster umbellatus), Eupatorium maculatum, Glyceria melicaria, Glyceria striata, Impatiens capensis, Lycopus uniflorus, Onoclea sensibilis, Osmunda cinnamomea, Rubus pubescens, Scirpus atrovirens, Symplocarpus foetidus, Thelypteris palustris, Typha* spp., and *Viola* spp. Mosses include *Climacium dendroides* and *Sphagnum* spp. Where the tall-shrub canopy is open, the graminoids can become dense. Scattered trees are found in many stands, including *Acer rubrum, Fraxinus nigra*, and *Thuja occidentalis*.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Palustrine
Indiana Dunes National Lakeshore Environment: This community was observed in a seasonally flooded to saturated site near a road. Hydrology may have been affected by road building.
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

Indiana Dunes National Lakeshore Vegetation: This swamp shrubland is strongly dominated by *Alnus incana* 2-5 m in height. Few other species were observed in the stand.
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*, but in the more southeastern portions of this type's range, *Alnus serrulata* can occur with *Alnus incana*. Where alder is not as dominant, other shrubs, such as *Cornus sericea, Ilex verticillata, Rubus idaeus, Salix* spp., *Spiraea alba, Spiraea tomentosa,* and *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*. The herbaceous layer contains species such as *Symphyotrichum lanceolatum var. lanceolatum (= Aster simplex), Symphyotrichum puniceum (= Aster puniceus), Calamagrostis canadensis, Caltha palustris, Carex lacustris, Carex prairea, Carex trisperma, Doellingeria umbellata (= Aster umbellatus), Eupatorium maculatum, Glyceria melicaria, Glyceria striata, Impatiens capensis, Lycopus uniflorus, Onoclea sensibilis, Osmunda cinnamomea, Rubus pubescens, Scirpus atrovirens, Symplocarpus foetidus, Thelypteris palustris, Typha* spp., and *Viola* spp. Mosses include *Climacium dendroides* and *Sphagnum* spp. Where the tall-shrub

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canopy is open, the graminoids can become dense. Scattered trees are found in many stands, including *Acer rubrum, Fraxinus nigra*, and *Thuja occidentalis*.

Global Dynamics:

INDIANA DUNES NATIONAL LAKESHORE FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform
Alnus incana	Tall shrub	Broad-leaved deciduous shrub

GLOBAL FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform
Alnus incana	Tall shrub	Broad-leaved deciduous shrub

INDIANA DUNES NATIONAL LAKESHORE OTHER NOTEWORTHY SPECIES

GLOBAL OTHER NOTEWORTHY SPECIES

CONSERVATION STATUS RANK

Global Rank & Reasons: G5. (June 25, 2006). This association is widely distributed and considered secure in many states

RELATED CONCEPTS

Global Similar Associations:

- *Alnus serrulata* Swamp Shrubland [CEGL005082]
- *Alnus incana – Cornus (amomum, sericea) / Clematis virginiana* Shrubland [CEGL006062]
- *Alnus incana ssp. rugosa – Nemopanthus mucronata / Sphagnum* spp. Shrubland [cegl006158]

Global Related Concepts:

CLASSIFICATION & OTHER COMMENTS

Indiana Dunes National Lakeshore Classification Comments: Though this association was only observed once, and no plot or accuracy assessment data were collected on it, the placement within the association is relatively easy. Strong dominance (>75% cover) in the canopy by *Alnus incana* is characteristic of this association.

Indiana Dunes National Lakeshore Other Comments:

Global Classification 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* stands in *Alnus serrulata* Swamp Shrubland (CEGL005082); that association is distinguished by somewhat more southern associates, including *Rhododendron viscosum, Lindera benzoin, Peltandra virginica*, etc.. With increasing tree canopy cover, this association can be similar to *Larix laricina* forest types, *Thuja occidentalis* saturated forest types, and *Fraxinus nigra - Acer rubrum* saturated forest types.

ELEMENT DISTRIBUTION

Indiana Dunes National Lakeshore Range: Only one stand of this association was found in the eastern part of the park near Beverly Shores.

Global Range: This alder swamp community type 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, IL, IN, MA, MB, ME, MI, MN, ND, NH, NJ?, NY, OH, ON, PA, VT, WI, WV

USFS Ecoregions: 212Cb:CCC, 212Da:CCC, 212Db:CCC, 212Dc:CCC, 212Fc:CCC, 212Ha:CCP, 212Hb:CCP, 212He:CCP, 212Hh:CCP, 212Hi:CCP, 212Hj:CCP, 212Hk:CCP, 212Hl:CCC, 212Hm:CCP, 212Hn:CCP, 212Ho:CCP, 212Hp:CCP, 212Hq:CCC, 212Hr:CCP, 212Hs:CCP, 212Ht:CCC, 212Hv:CCP, 212Hw:CCP, 212Hy:CCP, 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, Indiana Dunes, Isle Royale, Pictured Rocks, Saratoga, 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

Indiana Dunes National Lakeshore Map Units Summary:

Indiana Dunes National Lakeshore Inventory Notes: Only one occurrence of this association was noted in the INDU project area and not plots or accuracy assessment data were collected from that stand.

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Indiana Dunes National Lakeshore Plots:
Local Description Author(s): N. Lehmann
Global Description Author(s): D. Faber-Langendoen, mod. S.C. Gawler

References: Anderson 1982, Anderson and Schwegman 1991, Breden et al. 2001, Byers, Vanderhorst, and Streets 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 No date, MNNHP 1993, Midwestern Ecology Working Group No date, NDNHI No date, NRCS 2004, Ohmann and Ream 1971, Rentch 2003, Robinette 1966, Sperduto 2000b., Swain and Kearsley 2001, Thompson and Sorenson 2000, WNHIP No date, Walbridge1982, Walbridge and Lang 1982.

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III.B.2.N.e. Seasonally flooded cold-deciduous shrubland

A.989 *Cornus sericea* - *Salix* spp. Seasonally Flooded Shrubland Alliance

Red-osier Dogwood - Willow species Seasonally Flooded Shrubland Alliance

[CEGL002186] *Cornus sericea* - *Salix* spp. - (*Rosa palustris*) Shrubland

Translated Name: **Red-osier Dogwood - Willow species - (Swamp Rose) Shrubland**
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)
- Laurentian-Acadian Freshwater Marsh (CES201.594)

Circumscription Confidence: 2 - Moderate
Concept Author(s): D. Faber-Langendoen

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* spp., which collectively share dominance with *Cornus sericea*. Willow species include *Salix bebbiana, Salix discolor, Salix eriocephala, Salix interior, Salix fragilis*, and *Salix petiolaris*. Other shrub associates include *Cephalanthus occidentalis* (southeastward), *Cornus amomum, Ribes americanum, Rosa palustris* (more common eastward), *Rosa blanda* and *Rosa woodsii var. woodsii (= Rosa macounii)* (more common westward), *Rubus pubescens* (northward), *Rubus idaeus ssp. strigosus (= Rubus strigosus), Sambucus canadensis, Spiraea alba*, and *Viburnum lentago*. Woody vines present include *Clematis virginiana, Parthenocissus quinquefolia*, and *Toxicodendron radicans*. Characteristic herbs include *Asclepias incarnata, Symphyotrichum lanceolatum var. lanceolatum (= Aster simplex), Calamagrostis canadensis, Eupatorium maculatum, Glyceria striata (= Glyceria nervata), Impatiens capensis (= Impatiens biflora), Lycopus americanus, Lycopus uniflorus, Phalaris arundinacea, Solidago gigantea*, and *Thalictrum dasycarpum*. A variety of sedges may dominate more open stands, including *Carex lacustris* and *Carex stricta*. Tree species include *Acer rubrum, Fraxinus pennsylvanica*, and *Ulmus americana*.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Palustrine
Indiana Dunes National Lakeshore Environment: The dogwood - willow shrub swamp shrubland is on found seasonally flooded interdunal lowlands with silty loam and mucky soils. Hydrologic alterations (draining) and fire exclusion affect most of the occurrences of this community. Genetic studies indicate that the native species of *Typha* may no longer exist but are all *Typha X glauca* (Marburger, Mason, and Pavlovic, NPS, pers. comm.).
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

Indiana Dunes National Lakeshore Vegetation: This shrubland community has a tall (>2 m) shrub layer with about 25 to 90% cover; and trees, if present, are few. Common shrubs include *Cornus sericea ssp. sericea, Cornus obliqua, Rosa palustris, Salix petiolaris*, and *Salix interior*. *Spiraea alba, Toxicodendron vernix*, and *Viburnum prunifolium* are often present. Trees may include *Populus deltoides* or *Populus tremuloides*. The herbaceous layer is commonly composed of *Typha latifolia, Carex* spp., *Calamagrostis canadensis, Onoclea sensibilis*, and *Phragmites australis*. This community also supports state-imperiled *Salix serissima*.
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* spp., which collectively share dominance with *Cornus sericea*. Willow species include *Salix bebbiana, Salix discolor, Salix eriocephala, Salix exigua (= Salix interior), Salix fragilis*, and *Salix petiolaris*. Other shrubs associates include *Cephalanthus occidentalis* (southeastward), *Cornus amomum, Ribes americanum, Rosa palustris* (more common eastward), *Rosa blanda* and *Rosa woodsii var. woodsii (= Rosa macounii)* (more common westward), *Rubus pubescens* (northward), *Rubus idaeus ssp. strigosus (= Rubus strigosus), Sambucus canadensis, Spiraea alba*, and *Viburnum lentago*.

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Woody vines present include *Clematis virginiana, Parthenocissus quinquefolia,* and *Toxicodendron radicans*. Characteristic herbs include *Asclepias incarnata, Symphyotrichum lanceolatum var. lanceolatum (= Aster simplex), Calamagrostis canadensis, Eupatorium maculatum, Glyceria striata (= Glyceria nervata), Impatiens capensis (= Impatiens biflora), Lycopus americanus, Lycopus uniflorus, Phalaris arundinacea, Solidago gigantea,* and *Thalictrum dasycarpum*. A variety of sedges may dominate more open stands, including *Carex lacustris* and *Carex stricta*. Tree species include *Acer rubrum, Fraxinus pennsylvanica,* and *Ulmus americana* (Curtis 1959, White and Madany 1978, Chapman et al. 1989, Reschke 1990, MNNHP 1993, Harris et al. 1996).

Global Dynamics: Shrub swamps may naturally succeed herbaceous wet meadows as part of successional series in lakes and ponds. They may also originate from clearing of forested swamps (Curtis 1959), or draining of wet meadows (MNNHP 1993). Such open herbaceous meadows may first succeed to a shrubby meadow before becoming a dense shrub swamp. Infrequent fires may have maintained shrub swamps in the western part of the range, preventing tree canopy closure (MNNHP 1993).

INDIANA DUNES NATIONAL LAKESHORE FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform
Populus tremuloides	Tree canopy	Broad-leaved deciduous tree
Cornus obliqua	Tall shrub/sapling	Broad-leaved deciduous shrub
Cornus sericea ssp. *sericea*	Tall shrub/sapling	Broad-leaved deciduous shrub
Rosa palustris	Tall shrub/sapling	Broad-leaved deciduous shrub
Salix interior	Tall shrub/sapling	Broad-leaved deciduous shrub
Salix petiolaris	Tall shrub/sapling	Broad-leaved deciduous shrub
Spiraea alba	Tall shrub/sapling	Broad-leaved deciduous shrub
Viburnum prunifolium	Tall shrub/sapling	Broad-leaved deciduous shrub
Clematis virginiana	Herb (field)	Vine/Liana
Vitis riparia	Herb (field)	Vine/Liana
Calamagrostis canadensis	Herb (field)	Graminoid

GLOBAL FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform

INDIANA DUNES NATIONAL LAKESHORE OTHER NOTEWORTHY SPECIES

Cynoglossum officinale, Impatiens balsamina, Lonicera tatarica, Lonicera x *bella, Lysimachia nummularia, Mentha spicata, Rosa multiflora, Salix serissima*

GLOBAL OTHER NOTEWORTHY SPECIES

CONSERVATION STATUS RANK

Global Rank & Reasons: G5

RELATED CONCEPTS

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) =

CLASSIFICATION & OTHER COMMENTS

Indiana Dunes National Lakeshore Classification Comments:

Indiana Dunes National Lakeshore Other Comments:

Global Classification 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* and *Cornus* 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

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separate group (e.g., *Cornus amomum - Salix* spp. - *Toxicodendron vernix - Rhamnus lanceolata* Fen Shrubland (CEGL005087) and *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, Lindera benzoin, Viburnum dentatum, Viburnum lentago* (Bakowsky and Lee 1996, Lee et al. 1998). In New York, this type may occur on the Great Lakes plain.

ELEMENT DISTRIBUTION

Indiana Dunes National Lakeshore Range: This shrubland is found at the Cowles Bog, Keiser, and Miller Woods park units.
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, NY, OH, ON, PA, WI
USFS Ecoregions: 212Hb:CCP, 212He:CC?, 212Hh:CC?, 212Hi:CCC, 212Hj:CC?, 212Hl:CC?, 212Hm:CC?, 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

Indiana Dunes National Lakeshore Map Units Summary:
Indiana Dunes National Lakeshore Inventory Notes:
Indiana Dunes National Lakeshore Plots: INDU.VP026, INDU.VP027, INDU.VP028, INDU.VP029, INDU.VP030, INDU.VP074, INDU.VP151, INDU.VP178, INDU.AA016, INDU.AA191, INDU.AA259, INDU.AA319, INDU.AA353, INDU.AA469, INDU.AA473, INDU.AA482, INDU.AA492, INDU.AA559, INDU.AA569, INDU.AA735, INDU.AA742, INDU.AA753.
Local Description Author(s): N. Lehmann
Global Description Author(s): 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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III.B.2.N.f. Semipermanently flooded cold-deciduous shrubland

A.1011 *Cephalanthus occidentalis* Semipermanently Flooded Shrubland Alliance

Common Buttonbush Semipermanently Flooded Shrubland Alliance

[CEGL002190] *Cephalanthus occidentalis* / *Carex* spp. Northern Shrubland

Translated Name: **Common Buttonbush / Sedge species Northern Shrubland**
Common Name: **Northern Buttonbush Swamp**
Ecological System(s):

- North-Central Interior Wet Meadow-Shrub Swamp (CES202.701)
- North-Central Interior Wet Flatwoods (CES202.700)
- North-Central Interior Floodplain (CES202.694)
- Laurentian-Acadian Wet Meadow-Shrub Swamp (CES201.582)

Circumscription Confidence: 2 - Moderate
Concept Author(s): D. Faber-Langendoen

ELEMENT CONCEPT

Global Summary: This buttonbush swamp shrubland occurs throughout glaciated regions of the midwestern and northeastern United States and adjacent Canada. Stands occupy shallow water depressions, oxbow ponds, and backwater sloughs of stream and river floodplains. Inundation is usually continuous throughout the year, but these sites can become dry in mid or late summer or during periods of prolonged drought. Soils are deep (>100 cm) consisting of peat or muck over alluvial parent material. The shrub layer can vary from very open to closed (20-80%). *Cephalanthus occidentalis* typically comprises nearly 90% of the shrub layer in waters 1-2 m deep. Other shrubs commonly encountered include *Cornus sericea, Decodon verticillatus, Ilex verticillata, Rosa palustris,* and *Salix nigra*. The herbaceous layer can be very sparse, due to flooding. Rooted or floating aquatics may dominate, including *Lemna minor* and *Nuphar lutea ssp. advena*. Herbs present on the shallow margins include *Bidens frondosa, Boehmeria cylindrica, Carex lacustris, Glyceria striata,* and others. A scattered tree canopy may occur, including the following species: *Acer rubrum, Acer saccharinum, Fraxinus nigra, Fraxinus pennsylvanica,* and *Ulmus americana*. Diagnostic features include the dominance by *Cephalanthus occidentalis* in glaciated regions and, typically, the presence of standing water.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Palustrine
Indiana Dunes National Lakeshore Environment: The buttonbush swamp shrubland occurs on poorly drained silty and/or sandy loam, and muck soils. Stands are found in interdunal low areas and near rivers. These areas are usually inundated throughout the year, but some dry out during the summer. Hydrologic changes, such as ditching and draining and cultural activities, affect species densities and occurrences.
Global Environment: This wet shrubland community occupies shallow water depressions, oxbow ponds, and backwater sloughs of stream and river floodplains throughout swampy forested areas in glaciated terrain. Inundation is usually continuous throughout the year, but these sites can become dry in mid or late summer or during periods of prolonged drought (Faber-Langendoen and Maycock 1989). Soils are deep (>100 cm) consisting of peat or muck over alluvial parent material.

VEGETATION DESCRIPTION

Indiana Dunes National Lakeshore Vegetation: The density of the shrub layer varies from about 30 to 100% cover. *Cephalanthus occidentalis* can comprise 10-100% of the cover. Other shrubs that commonly occur are *Cornus sericea ssp. sericea, Decodon verticillatus, Rosa palustris, Salix nigra,* and *Ilex verticillata*. Scattered trees may include *Fraxinus americana* or *Fraxinus pennsylvanica, Acer rubrum* or *Acer saccharinum*, or *Populus tremuloides*. *Calamagrostis canadensis* dominates the herbaceous layer, which can be sparse to dense. *Carex crinita, Carex lupulina, Cicuta bulbifera, Rumex verticillatus,* and *Typha latifolia* are common. In standing water, *Lemna minor, Lemna trisulca*, and *Wolffia columbiana* may cover up to half the area. This community also supports state-vulnerable *Menyanthes trifoliata*.
Global Vegetation: The shrub layer can vary from very open to closed (20-80%). *Cephalanthus occidentalis* typically comprises nearly 90% of the shrub layer in waters 1-2 m deep. Other shrubs commonly encountered include *Cornus sericea, Decodon verticillatus, Ilex verticillata, Rosa palustris,* and *Salix nigra*. The herbaceous layer can be very sparse, due to flooding. Rooted or floating aquatics may dominate, including *Lemna minor* and *Nuphar lutea ssp. advena (= Nuphar advena).* Herbs present on the shallow margins include *Bidens frondosa, Boehmeria cylindrica, Carex lacustris, Glyceria striata*, and others. In Missouri *Hibiscus laevis (= Hibiscus militaris)* is common. A scattered tree canopy may occur, including the following species: *Acer rubrum, Acer saccharinum, Fraxinus nigra, Fraxinus pennsylvanica*, and *Ulmus americana* (Anderson 1996, Faber-Langendoen and Maycock 1989).
Global Dynamics:

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INDIANA DUNES NATIONAL LAKESHORE FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform
Populus tremuloides	Tree canopy	Broad-leaved deciduous tree
Salix nigra	Tree canopy	Broad-leaved deciduous tree
Cephalanthus occidentalis	Tall shrub/sapling	Broad-leaved deciduous shrub
Cornus sericea ssp. *sericea*	Tall shrub/sapling	Broad-leaved deciduous shrub
Decodon verticillatus	Tall shrub/sapling	Broad-leaved deciduous shrub
Rosa palustris	Tall shrub/sapling	Broad-leaved deciduous shrub
Bidens coronata	Herb (field)	Forb
Cicuta bulbifera	Herb (field)	Forb
Calamagrostis canadensis	Herb (field)	Graminoid
Carex crinita	Herb (field)	Graminoid
Carex lupulina	Herb (field)	Graminoid
Torreyochloa pallida var. *pallida*	Herb (field)	Graminoid
Typha latifolia	Herb (field)	Graminoid
Populus tremuloides	Herb (field)	Other herbaceous
Lemna minor	Floating aquatic	Aquatic herb (floating & submergent)
Lemna trisulca	Floating aquatic	Aquatic herb (floating & submergent)
Wolffia columbiana	Floating aquatic	Aquatic herb (floating & submergent)

GLOBAL FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform

INDIANA DUNES NATIONAL LAKESHORE OTHER NOTEWORTHY SPECIES

Agrostis gigantea, Lysimachia nummularia, Lythrum salicaria, Menyanthes trifoliata

GLOBAL OTHER NOTEWORTHY SPECIES

CONSERVATION STATUS RANK

Global Rank & Reasons: G4

RELATED CONCEPTS

Global Similar Associations:

- *Cephalanthus occidentalis - Decodon verticillatus* Shrubland (CEGL006069)--northeastern type.
- *Cephalanthus occidentalis / Carex* spp. - *Lemna* spp. Southern Shrubland (CEGL002191)--southern buttonbush swamp type.

Global Related Concepts:

CLASSIFICATION & OTHER COMMENTS

Indiana Dunes National Lakeshore Classification Comments: Genetic studies are beginning to indicate that the native species of *Typha* may no longer exist but are all *Typha X glauca* (Marburger, Mason, and Pavlovic, NPS, pers. comm.).

Indiana Dunes National Lakeshore Other Comments:

Global Classification Comments: The limits of glaciation used to define the southern boundary of this type include all glacial periods. It may, however, be more practical to use the ecoregion map divisions, such that the southern limit is approximately equal to the southern boundaries of Sections 251C, 222G, 222H and 221F. A rule as to the percentage dominance of *Cephalanthus occidentalis* (e.g., at least 50% cover) is probably needed to distinguish this type from dogwood-willow swamps. See also *Cephalanthus occidentalis - Decodon verticillatus* Shrubland (CEGL006069), found in Lower New England and the mid-Atlantic and central Appalachian regions of the eastern United States.

ELEMENT DISTRIBUTION

Indiana Dunes National Lakeshore Range: The buttonbush swamp shrubland environment and vegetation are common throughout the park.

Global Range: This buttonbush swamp shrubland occurs throughout glaciated regions of the midwestern and northeastern United States and adjacent Canada, ranging from northern Missouri north to southern Michigan, east to Ohio and southern Ontario, and south to Indiana and Illinois.

Nations: CA, US

States/Provinces: IA, IL, IN, MI, MO, NY, OH, ON, VT

USFS Ecoregions: 212Hv:CCC, 221Ec:CPP, 221Ed:CPP, 221Ef:CPP, 221Fa:CCC, 221Fc:CCC, 222Ga:CCC, 222Gb:CCC, 222Ge:CCC, 222Ha:CCC, 222Hb:CCC, 222Hf:CCP, 222Ib:CCC, 222Jb:CCC, 222Jc:CCC, 222Jh:CCC, 222Ji:CCC, 222Jj:CCC, 222Kg:CCC, 222Kh:CCC, 222Kj:CCC, 251Cc:CCC, 251Cf:CCC, 251Cj:CCC, 251Ck:CCC, 251Dd:CCP, 251De:CCP, 251Dg:CCC, 251Dh:CCP, M221:P

Federal Lands: NPS (Effigy Mounds, Indiana Dunes); USFWS (Iroquois)

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ELEMENT SOURCES

Indiana Dunes National Lakeshore Map Units Summary:

Indiana Dunes National Lakeshore Inventory Notes:

Indiana Dunes National Lakeshore Plots: INDU.VP023, INDU.VP051, INDU.VP071, INDU.VP140, INDU.VP142, INDU.VP165, INDU.AA021, INDU.AA036, INDU.AA079, INDU.AA086, INDU.AA091, INDU.AA135, INDU.AA199, INDU.AA214, INDU.AA237, INDU.AA252, INDU.AA258, INDU.AA307, INDU.AA343, INDU.AA361, INDU.AA380, INDU.AA405, INDU.AA449, INDU.AA467, INDU.AA493, INDU.AA527, INDU.AA601, INDU.AA622, INDU.AA650, INDU.AA721.

Local Description Author(s): N. Lehmann

Global Description Author(s): D. Faber-Langendoen

References: Anderson 1996, Chapman et al. 1989, Faber-Langendoen and Maycock 1989, Midwestern Ecology Working Group n.d.

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V. Herbaceous Vegetation

V.A.5.N.a. Tall sod temperate grassland

A.1198 *Schizachyrium scoparium - Sorghastrum nutans* Herbaceous Alliance

Little Bluestem - Yellow Indiangrass Herbaceous Alliance

[CEGL002210] *Schizachyrium scoparium - Sorghastrum nutans - Andropogon gerardii - Lespedeza capitata* Sand Herbaceous Vegetation

Translated Name: **Little Bluestem - Yellow Indiangrass - Big Bluestem - Roundhead Bushclover Sand Herbaceous Vegetation**

Common Name: **Midwest Dry-Mesic Sand Prairie**

Ecological System(s):

- North-Central Interior Sand and Gravel Tallgrass Prairie (CES202.695)

Circumscription Confidence: 2 - Moderate

Concept Author(s): J. Drake

ELEMENT CONCEPT

Global Summary: This dry-mesic sand bluestem prairie community is found in the upper midwestern United States and adjacent Canada. Stands occur on flat to moderately sloping sites with sand, loamy sand, or, rarely, sandy loam soils. The deep, well-drained soils formed from eolian sand, glacial outwash, old dunes, alluvium, or sandy glacial lakeplains. Sparse to moderately dense mid and tall grasses dominate the community. Forbs do not contribute greatly to vegetation cover but forb diversity is generally moderate to high. The most abundant species in this community are *Andropogon gerardii, Carex* spp., *Schizachyrium scoparium, Sorghastrum nutans*, and *Hesperostipa spartea (= Stipa spartea)*. Other common species include *Liatris aspera, Lespedeza capitata, Lithospermum caroliniense, Symphyotrichum ericoides (= Aster ericoides)*, and *Dalea villosa*. Woody species tolerant of dry conditions, such as *Salix humilis, Populus tremuloides*, and *Acer rubrum*, are sometimes found in this community.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Terrestrial

Indiana Dunes National Lakeshore Environment: This sand prairie community is found in interdunal upland plains. Soil is dry-mesic to wet-mesic loamy sand and moderately well-drained. In the East units of the park, these areas have been highly impacted by human activities and may no longer exist, though there are stands where *Schizachyrium scoparium* and prairie associates have been planted.

Global Environment: This community is found on flat to moderately sloping sites with sand, loamy sand, or, rarely, sandy loam soils (White and Madany 1978, MNNHP 1993). The deep, well-drained soils formed from eolian or alluvial sand south of the limit of glaciation and also from glacial outwash, old dunes, alluvium, or sandy glacial lakeplains (Chapman 1984, Nelson 1985).

VEGETATION DESCRIPTION

Indiana Dunes National Lakeshore Vegetation: The total vegetative cover is 80-90% and mostly herbaceous. *Schizachyrium scoparium, Sorghastrum nutans*, and *Panicum virgatum* are the dominant grasses. In wetter pockets, *Calamagrostis canadensis* dominates. Copses of *Populus tremuloides* and/or *Salix* spp. are scattered throughout. Common forbs include species of *Euthamia, Lespedeza, Liatris, Spiraea*, and *Symphyotrichum. Baptisia alba var. macrophylla (= Baptisia leucantha), Coreopsis tripteris, Eryngium yuccifolium*, and *Euphorbia corollata* are scattered in the community. Other common herbaceous species include *Andropogon gerardii, Hesperostipa spartea (= Stipa spartea), Potentilla arguta*, and *Sporobolus heterolepis*. *Amorpha canescens* is a common subshrub. Woody species occur but are not common in high-quality examples of this community (Curtis 1959, Nelson 1985, MNNHP 1993). This community also supports state-vulnerable *Ammophila breviligulata*.

Global Vegetation: Sparse to moderately dense mid and tall grasses dominate this community. Forbs do not contribute greatly to vegetation cover, but forb diversity is generally moderate to high (MNNHP 1993). The most abundant species in this community are *Andropogon gerardii, Carex* spp., *Schizachyrium scoparium, Sorghastrum nutans*, and *Hesperostipa spartea (= Stipa spartea)*. Other common species include *Liatris aspera, Lespedeza capitata, Lithospermum caroliniense, Symphyotrichum ericoides (= Aster ericoides)*, and *Dalea villosa*. Woody species tolerant of dry conditions, such as *Salix humilis, Populus tremuloides*, and *Acer rubrum*, are sometimes found in this community.

Global Dynamics:

INDIANA DUNES NATIONAL LAKESHORE FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform
Populus tremuloides	Tall shrub/sapling	Broad-leaved deciduous tree

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Cornus racemosa	Tall shrub/sapling	Broad-leaved deciduous shrub
Rubus flagellaris	Tall shrub/sapling	Broad-leaved deciduous shrub
Liatris spicata	Herb (field)	Forb
Pycnanthemum virginianum	Herb (field)	Forb
Stachys hyssopifolia	Herb (field)	Forb
Calamagrostis canadensis	Herb (field)	Graminoid
Panicum virgatum	Herb (field)	Graminoid
Schizachyrium scoparium	Herb (field)	Graminoid
Sorghastrum nutans	Herb (field)	Graminoid
Osmunda regalis var. *spectabilis*	Herb (field)	Fern or fern ally
Thelypteris palustris	Herb (field)	Fern or fern ally

GLOBAL FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform

INDIANA DUNES NATIONAL LAKESHORE OTHER NOTEWORTHY SPECIES

Agrostis gigantea, Ammophila breviligulata, Asparagus officinalis, Lonicera x *bella, Verbascum thapsus*

GLOBAL OTHER NOTEWORTHY SPECIES

CONSERVATION STATUS RANK

Global Rank & Reasons: G3 There are probably fewer than 100 occurrences rangewide. Sixty-three have been documented: 35 in Indiana (where the community is ranked S3), 19 in Illinois (S2), and 9 in Minnesota (S1,S2,S1). Although no other occurrences have been documented, the community is also reported from Michigan (S1), Ontario (S?), and possibly Wisconsin (SP) and has been virtually extirpated from Missouri (database record as SX, but there is now one site - Steyermark sand prairie - that contains this type). It occurs in 13 ecoregional subsections. There are probably fewer than 10,000 acres rangewide. Sizes are known for 40 occurrences, totaling 2600 acres. Lack of fire may permit more woody species to invade this community.

RELATED CONCEPTS

Global Similar Associations:

- *Quercus alba - (Quercus velutina) / Lespedeza virginica - Eupatorium hyssopifolium* Woodland (CEGL006433)
- *Schizachyrium scoparium - Danthonia spicata - Carex pensylvanica - (Viola pedata)* Herbaceous Vegetation (CEGL002318)
- *Schizachyrium scoparium - Hesperostipa spartea - Bouteloua (curtipendula, gracilis)* Sand Herbaceous Vegetation (CEGL005204)
- *Schizachyrium scoparium - Sorghastrum nutans - Hypoxis hirsuta - Baptisia tinctoria* Herbaceous Vegetation (CEGL006187)

Global Related Concepts:

- Dry-Mesic Sand Prairie (Nelson 1985) B
- Dry-mesic Sand Prairie (Chapman et al. 1989) =
- Mesic Sand Prairie (Chapman 1984) =

CLASSIFICATION & OTHER COMMENTS

Indiana Dunes National Lakeshore Classification Comments: The community exists in the large sand-mined areas at the West Beach and Inland Marsh park units. Small areas with similar species are associated with the black oak forest and lupine barrens communities.

Indiana Dunes National Lakeshore Other Comments: The year of sampling (2005) was very dry and few forbs were flowering.

Global Classification Comments: In Minnesota, the distinction between a dry versus dry-mesic sand prairie is not clear; thus their dry prairie, barrens subtype is listed here and with *Schizachyrium scoparium - Danthonia spicata - Carex pensylvanica - (Viola pedata)* Herbaceous Vegetation (CEGL002318). In Minnesota, the NW and Central barrens subtypes are also placed with *Schizachyrium scoparium - Hesperostipa spartea - Bouteloua (curtipendula, gracilis)* Sand Herbaceous Vegetation (CEGL005204). Finally, this type should be compared with *Schizachyrium scoparium - Sorghastrum nutans - Hypoxis hirsuta - Baptisia tinctoria* Herbaceous Vegetation (CEGL006187), found on Long Island, New York. This type could be in northern Missouri in the upper Mississippi River region.

ELEMENT DISTRIBUTION

Indiana Dunes National Lakeshore Range: This sand prairie community is found in the Tolleston, Inland Marsh, West Beach, Cowles Bog, and Visitor Center units.

Global Range: This dry-mesic sand bluestem prairie community is found in the upper midwestern United States.

Nations: CA, US

States/Provinces: IL, IN, MI, MN, MO, OH, ON, WI

USFS Ecoregions: 212Hu:CPP, 212Hy:CPP, 212Jg:CCC, 212Kb:CCC, 212Mb:C??, 212Nc:CCC, 221Eg:CCC, 221Fa:CCC, 222If:CCC, 222Jh:CCC, 222Ji:CCC, 222Jj:CCC, 222Kg:CCC, 222Kh:CCC, 222Ki:CCC, 222Kj:CCC, 222La:CCC, 222Lb:CCC,

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222Lc:CCC, 222Lf:CCC, 222Mb:CCC, 222Mc:CCC, 222Md:CCC, 232:?, 251Cf:CCC, 251Ci:CCC, 251Da:CCC, 251Dd:CCC, 251Df:CCC, 251Dg:CCC, 251Dh:CCC

Federal Lands: NPS (Indiana Dunes, Saint Croix); USFS (Huron-Manistee, Manistee)

ELEMENT SOURCES

Indiana Dunes National Lakeshore Map Units Summary:

Indiana Dunes National Lakeshore Inventory Notes: Numerous species could not be identified due to the lack of reproductive structures.

Indiana Dunes National Lakeshore Plots: INDU.VP062, INDU.VP147, INDU.VP182, INDU.VP183, INDU.AA089, INDU.AA117, INDU.AA213, INDU.AA251, INDU.AA332, INDU.AA378, INDU.AA388, INDU.AA397, INDU.AA419, INDU.AA516, INDU.AA550, INDU.AA566, INDU.AA607, INDU.AA631, INDU.AA638, INDU.AA665, INDU.AA715, INDU.AA754.

Local Description Author(s): N. Lehmann

Global Description Author(s): J. Drake

References: Anderson 1982, Anderson 1996, Chapman 1984, Chapman et al. 1989, Curtis 1959, Homoya et al. 1988, MNNHP 1993, Midwestern Ecology Working Group n.d., Nelson 1985, WNHIP unpubl. data, White and Madany 1978

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V.A.5.N.c. Medium-tall sod temperate or subpolar grassland

A.1207 *Ammophila breviligulata* Herbaceous Alliance

American Beachgrass Herbaceous Alliance

[CEGL005098] *Ammophila breviligulata* - (*Schizachyrium scoparium*) Herbaceous Vegetation

Translated Name: **American Beachgrass - (Little Bluestem) Herbaceous Vegetation**
Common Name: **Great Lakes Beachgrass Dune**
Ecological System(s):
- Great Lakes Dune (CES201.026)
- Great Lakes Wooded Dune and Swale (CES201.726)

Circumscription Confidence: 2 - Moderate
Concept Author(s): P. Comer

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* (or in the eastern part of the range *Ammophila champlainensis*); erosional areas, such as slacks in blowouts and dune fields, by *Calamovilfa longifolia*; and stabilized areas by *Schizachyrium scoparium*. In dune fields and on the most stable dune ridges, especially around northern Lake Michigan and Lake Huron, low evergreen shrubs (*Arctostaphylos uva-ursi, Juniperus communis, Juniperus horizontalis*) occupy dune crests and also the ground layer in the savanna edge of dunes; elsewhere, deciduous shrubs are dominant, including *Prunus pumila, Salix cordata* and *Salix myricoides (= Salix glaucophylloides)*. These two shrubby phases are separated from this open grassland type, but could be treated as phases of this type.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Terrestrial
Indiana Dunes National Lakeshore Environment: The beachgrass dune community is located at the top and sides of young dunes near the shoreline of southern Lake Michigan. Soil is sand with little organic matter and very well-drained.
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

Indiana Dunes National Lakeshore Vegetation: This community is comprised almost exclusively of *Ammophila breviligulata* (state-vulnerable) on active dunes near the beaches. *Calamovilfa longifolia* is an important component on slightly stabilized dunes and is the dominant species on eroded dunal areas farther from the beach. On somewhat stabilized dunes, *Schizachyrium scoparium* increases in importance. Common species in this community include *Artemisia campestris ssp. caudata, Asclepias syriaca*, and *Lithospermum caroliniense var. croceum*. Woody species that may be found are *Vitis riparia, Populus deltoides, Ptelea trifoliata var. mollis*, and *Salix eriocephala*. Non-indigenous species found here are *Poa compressa* and *Saponaria officinalis*. In addition, this community supports state-imperiled *Catalpa speciosa, Juncus balticus var. littoralis, Prunus pensylvanica*, and *Symphyotrichum oblongifolium*, and state-vulnerable *Hypericum kalmianum*.
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 (= Ammophila champlainensis*); erosional areas, such as slacks in blowouts and dune fields, by *Calamovilfa longifolia*; and stabilized areas by *Schizachyrium scoparium*. In dune fields and on the most stable dune ridges, especially around northern Lake Michigan and Huron, low evergreen shrubs (*Arctostaphylos uva-ursi, Juniperus communis, Juniperus horizontalis*) occupy dune crests and also the ground layer in the savanna edge of dunes; elsewhere, deciduous shrubs are dominant, including *Prunus pumila, Salix cordata* and *Salix myricoides (= Salix glaucophylloides)*. These two shrubby phases are separated from this open grassland type, but could be treated as phases of this type.
Global Dynamics: Dynamic tension exists at the forest edge where trees invade dune fields, often creating wind-stressed savanna, typically oak-pine in the south, pine-conifer in the north. When lake levels go down and beach and dune area increases lakeward, wind speed and sand abrasion decrease in the savanna edge, permitting forest development.

INDIANA DUNES NATIONAL LAKESHORE FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform
Ammophila breviligulata	Herb (field)	Graminoid

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Calamovilfa longifolia	Herb (field)	Graminoid
Schizachyrium scoparium	Herb (field)	Graminoid

GLOBAL FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform

INDIANA DUNES NATIONAL LAKESHORE OTHER NOTEWORTHY SPECIES

Ailanthus altissima, Alliaria petiolata, Ammophila breviligulata, Catalpa speciosa,Centaurea biebersteinii, Hypericum kalmianum, Juncus balticus var. *littoralis, Poa compressa, Populus nigra, Prunus pensylvanica, Rubus laciniatus, Saponaria officinalis, Symphyotrichum oblongifolium*

GLOBAL OTHER NOTEWORTHY SPECIES

Cirsium pitcheri

CONSERVATION STATUS RANK

Global Rank & Reasons: G3G5

RELATED CONCEPTS

Global Similar Associations:
- *Cakile edentula* Great Lakes Shore Sparse Vegetation (CEGL005162)
- *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

CLASSIFICATION & OTHER COMMENTS

Indiana Dunes National Lakeshore Classification Comments:
Indiana Dunes National Lakeshore Other Comments:
Global Classification Comments: Perhaps 25-35% of Great Lakes dune species grow in maritime dunes (e.g., *Cakile edentula, Ammophila breviligulata, Hudsonia tomentosa, Lathyrus japonicus var. maritimus (= Lathyrus maritimus)*), but the many western species (such as *Schizachyrium scoparium*) set Great Lakes dunes apart (as do its endemic plants, such as *Cirsium pitcheri*). In Vermont (Lake Champlain) and New York (eastern Lake Ontario) the dunes apparently contain *Ammophila champlainensis* instead of *Ammophila breviligulata.* 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).

ELEMENT DISTRIBUTION

Indiana Dunes National Lakeshore Range: This beachgrass dune community is found near the Lake Michigan shoreline in both East and West park units.
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
USFS Ecoregions: 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

Indiana Dunes National Lakeshore Map Units Summary:
Indiana Dunes National Lakeshore Inventory Notes:
Indiana Dunes National Lakeshore Plots: INDU.VP004, INDU.VP050, INDU.VP057, INDU.VP058, INDU.VP059, INDU.VP098, INDU.VP099, INDU.AA067, INDU.AA077, INDU.AA247, INDU.AA282, INDU.AA321, INDU.AA352, INDU.AA387, INDU.AA476, INDU.AA521, INDU.AA554, INDU.AA679, INDU.AA695, INDU.AA701, INDU.AA733, INDU.AA749, INDU.AA755.
Local Description Author(s): N. Lehmann
Global Description Author(s): P. Comer

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References: Cowardin et al. 1979, Midwestern Ecology Working Group n.d., Thompson 1996, Thompson and Sorenson 2000, WNHIP unpubl. Data

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V.A.5.N.c. Medium-tall sod temperate or subpolar grassland

A.1224 *Schizachyrium scoparium* - (*Sporobolus cryptandrus*) Herbaceous Alliance

Little Bluestem - (Sand Dropseed) Herbaceous Alliance

[CEGL005099] ***Schizachyrium scoparium - Carex tonsa var. rugosperma - Carex muehlenbergii - Lithospermum caroliniense - Opuntia humifusa*** **Herbaceous Vegetation**

Translated Name: **Little Bluestem - Parachute Sedge - Muhlenberg's Sedge - Plains Puccoon - Eastern Prickly-pear Herbaceous Vegetation**

Common Name: **Midwest Sand Barrens**

Ecological System(s):

Circumscription Confidence: 3 - Weak

Concept Author(s): D. Faber-Langendoen

ELEMENT CONCEPT

Global Summary: This community is widespread throughout the midwestern region of the United States, where it is found on a variety of sandy soils. Stands can occur on steep slopes on sandy outwash, sandy lakeplains, and alluvial deposits along rivers and streams. They may occur on sand ridges (including inland dunes and sandy areas of coarse-textured end moraines), particularly on blowouts. Soils are well-drained to excessively drained, coarse-textured sands, loamy sands, and sandy loams. Gravels are very minor. Soils generally lack a dark A horizon, and the upper horizons can be somewhat acidic. Graminoids dominate the herbaceous layer, which is often very open. Dominant and characteristic graminoids include *Carex siccata (= Carex foenea), Carex muehlenbergii, Carex tonsa var. rugosperma (= Carex rugosperma), Cyperus lupulinus, Cyperus schweinitzii, Aristida basiramea, Aristida tuberculosa, Dichanthelium ovale var. addisonii (= Dichanthelium commonsianum), Koeleria macrantha, Schizachyrium scoparium, Sporobolus cryptandrus*, and *Hesperostipa spartea (= Stipa spartea)*. *Calamovilfa longifolia* may be prominent in more open dune ridges. Characteristic forbs include *Antennaria plantaginifolia, Lithospermum caroliniense, Penstemon grandiflorus*, and *Solidago nemoralis*. Other associated herbs include *Asclepias tuberosa, Dalea villosa, Euphorbia corollata, Krigia virginica*, and *Lupinus perennis*. *Hudsonia tomentosa* is more often restricted to local disturbances such as blowouts or slipfaces. Shrubs or shrub-like species include *Salix humilis* and *Opuntia humifusa*.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Terrestrial

Indiana Dunes National Lakeshore Environment: Stands of this sand barrens community are found on interdunal sand plains and steep dunes. Soils are rapidly drained sand with little organic matter.

Global Environment: Stands can occur on steep slopes on sandy outwash, sandy lakeplains, and alluvial deposits along rivers and streams. They may occur on sand ridges (including inland dunes and sandy areas of coarse-textured end moraines), particularly on blowouts. Soils are well-drained to excessively drained, coarse-textured sands, loamy sands, and sandy loams. Gravels are very minor. Soils generally lack a dark A horizon and the upper horizons can be somewhat acidic (Curtis 1959, MNNHP 1993, Anderson 1996).

VEGETATION DESCRIPTION

Indiana Dunes National Lakeshore Vegetation: Vegetation cover is patchy; bare sand is interspersed with clumps of vines (mostly *Celastrus scandens, Toxicodendron radicans, Vitis riparia*, and *Vitis vinifera*); trees such as *Juniperus virginiana, Populus deltoides, Populus tremuloides*, or *Quercus velutina* are very sparse and stunted. More vegetated parts of the community are dominated by *Schizachyrium scoparium*, but *Calamovilfa longifolia* and *Sporobolus cryptandrus* are very common. Few individual plants of a wide range of herbaceous species grow among these grasses, such as *Dichanthelium villosissimum var. villosissimum (= var. pseudopubescens), Solidago simplex var. gillmanii (= Solidago racemosa var. gillmanii), Artemisia campestris ssp. caudata, Euphorbia corollata, Lithospermum caroliniense var. croceum, Opuntia humifusa, Ammophila breviligulata, Koeleria macrantha*, and *Tradescantia ohiensis*. Non-indigenous species found include *Lonicera tatarica, Robinia pseudoacacia, Bromus tectorum, Poa pratensis, Rumex acetosella*, and *Verbascum thapsus*. In addition, this community supports state-imperiled *Arctostaphylos uva-ursi, Dichanthelium wilcoxianum, Juniperus communis, Prunus pensylvanica*, and *Rhus aromatica var. arenaria*, and state-vulnerable *Ammophila breviligulata*.

Global Vegetation: Graminoids dominate the herbaceous layer, which is often very open. Dominant and characteristic graminoids include *Carex siccata (= Carex foenea), Carex muehlenbergii, Carex tonsa var. rugosperma (= Carex rugosperma), Cyperus lupulinus, Cyperus schweinitzii, Aristida basiramea, Aristida tuberculosa, Dichanthelium ovale var. addisonii (= Dichanthelium commonsianum), Koeleria macrantha, Schizachyrium scoparium, Sporobolus cryptandrus*, and *Hesperostipa spartea (= Stipa spartea)*. *Calamovilfa longifolia* may be prominent in more open dune ridges. Characteristic forbs include *Antennaria plantaginifolia, Lithospermum caroliniense, Penstemon grandiflorus*, and *Solidago nemoralis*. Other associated herbs include *Asclepias tuberosa, Dalea villosa, Euphorbia corollata, Krigia virginica*, and *Lupinus perennis*. *Hudsonia tomentosa* is more often restricted to local

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disturbances such as blowouts or slipfaces. Shrubs or shrub-like species include *Salix humilis* and *Opuntia humifusa* (Curtis 1959, MNNHP 1993, Anderson 1996, Schneider and Cochrane 1997).

Global Dynamics: Windstorms can create blowouts.

INDIANA DUNES NATIONAL LAKESHORE FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform
Rhus aromatica var. *arenaria*	Tall shrub/sapling	Broad-leaved deciduous shrub
Arctostaphylos uva-ursi	Herb (field)	Dwarf-shrub
Opuntia humifusa	Herb (field)	Succulent shrub
Celastrus scandens	Herb (field)	Vine/Liana
Toxicodendron radicans	Herb (field)	Vine/Liana
Vitis riparia	Herb (field)	Vine/Liana
Arabis lyrata	Herb (field)	Forb
Artemisia campestris ssp. *caudata*	Herb (field)	Forb
Euphorbia corollata	Herb (field)	Forb
Liatris aspera	Herb (field)	Forb
Solidago simplex var. *gillmanii*	Herb (field)	Forb
Tradescantia ohiensis	Herb (field)	Forb
Ammophila breviligulata	Herb (field)	Graminoid
Bromus tectorum	Herb (field)	Graminoid
Dichanthelium villosissimum var. *villosissimum*	Herb (field)	Graminoid
Koeleria macrantha	Herb (field)	Graminoid
Schizachyrium scoparium	Herb (field)	Graminoid
Sporobolus cryptandrus	Herb (field)	Graminoid
Equisetum hyemale	Herb (field)	Fern or fern ally

GLOBAL FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform

INDIANA DUNES NATIONAL LAKESHORE OTHER NOTEWORTHY SPECIES

Ailanthus altissima, Ammophila breviligulata, Arctostaphylos uva-ursi, Bromus tectorum, Dichanthelium wilcoxianum, Juniperus communis, Lonicera tatarica, Prunus pensylvanica, Rhus aromatica var. *arenaria, Rumex acetosella, Verbascum thapsus, Vitis vinifera, Vulpia myuros*

GLOBAL OTHER NOTEWORTHY SPECIES

CONSERVATION STATUS RANK

Global Rank & Reasons: G2G3 There are probably fewer than 100 occurrences of this community rangewide. It is reported from Ohio (where it is ranked S2), Indiana (S2), and Wisconsin (SU), and it may also occur in Illinois. Currently 7 occurrences have been documented from Indiana and Ohio. No data on current acreage are available, but there are probably less than 10,000 acres rangewide (assuming most occurrences are less than 100 acres). Historical acreage and trends are unknown, but it seems likely that some areas of this community have been destroyed by agricultural and residential development.

RELATED CONCEPTS

Global Similar Associations:

- *Corylus americana - Salix humilis / Schizachyrium scoparium* Shrubland (CEGL005072)
- *Pteridium aquilinum - Bromus kalmii* Herbaceous Vegetation (CEGL005142)
- *Schizachyrium scoparium - Bouteloua curtipendula* Gravel Herbaceous Vegetation (CEGL002215)
- *Schizachyrium scoparium - Danthonia spicata - Carex pensylvanica - (Viola pedata)* Herbaceous Vegetation (CEGL002318)
- *Schizachyrium scoparium - Hesperostipa spartea - Bouteloua (curtipendula, gracilis)* Sand Herbaceous Vegetation (CEGL005204)

Global Related Concepts:

- Oak Barrens (Anderson 1996) B
- Sand Barrens (Anderson 1982) =

CLASSIFICATION & OTHER COMMENTS

Indiana Dunes National Lakeshore Classification Comments: Recent genetic analyses suggest widespread hybridization between the native *Celastrus scandens* and the highly invasive nonnative *Celastrus orbiculata* that may be undetectable in the field (Pavlovic, NPS, pers. comm.). The patchy character described for this community requires observation at the scale of at least a hectare.

Indiana Dunes National Lakeshore Other Comments:

Global Classification Comments: In Minnesota, relation to the Minnesota Dry Prairie, barrens subtype in southeastern and central Minnesota needs clarification. The Minnesota type is currently crosswalked to *Schizachyrium scoparium - Danthonia spicata - Carex*

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pensylvanica - (Viola pedata) Herbaceous Vegetation (CEGL002318), but appears to be more like a sand barrens type. Separation of this type from sand prairie (CEGL002318) or even sand-gravel prairie, *Schizachyrium scoparium - Bouteloua curtipendula* Gravel Herbaceous Vegetation (CEGL002215), may be difficult. They may represent a later successional stage, with the sand barrens originating when exposed areas of sandy or sandy/gravelly substrates are created, either by wind or human clearing, and the sand prairies and gravel prairies succeeding them (Curtis 1959, Anderson 1996). Thus, it's possible that the sand barrens type can be combined into those two types. In general sand barrens occur on more dune-like habitats, coarse floodplain outwash, or on formerly plowed sand prairies, and sands may still move. Sand prairies occur on more stable sandy soils. Potential diagnostic species for sand prairies may be *Lithospermum canescens* and *Viola pedata*. Potential diagnostic species for sand barrens are *Cyperus lupulinus ssp. lupulinus (= Cyperus filiculmis), Cyperus schweinitzii, Carex muehlenbergii, Lithospermum caroliniense, Opuntia humifusa*, and *Sporobolus cryptandrus*. *Solidago nemoralis* is common, as are lichens.

ELEMENT DISTRIBUTION

Indiana Dunes National Lakeshore Range: The sand barrens community is well-developed at the West Beach park unit, east and west of the parking lot. It can also be found near the beach in the Keiser unit.
Global Range: This community is widespread throughout the midwestern region of the United States, where it is found on a variety of sandy soils, ranging from perhaps southeast and central Minnesota east to Ohio.
Nations: US
States/Provinces: IL, IN, MN, OH, WI
USFS Ecoregions: 222Hf:CCC, 222If:CCC, 222Ig:CCC, 222Jj:CCC, 251:?
Federal Lands: NPS (Indiana Dunes)

ELEMENT SOURCES

Indiana Dunes National Lakeshore Map Units Summary:
Indiana Dunes National Lakeshore Inventory Notes:
Indiana Dunes National Lakeshore Plots: INDU.VP005, INDU.VP044, INDU.VP048, INDU.VP049, INDU.VP083, INDU.VP084, INDU.VP113, INDU.VP114, INDU.VP117, INDU.VP118, INDU.VP120, INDU.VP134, INDU.VP158, INDU.AA106, INDU.AA160, INDU.AA221, INDU.AA235, INDU.AA691, INDU.AA726a.
Local Description Author(s): N. Lehmann
Global Description Author(s): D. Faber-Langendoen
References: Anderson 1982, Anderson 1996, Curtis 1959, MNNHP 1993, Midwestern Ecology Working Group n.d., ONHD unpubl. data, Schneider and Cochrane 1997, WNHIP unpubl. Data

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V.A.5.N.j. Temporarily flooded temperate or subpolar grassland

A.1347 *Spartina pectinata* Temporarily Flooded Herbaceous Alliance

Prairie Cordgrass Temporarily Flooded Herbaceous Alliance

[CEGL005109] *Spartina pectinata* - *Carex* spp. - *Calamagrostis canadensis* Lakeplain Herbaceous Vegetation

Translated Name: **Prairie Cordgrass - Sedge species - Bluejoint Lakeplain Herbaceous Vegetation**
Common Name: **Lakeplain Wet Prairie**
Ecological System(s):
- Great Lakes Wet-Mesic Lakeplain Prairie (CES202.027)

Circumscription Confidence: 2 - Moderate
Concept Author(s): J. Drake

ELEMENT CONCEPT

Global Summary: This wet lakeland prairie grassland community is found in the southern Great Lakes region of the midwestern United States. Stands occur on level, sandy glacial outwash, sandy glacial lakeplains, and deposits of dune sand in silty/clayey glacial lakeplains. There is often a clay layer below the surface that results in temporary flooding in the winter and spring and drought in the summer and fall. The soil is neutral to somewhat alkaline. Average vegetation height is 1-2 m with little bare ground exposed. The dominant species are graminoids, although forbs and small trees and shrubs are common. *Calamagrostis canadensis, Carex aquatilis, Carex pellita (= Carex lanuginosa),* and *Spartina pectinata* are typical dominants. *Andropogon gerardii, Symphyotrichum ericoides (= Aster ericoides), Juncus balticus, Panicum virgatum, Oligoneuron ohioense (= Solidago ohioensis),* and *Sorghastrum nutans* are all common components of this community. The shrubs *Cornus sericea* and *Dasiphora fruticosa ssp. floribunda (= Pentaphylloides floribunda),* and small *Fraxinus pennsylvanica* and *Populus deltoides* trees may also be found.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Palustrine
Indiana Dunes National Lakeshore Environment: Stands of the wet lakeland prairie grassland occur in lowland depressions and drawdown lake areas. Soils are loamy or silty loam sand and are often flooded in the spring and dry in summer. Hydrologic disturbance is common. Some of the occurrences have large amounts of *Phalaris arundinacea* and/or *Solidago* spp.
Global Environment: This community occurs on level, sandy glacial outwash, sandy glacial lakeplains, and deposits of dune sand in silty/clayier glacial lakeplains. Soils are sandy or sandy loam soil, rarely with clay or silt loam. There is often a clay layer below the surface that impedes drainage and prevents groundwater from moving to the surface (Comer et al. 1995b). These conditions result in temporary flooding in the winter and spring and drought in the summer and fall. The soil is neutral to somewhat alkaline (Chapman 1984). The subsurface clay was deposited on the beds of glacial lakes, whereas the sand was deposited on lake beaches or by alluvial processes (Comer et al. 1995b).

VEGETATION DESCRIPTION

Indiana Dunes National Lakeshore Vegetation: Vegetation is predominantly graminoids 1-2 m in height. *Calamagrostis canadensis* is usually the dominant grass, though *Spartina pectinata* can be common in Hoosier Prairie. Shrubs such as *Apocynum androsaemifolium, Cornus racemosa, Salix eriocephala, Salix interior,* and *Salix petiolaris* may be present. *Symphyotrichum ericoides var. ericoides, Sorghastrum nutans,* and *Solidago* spp. also occur. Aggressive species of *Solidago* or *Phalaris arundinacea* may dominate some stands. This community also supports state-imperiled *Juncus balticus var. littoralis.*
Global Vegetation: Average vegetation height is 1-2 m with little bare ground exposed. The dominant species are graminoids, although forbs and small trees and shrubs are common. *Calamagrostis canadensis, Carex aquatilis, Carex pellita (= Carex lanuginosa),* and *Spartina pectinata* are typical dominants. *Andropogon gerardii, Symphyotrichum ericoides (= Aster ericoides), Juncus balticus, Panicum virgatum, Oligoneuron ohioense (= Solidago ohioensis),* and *Sorghastrum nutans* are all common components of this community. The shrubs *Cornus sericea* and *Dasiphora fruticosa ssp. floribunda (= Pentaphylloides floribunda),* and small *Fraxinus pennsylvanica* and *Populus deltoides* trees may also be found (Faber-Langendoen and Maycock 1987, 1994, Comer et al. 1995b).
Global Dynamics: The wide range of moisture conditions experienced by these sites reduces the ability of woody vegetation to invade (Comer et al. 1995b). Fires are likely to have periodically moved through this prairie community before effective fire suppression in the twentieth century.

INDIANA DUNES NATIONAL LAKESHORE FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform
Calamagrostis canadensis	Herb (field)	Graminoid
Spartina pectinata	Herb (field)	Graminoid

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GLOBAL FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform

INDIANA DUNES NATIONAL LAKESHORE OTHER NOTEWORTHY SPECIES

Juncus balticus var. *littoralis*

GLOBAL OTHER NOTEWORTHY SPECIES

CONSERVATION STATUS RANK

Global Rank & Reasons: G2G3 There are probably fewer than 100 occurrences of this community rangewide. It is reported from Ohio (where it is ranked S3), Indiana (S2), Michigan (S2), Ontario (S?) and Vermont (S?). Currently 19 occurrences have been documented from Indiana and Michigan. There are probably less than 4000 acres rangewide. Currently over 370 acres have been documented; the average documented size is about 37 acres. Acreage of this community has probably been reduced by both residential and commercial development near the Great Lakes and Lake Champlain shores.

RELATED CONCEPTS

Global Similar Associations:

- *Spartina pectinata* - *Carex* spp. - *Calamagrostis canadensis* Sand Herbaceous Vegetation (CEGL005178)

Global Related Concepts:

- Lacustrine Littoral Nonpersistent Emergent Wetland, Seasonally Flooded (L2EM2C) (Cowardin et al. 1979) ?
- Lakeplain Wet Prairie (Chapman et al. 1989) =
- Lakeplain wet prairie (Comer et al. 1995b) =
- Lakeshore Grassland (Thompson 1996) B
- Wet loam prairie (Faber-Langendoen and Maycock 1987) =
- Wet prairie (Faber-Langendoen and Maycock 1994) =

CLASSIFICATION & OTHER COMMENTS

Indiana Dunes National Lakeshore Classification Comments:

Indiana Dunes National Lakeshore Other Comments:

Global Classification Comments: Faber-Langendoen and Maycock (1994) found that wet lakeplain prairies were floristically distinct from other wet prairies in Michigan and Wisconsin, though no diagnostic species were provided. In Ohio, this type is found at Castalia Prairie. In Vermont this type is found in the Lake Champlain area.

ELEMENT DISTRIBUTION

Indiana Dunes National Lakeshore Range: This wet lakeland prairie grassland is found at Hoosier Prairie.

Global Range: This lakeplain wet prairie grassland community occurs in the southern Great Lakes region of the midwestern United States, ranging from northern Indiana, northern Ohio, southern Michigan, and southern Ontario, eastward to possibly Vermont. In Michigan, lakeplain wet prairies are most commonly found close to the shoreline of Saginaw Bay and within the St. Clair River Delta.

Nations: CA, US

States/Provinces: IL, IN, MI, OH, ON

USFS Ecoregions: 212E:CC, 222If:CCC, 222Jb:CCC, 222Jd:CCC, 222Je:CCC, 222Jj:CCC, 222Qb:CCC

Federal Lands: NPS (Indiana Dunes)

ELEMENT SOURCES

Indiana Dunes National Lakeshore Map Units Summary:

Indiana Dunes National Lakeshore Inventory Notes:

Indiana Dunes National Lakeshore Plots: INDU.VP063, INDU.VP175, INDU.AA289, INDU.AA305, INDU.AA441, INDU.AA690.

Local Description Author(s): N. Lehmann

Global Description Author(s): J. Drake

References: Chapman 1984, Chapman et al. 1989, Comer et al. 1995b, Cowardin et al. 1979, Faber-Langendoen and Maycock 1987, Faber-Langendoen and Maycock 1994, Midwestern Ecology Working Group n.d., Thompson 1996, Thompson and Sorenson 2000

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V.A.5.N.k. Seasonally flooded temperate or subpolar grassland

A.1397 *Carex stricta* Seasonally Flooded Herbaceous Alliance

Tussock Sedge Seasonally Flooded Herbaceous Alliance

[CEGL002258] *Carex stricta - Carex* spp. Herbaceous Vegetation

Translated Name: **Tussock Sedge - Sedge species Herbaceous Vegetation**
Common Name: **Tussock 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)
- Western Great Plains Open Freshwater Depression Wetland (CES303.675)
- Laurentian-Acadian Wet Meadow-Shrub Swamp (CES201.582)

Circumscription Confidence: 2 - Moderate
Concept Author(s): D. Faber-Langendoen

ELEMENT CONCEPT

Global Summary: This wet sedge meadow community is found in the southern Great Lakes region and parts of the central midwestern United States. Sites occur in stream valleys, along lake margins, and in depressions and channels in glacial outwash. Soils include wet mineral soils, muck, or shallow peat (<0.5 m), with the water table below the surface for most of the growing season. The vegetation is dominated by sedges and grasses, but the shrub component can be high as 25%. Dominant plants include *Calamagrostis canadensis* and *Carex stricta*. Associated graminoids include *Carex aquatilis, Carex pellita (= Carex lanuginosa), Carex bebbii, Carex lacustris, Eleocharis* spp., *Juncus* spp., *Phalaris arundinacea* (common in more degraded examples), and *Typha latifolia*. Typical forbs include *Anemone canadensis, Asclepias incarnata, Symphyotrichum lanceolatum var. lanceolatum (= Aster simplex), Equisetum arvense, Eupatorium maculatum, Eupatorium perfoliatum, Iris versicolor, Lycopus americanus,* and *Solidago canadensis.*

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Palustrine
Indiana Dunes National Lakeshore Environment: This wet sedge meadow community is found in low areas and bottomlands that are seasonally flooded or saturated. Soils are mostly muck.
Global Environment: Sites occur in stream valleys, along lake margins, and in depressions and channels in glacial outwash. Soils include wet mineral soils, muck, or shallow peat (<0.5 m), with the water table below the surface for most of the growing season (Chapman et al. 1989, MNNHP 1993).

VEGETATION DESCRIPTION

Indiana Dunes National Lakeshore Vegetation: The cover of this community is dominated by graminoids such as *Calamagrostis canadensis, Carex aquatilis var. aquatilis, Juncus effusus,* and *Typha latifolia*. Species that may dominate areas of the sedge meadow when they are present include *Echinochloa crus-galli, Eupatorium maculatum, Poa compressa* (nonnative), and *Scirpus cyperinus*. Other species frequently encountered, but in smaller amounts, are *Polygonum sagittatum, Calystegia sepium* ssp. *sepium, Impatiens capensis,* and *Mentha arvensis*. A variety of sedge species are found throughout. In addition, this community supports state-critically imperiled *Myosotis laxa* and state-imperiled *Eleocharis wolfii*.
Global Vegetation: The vegetation is dominated by sedges and grasses, but the shrub component can be high as 25%. Dominant plants include *Calamagrostis canadensis* and *Carex stricta*. Associated graminoids include *Carex aquatilis, Carex pellita (= Carex lanuginosa), Carex bebbii, Carex lacustris, Eleocharis* spp., *Juncus* spp., *Phalaris arundinacea* (common in more degraded examples), and *Typha latifolia*. Typical forbs include *Anemone canadensis, Asclepias incarnata, Symphyotrichum lanceolatum var. lanceolatum (= Aster simplex), Equisetum arvense, Eupatorium maculatum, Eupatorium perfoliatum, Iris versicolor, Lycopus americanus,* and *Solidago canadensis* (Curtis 1959, Chapman et al. 1989, MNNHP 1993).
Global Dynamics: Wet meadows tend to succeed to shrub swamp communities in the absence of fire (MNNHP 1993). Lowering of the water table by ditching or drought may speed up succession to shrub swamp. Wet meadows on muck or peat recover very slowly, if at all, once altered by artificial flooding or ditching (MNNHP 1993).

INDIANA DUNES NATIONAL LAKESHORE FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform
Calystegia sepium ssp. *sepium*	Herb (field)	Vine/Liana
Polygonum sagittatum	Herb (field)	Vine/Liana
Bidens coronata	Herb (field)	Forb
Eupatorium maculatum	Herb (field)	Forb
Impatiens capensis	Herb (field)	Forb

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Mentha arvensis	Herb (field)	Forb
Calamagrostis canadensis	Herb (field)	Graminoid
Echinochloa crus-galli	Herb (field)	Graminoid
Juncus effusus	Herb (field)	Graminoid
Poa compressa	Herb (field)	Graminoid
Scirpus cyperinus	Herb (field)	Graminoid
Typha latifolia	Herb (field)	Graminoid

GLOBAL FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform

INDIANA DUNES NATIONAL LAKESHORE OTHER NOTEWORTHY SPECIES

Calystegia sepium ssp. *sepium, Echinochloa crus-galli, Eleocharis wolfii, Lythrum salicaria, Myosotis laxa, Poa compressa, Polygonum hydropiper*

GLOBAL OTHER NOTEWORTHY SPECIES

CONSERVATION STATUS RANK

Global Rank & Reasons: G4?

RELATED CONCEPTS

Global Similar Associations:

- *Calamagrostis canadensis - Phalaris arundinacea* Herbaceous Vegetation (CEGL005174)
- *Carex (rostrata, utriculata) - Carex lacustris - (Carex vesicaria)* Herbaceous Vegetation (CEGL002257)--This types is typically dominated by coarse sedges, but occasionally by *Carex stricta*.
- *Carex lacustris* Herbaceous Vegetation (CEGL002256)
- *Carex* spp. *- (Carex pellita, Carex vulpinoidea)* Herbaceous Vegetation (CEGL005272)
- *Carex stricta - Carex vesicaria* Herbaceous Vegetation (CEGL006412)
- *Carex stricta - Valeriana edulis - Parnassia palustris* Herbaceous Vegetation (CEGL005241)--This is the fen equivalent of the sedge meadow type.
- *Chamaedaphne calyculata / Carex oligosperma / Sphagnum* spp. Dwarf-shrubland (CEGL005091)
- *Cornus sericea - Salix (bebbiana, discolor, petiolaris) / Calamagrostis stricta* Shrubland (CEGL002187)

Global Related Concepts:

CLASSIFICATION & OTHER COMMENTS

Indiana Dunes National Lakeshore Classification Comments:

Indiana Dunes National Lakeshore Other Comments:

Global Classification Comments: This type may have some fen characteristics, but stands dominated by *Carex stricta* with fen associates are better placed in *Carex stricta - Valeriana edulis - Parnassia palustris* Herbaceous Vegetation (CEGL005241), whose concept is strongly based on northeastern Iowa stands (Leoschke and Pearson 1987). The northern limits of this type are not clear with respect to *Carex (rostrata, utriculata) - Carex lacustris - (Carex vesicaria)* Herbaceous Vegetation (CEGL002257). Wet meadow stands in the northern parts of Michigan, Wisconsin, and Minnesota are usually placed in CEGL002257, and, although they are more typically dominated by coarse sedges (*Carex rostrata, Carex lacustris, Carex vesicaria*), they can occasionally have dominance by *Carex stricta*) (Harris et al. 1996, W12). As a result ecoregion distribution of this type needs review. Ontario stands may have some *Carex lasiocarpa* in this type.

ELEMENT DISTRIBUTION

Indiana Dunes National Lakeshore Range: This wet sedge meadow community is found in parts of Cowles Bog in the Cowles Bog unit (part of the former Great Marsh) and at Hoosier Prairie.

Global Range: This wet sedge meadow community is found in the southern Great Lakes region of the United States and Canada, and parts of the central Midwest, ranging from Indiana and Ontario, west to Minnesota and Iowa.

Nations: CA, US

States/Provinces: IA, IL, IN, MI, MN, ND, ON, WI

USFS Ecoregions: 212Hb:CCC, 212Hl:CCC, 212Hm:CCP, 212Hn:CCP, 212Ho:CCP, 212Hp:CCP, 212Hq:CCP, 212Hr:CCP, 212Ht:CCP, 212Hv:CCC, 212Hw:CCC, 212Hx:CCP, 212Hy:CCC, 212Ib:CPP, 212Ja:CCP, 212Jb:CC?, 212Jc:CCP, 212Je:CCP, 212Jf:CCC, 212Jj:CCP, 212Jk:CCC, 212Jl:CCP, 212Jm:CCC, 212Ka:CPP, 212Mb:CPP, 212Na:CPP, 212Nb:CPP, 212Nc:CPP, 222Ha:CPP, 222Hb:CPP, 222Ja:CCP, 222Jb:CCC, 222Jg:CCC, 222Jh:CCC, 222Ji:CCC, 222Jj:CCC, 222Ka:CCC, 222Kb:CCC, 222Kd:CCC, 222Ke:CCC, 222Kf:CCC, 222Kg:CCC, 222Kh:CCC, 222Ki:CCC, 222Kj:CCC, 222Lb:CCC, 222Lc:CCC, 222Le:CCC, 222Lf:CCC, 222Me:CCC, 251Aa:CCC, 251Ab:CCC, 251Bb:CCC, 251Bd:CCC, 251Ca:CCC, 251Cc:CCC, 251Cf:CCC, 251Ch:CCC, 251Dc:CCC, 251Dd:CCP, 251Dg:CCC, 251Dh:CCP

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

ELEMENT SOURCES

Indiana Dunes National Lakeshore Map Units Summary:
Indiana Dunes National Lakeshore Inventory Notes:
Indiana Dunes National Lakeshore Plots: INDU.VP038, INDU.VP088, INDU.VP089, INDU.VP177, INDU.AA020, INDU.AA029, INDU.AA115, INDU.AA143, INDU.AA161, INDU.AA329, INDU.AA391, INDU.AA461, INDU.AA501, INDU.AA504, INDU.AA588, INDU.AA623, INDU.AA635, INDU.AA660, INDU.AA671, INDU.AA713.
Local Description Author(s): N. Lehmann
Global Description Author(s): D. Faber-Langendoen
References: Chapman et al. 1989, Curtis 1959, Harris et al. 1996, INAI unpubl. data, Leoschke and Pearson 1987, MNNHP 1993, Midwestern Ecology Working Group n.d., NDNHI n.d., WNHIP unpubl. data, White and Madany 1978

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V.A.5.N.k. Seasonally flooded temperate or subpolar grassland

A.1368 *Cladium mariscoides* Seasonally Flooded Herbaceous Alliance

Smooth Sawgrass Seasonally Flooded Herbaceous Alliance

[CEGL005105] *Dasiphora fruticosa* ssp. *floribunda* / *Cladium mariscoides* - *Juncus balticus* - (*Rhynchospora capillacea*) Herbaceous Vegetation

Translated Name: **Shrubby-cinquefoil / Smooth Sawgrass - Baltic Rush - (Limestone Beaksedge) Herbaceous Vegetation**
Common Name: **Interdunal Wetland**
Ecological System(s):
- Great Lakes Wooded Dune and Swale (CES201.726)
- Northern Great Lakes Interdunal Wetland (CES201.034)

Circumscription Confidence: 2 - Moderate
Concept Author(s): J. Drake and D. Faber-Langendoen

ELEMENT CONCEPT

Global Summary: This interdunal wetland herbaceous community is found in dune systems of the southern (and perhaps northern) Great Lakes in the United States and Canada. Stands occur on the sandy soils of wet depressions in wind-deposited dune systems. The substrate is 75-100% sand. Organics and silts occur in small amounts in depressions of exposed dunelands, and in larger amounts in sheltered, inland wet depressions. Herbaceous vascular plants have <30% cover, trees and shrubs together have <30% cover, and trees alone have <5% cover. Several variants occur, correlating with depth to the mean annual water table (centers of swales versus highest portions of swales) and distance inland from the lakeshore (exposed duneland versus sheltered inland/duneland). The physiognomy and floristics of the herb-dominated intermediate zone of the swale are emphasized in this description, and include *Calamagrostis canadensis, Carex* spp., *Cladium mariscoides, Eleocharis quinqueflora, Equisetum variegatum, Juncus balticus, Dichanthelium acuminatum var. fasciculatum (= Panicum implicatum), Rhynchospora capillacea, Schoenoplectus acutus (= Scirpus acutus),* and *Typha* spp. Apart from the dominants, characteristic species include *Carex viridula, Oligoneuron ohioense (= Solidago ohioensis), Hypericum kalmianum, Panicum flexile, Scleria verticillata, Lysimachia quadriflora, Packera paupercula (= Senecio pauperculus),* and *Eleocharis* spp. (including *Eleocharis quinqueflora (= Eleocharis pauciflora)*). *Rhynchospora capillacea* is not in Ohio sites. Compositional changes take place if surrounding open dunes are stabilized and succeed to a forested condition.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Palustrine
Indiana Dunes National Lakeshore Environment: This interdunal wetland herbaceous community is found in low-lying interdunal depressions. Soils are sandy muck, at or near the water table, with high mineral content.
Global Environment: Interdunal wetlands are found on the sandy soils of wet depressions in wind-deposited dune systems of the Great Lakes. The depressions often form a sequence, with the youngest near the lake and older ones inland. Ontario occurrences of this same vegetative community have been recorded from moist, sandy substrates well inland. The substrate is 75-100% sand. Organics and silts occur in small amounts in depressions of exposed dunelands, and in larger amounts in sheltered, inland wet depressions. High concentrations of calcium, magnesium, and carbonate increase alkalinity and fertility. Phosphorus and important trace minerals, such as iron, manganese, zinc, copper, and cobalt, decrease when pH is above 7. Cation-exchange capacity is low. Occasionally, when located within active dune fields, these communities are buried by dune sand. Springs have been recorded to occur within interdunal wetland complexes, probably resulting from hydrological heads developed within adjacent dune ridges. These springs, when occurring on an occasional basis, set back succession within the wetland (Hiebert et al. 1986).

VEGETATION DESCRIPTION

Indiana Dunes National Lakeshore Vegetation: In general, bare soil covers about 50% of the stands of this community. Tree species such as *Pinus banksiana* and *Populus deltoides* grow in proximity to, and may be present as seedlings in, the community. The dominant shrub is *Hypericum kalmianum* with under 20% cover. The herbaceous layer (30-60% cover) is dominated by *Juncus balticus var. littoralis, Rhynchospora capillacea, Cladium mariscoides, Triglochin maritima, Eleocharis acicularis*, and *Rhynchospora capitellata*. *Utricularia cornuta* and *Lobelia kalmii* are found in small amounts in most of the occurrences. Invasives include *Phragmites australis* and the exotic *Lythrum salicaria*. This community also supports state-imperiled *Juncus balticus var. littoralis, Juncus pelocarpus, Oligoneuron album*, *Pinus banksiana*, and *Utricularia cornuta*, and state-vulnerable *Hypericum kalmianum*.
Global Vegetation: Herbaceous vascular plants have <30% cover, trees and shrubs together have <30% cover, and trees alone have <5% cover. Several variants of this community occur, correlating with depth to the mean annual water table (centers of swales versus highest portions of swales) and distance inland from the lakeshore (exposed duneland versus sheltered inland/duneland). The species composition of the community resembles alkaline shrub/herb fens, especially in the zone of groundwater emergence. The physiognomy and floristics of the herb-dominated intermediate zone of the swale are emphasized in this description and include

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Calamagrostis canadensis, Carex spp., *Cladium mariscoides, Eleocharis quinqueflora, Equisetum variegatum, Juncus balticus, Dichanthelium acuminatum var. fasciculatum (= Panicum implicatum), Rhynchospora capillacea, Schoenoplectus acutus (= Scirpus acutus),* and *Typha* spp. Apart from the dominants, characteristic species include *Carex viridula, Oligoneuron ohioense (= Solidago ohioensis), Hypericum kalmianum, Panicum flexile, Scleria verticillata, Lysimachia quadriflora, Packera paupercula (= Senecio pauperculus), Eleocharis* spp. (including *Eleocharis quinqueflora (= Eleocharis pauciflora)*). *Rhynchospora capillacea* is not in Ohio sites (White and Madany 1978, Homoya et al. 1985, Hiebert et al 1986, Chapman et al. 1989).

Global Dynamics:

INDIANA DUNES NATIONAL LAKESHORE FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform
Hypericum kalmianum	Tall shrub/sapling	Broad-leaved evergreen shrub
Lobelia kalmii	Herb (field)	Forb
Utricularia cornuta	Herb (field)	Forb
Cladium mariscoides	Herb (field)	Graminoid
Eleocharis acicularis	Herb (field)	Graminoid
Juncus balticus var. *littoralis*	Herb (field)	Graminoid
Juncus pelocarpus	Herb (field)	Graminoid
Rhynchospora capillacea	Herb (field)	Graminoid
Rhynchospora capitellata	Herb (field)	Graminoid
Triglochin maritima	Herb (field)	Graminoid

GLOBAL FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform
Calamagrostis canadensis	Herb (field)	Graminoid
Cladium mariscoides	Herb (field)	Graminoid
Dichanthelium acuminatum var. *fasciculatum*	Herb (field)	Graminoid
Eleocharis quinqueflora	Herb (field)	Graminoid
Juncus balticus	Herb (field)	Graminoid
Rhynchospora capillacea	Herb (field)	Graminoid
Schoenoplectus acutus	Herb (field)	Graminoid
Triglochin maritima	Herb (field)	Graminoid
Equisetum variegatum	Herb (field)	Fern or fern ally

INDIANA DUNES NATIONAL LAKESHORE OTHER NOTEWORTHY SPECIES

Hypericum kalmianum, Juncus balticus var. *littoralis, Juncus pelocarpus, Lythrum salicaria, Oligoneuron album, Phragmites australis, Pinus banksiana, Utricularia cornuta*

GLOBAL OTHER NOTEWORTHY SPECIES

Oligoneuron houghtonii

CONSERVATION STATUS RANK

Global Rank & Reasons: G3? The total number of occurrences is unknown. Thirty-six have been documented: 2 in Illinois (where the community is ranked S1), 6 in Indiana (S1), 23 in Michigan (S2), and 5 in Wisconsin (S1). No other occurrences have been documented, but the community also occurs in Ontario (S2,S1). It is found in 14 ecoregional subsections. Sizes of 29 occurrences range from 1 to 430 acres, totaling 1326. The community is found on the sandy soils (75-100% sand) of wet depressions in wind-deposited dune systems of the Great Lakes.

RELATED CONCEPTS

Global Similar Associations:

- *Calamagrostis canadensis - Carex viridula - Cladium mariscoides - Lobelia kalmii* Herbaceous Vegetation (CEGL005115)
- *Cladium mariscoides - (Carex lasiocarpa, Hypericum kalmianum, Oligoneuron riddellii, Eleocharis elliptica)* Herbaceous Vegetation (CEGL005104)
- *Cladium mariscoides - Carex cryptolepis - Rhynchospora alba - Juncus canadensis* Herbaceous Vegetation [Provisional] (CEGL005103)
- *Dasiphora fruticosa ssp. floribunda / Carex interior - Carex flava - Sarracenia purpurea* Shrub Herbaceous Vegetation (CEGL005140)
- *Dasiphora fruticosa ssp. floribunda / Carex sterilis - Andropogon gerardii - Arnoglossum plantagineum* Shrub Herbaceous Vegetation (CEGL005139)--is a rich fen.

Global Related Concepts:

- Palustrine (Cowardin et al. 1979) B

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CLASSIFICATION & OTHER COMMENTS

Indiana Dunes National Lakeshore Classification Comments: This community is the same as the panne community. Certain areas historically called pannes have become dominated by other vegetation (*Typha* spp., *Phragmites australis*) to the extent that they are classified as other communities.

Indiana Dunes National Lakeshore Other Comments:

Global Classification Comments: This type may fit better under a *Dasiphora fruticosa ssp. floribunda* saturated alliance (P. Comer pers. comm. 1997), where the shrub component may vary from low to as high as 50%. This range of this type is currently limited to the southern Great Lakes, but in Michigan this type could occur in northern Michigan, where it may be found as part of the Great Lakes Wooded Dune and Swale Complex (CECX005701). A number of the dominant and indicator species (*Cladium mariscoides, Dasiphora fruticosa ssp. floribunda, Oligoneuron ohioense (= Solidago ohioensis)*) are common in both the southern and northern wetlands, but stands in the south are often found with oak savanna and tallgrass prairie species on adjacent ridges, and thus have some compositional differences reflected in the wetlands (P. Comer pers. comm. 2000). It is also possible that *Calamagrostis canadensis - Carex viridula - Cladium mariscoides - Lobelia kalmii* Herbaceous Vegetation (CEGL005115) is the northern interdunal wetland equivalent.

ELEMENT DISTRIBUTION

Indiana Dunes National Lakeshore Range: This interdunal wetland herbaceous community is found at the West Beach, Miller, and Dunes State Park units.

Global Range: This interdunal wetland herbaceous community is found in dune systems of the southern (and perhaps northern) Great Lakes in the United States and Canada, ranging from northern Illinois and Indiana, northward to Wisconsin, Michigan, and Ontario. Great Lakes shores include Lake Michigan, Lake Huron (not south of Saginaw Bay), Georgian Bay, and possibly Lake Erie.

Nations: CA, US

States/Provinces: IL, IN, MI, ON, WI

USFS Ecoregions: 212Hd:CCC, 212Hj:CCC, 212Hl:CCC, 212Ho:CCC, 212Hr:CCC, 212Hw:CCC, 212Hx:CCC, 212Ia:CCC, 212Ja:CCP, 212Jb:CCC, 212Jn:CCC, 212Oa:CCC, 212Ob:CCC, 222Jj:CCC, 222Kg:CCC

Federal Lands: NPS (Indiana Dunes, Sleeping Bear Dunes); USFS (Huron-Manistee?, Huron?, Manistee?)

ELEMENT SOURCES

Indiana Dunes National Lakeshore Map Units Summary:

Indiana Dunes National Lakeshore Inventory Notes:

Indiana Dunes National Lakeshore Plots: INDU.VP003, INDU.VP100, INDU.VP111, INDU.VP116, INDU.VP119, INDU.AA203, INDU.AA429, INDU.AA568.

Local Description Author(s): N. Lehmann

Global Description Author(s): J. Drake and D. Faber-Langendoen

References: Bakowsky 1990, Chapman et al. 1989, Cowardin et al. 1979, Hiebert et al. 1986, Homoya et al. 1985, Homoya et al. 1988, Midwestern Ecology Working Group n.d., Reznicek and Catling 1989, WNHIP unpubl. data, White and Madany 1978

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V.A.5.N.k. Seasonally flooded temperate or subpolar grassland

A.1381 *Phalaris arundinacea* Seasonally Flooded Herbaceous Alliance

Reed Canarygrass Seasonally Flooded Herbaceous Alliance

[CEGL006044] *Phalaris arundinacea* Eastern Herbaceous Vegetation

Translated Name: **Reed Canarygrass Eastern Herbaceous Vegetation**
Common Name: **Reed Canarygrass Eastern Marsh**
Ecological System(s):

- Central Interior Highlands and Appalachian Sinkhole and Depression Pond (CES202.018)
- North-Central Interior Floodplain (CES202.694)
- Laurentian-Acadian Wet Meadow-Shrub Swamp (CES201.582)

Circumscription Confidence: 2 - Moderate
Concept Author(s): D. Faber-Langendoen

ELEMENT CONCEPT

Global Summary: This association is found throughout the northeastern United States and Canada, but its distribution as a natural type is complicated elsewhere. *Phalaris arundinacea* is native to the United States and Canada but is now more widely distributed and abundant because of local introductions from both local and European populations. The introduced strains may be more aggressive ecotypes than native strains. Stands are found in both minerotrophic basin wetlands as well as rivershores. *Phalaris arundinacea* has been widely used as a forage and hay crop, especially in marshes and floodplains, and it is used for wildlife food and for shoreline and ditch stabilization. Stands are dominated by *Phalaris arundinacea*, a 0.5- to 2-m tall perennial grass, which tends to occur in monocultures or associated with *Calamagrostis canadensis*. Associates in the glaciated Northeast include *Viburnum nudum, Alnus incana* or *Alnus serrulata, Viburnum dentatum*, and *Agrostis gigantea*. In Central Appalachian bottomland old fields, characteristic associates include *Verbesina alternifolia* (which may be codominant), *Solidago rugosa, Boehmeria cylindrica*, and *Euthamia graminifolia*, along with exotic species such as *Glechoma hederacea, Coronilla varia, Rosa multiflora*, and *Elaeagnus umbellata*. Midwest associates include species characteristic of wet meadows. *Phalaris arundinacea* can displace native species over time. Further work is required to resolve the natural versus introduced nature of this type in the Southeast before a description can be completed.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Palustrine
Indiana Dunes National Lakeshore Environment: Reed canarygrass marsh is found in highly disturbed wetlands between railroad tracks and/or constructed trails. The soil has a largely sand component but is highly disturbed and compacted. There are areas of drier piled-up soil within the wet areas.
Global Environment: Stands are found in both minerotrophic basin wetlands as well as rivershores. The dominant species has been widely used as a forage and hay crop, especially in marshes and floodplains, and it is used for wildlife food and for shoreline and ditch stabilization (Barnes 1999).

VEGETATION DESCRIPTION

Indiana Dunes National Lakeshore Vegetation: The vegetation is dominated by *Phalaris arundinacea* (up to 80-90% cover). The shrub layers are sparse and include *Prunus serotina, Sassafras albidum, Cornus racemosa, Rubus* spp., and the nonnative invasives *Elaeagnus umbellata* and *Rosa multiflora*. Vines are represented by *Vitis riparia* and the nonnative invasive *Celastrus orbiculata*. Some herbaceous species include *Cirsium muticum, Dichanthelium clandestinum, Pilea pumila, Solidago altissima*, and the fern *Onoclea sensibilis*.
Global Vegetation: Stands are dominated by *Phalaris arundinacea*, a 0.5- to 2-m tall perennial grass that is native to the United States and Canada, but which has also been introduced from European strains. The introduced strains may be more aggressive ecotypes than native strains (Barnes 1999). It tends to occur in monocultures or associated with *Calamagrostis canadensis* or, less commonly, with a mixture of forbs equaling the graminoid cover. Associates in the glaciated Northeast include *Viburnum nudum, Salix* spp., *Alnus incana* or *Alnus serrulata, Viburnum dentatum, Poa palustris, Mentha arvensis, Leersia virginica, Lythrum salicaria*, and *Agrostis gigantea*. In Central Appalachian bottomland old fields, characteristic associates include *Verbesina alternifolia* (which may be codominant), *Solidago rugosa, Boehmeria cylindrica*, and *Euthamia graminifolia*, along with exotic species such as *Glechoma hederacea, Coronilla varia, Rosa multiflora*, and *Elaeagnus umbellata*. Midwest associates include species characteristic of wet meadows. *Phalaris arundinacea* can displace native species over time (Apfelbaum and Sams 1987, Barnes 1999, and references therein). Further work is required to resolve the natural versus introduced nature of this type in the Southeast.
Global Dynamics: Shoreline habitats can be temporarily or seasonally flooded in spring. *Phalaris arundinacea* may respond well to summer drawdowns (Barnes 1999).

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INDIANA DUNES NATIONAL LAKESHORE FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform
Phalaris arundinacea	Herb (field)	Graminoid

GLOBAL FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform
Phalaris arundinacea	Herb (field)	Graminoid

INDIANA DUNES NATIONAL LAKESHORE OTHER NOTEWORTHY SPECIES

Arctium minus, Celastrus orbiculata, Morus alba, Rosa multiflora

GLOBAL OTHER NOTEWORTHY SPECIES

CONSERVATION STATUS RANK

Global Rank & Reasons: GNA (invasive) *Phalaris arundinacea* is native to the United States and Canada but is now more widely distributed and abundant because of local introductions from both local and European populations (Apfelbaum and Sams 1987). It can invade a variety of habitats.

RELATED CONCEPTS

Global Similar Associations:
- *Calamagrostis canadensis - Phalaris arundinacea* Herbaceous Vegetation (CEGL005174)
- *Phalaris arundinacea* Western Herbaceous Vegetation (CEGL001474)

Global Related Concepts:
- Bottomland old fields (Vanderhorst 2001a) =
- Palustrine Persistent Emergent Wetland (PEM1) (Cowardin et al. 1979) ?
- Reed canary grass riverine grassland (Perles et al. 2004) ?
- SNE low-energy riverbank community (Rawinski 1984) ?
- Shallow Emergent Marsh (Thompson 1996) ?
- Southern New England nutrient-poor streamside/lakeside marsh (Rawinski 1984) ?
- Southern New England nutrient-rich streamside/lakeside marsh (Rawinski 1984) ?

CLASSIFICATION & OTHER COMMENTS

Indiana Dunes National Lakeshore Classification Comments: Some of the *Spartina pectinata* communities have large cover of *Phalaris arundinacea* and/or *Solidago* spp.

Indiana Dunes National Lakeshore Other Comments:

Global Classification Comments: Type has a broad distribution; in fact, it is widespread throughout temperate areas of the northern hemisphere. It is native to the United States and Canada, but is now more widely distributed and abundant because of local introductions from both local and European populations (Apfelbaum and Sams 1987). It can invade a variety of habitats, suggesting that little unites these stands apart from the dominance of *Phalaris arundinacea*. However, that may be the only reasonable way to describe this type. This vegetation is documented from Shady Valley TNC Preserve, Johnson County, Tennessee, where it occupies channelized streams, impoundments, and fen restoration sites. In these examples, characteristic associates include *Juncus effusus, Carex lurida, Carex gynandra*, and *Alnus serrulata*.

ELEMENT DISTRIBUTION

Indiana Dunes National Lakeshore Range: Reed canarygrass marsh is found in the Cowles Bog and Keiser units.

Global Range: This association is found throughout the northeastern United States and Canada, but its distribution as a natural type is complicated elsewhere. It currently ranges from Virginia north to Vermont, east to Minnesota and south to Tennessee.

Nations: CA, US

States/Provinces: CT, DE, IA, IN, MA, MD, ME, MN, NH, NJ, NY, OH, ON, PA, RI, TN, VA, VT, WV

USFS Ecoregions: 212Fc:CCC, 212G:CP, 221Aa:CCC, 221Bc:CCC, 221Bd:CCC, 221Da:CCC, 221Fa:CCC, 222Ib:CCC, 222Ic:CCC, 222Jj:CCC, 222L:CC, M221Ac:CCC, M221Ad:CCC, M221Bb:CCC, M221Bf:CCC, M221Dc:CCC

Federal Lands: NPS (Allegheny Portage Railroad, C&O Canal?, Catoctin Mountain?, Delaware Water Gap, Effigy Mounds, Eisenhower, Gettysburg, Indiana Dunes, Saint Croix, Saratoga, Saugus Iron Works, Upper Delaware); USFWS (Assabet River?, Erie, Great Meadows?, Great Swamp, Iroquois, Montezuma, Oxbow, Parker River)

ELEMENT SOURCES

Indiana Dunes National Lakeshore Map Units Summary:

Indiana Dunes National Lakeshore Inventory Notes:

Indiana Dunes National Lakeshore Plots: INDU.VP036, INDU.AA011, INDU.AA498, INDU.AA549.

Local Description Author(s): N. Lehmann

Global Description Author(s): D. Faber-Langendoen, mod. S.C. Gawler

References: Apfelbaum and Sams 1987, Barnes 1999, Cowardin et al. 1979, Edinger et al. 2002, Fike 1999, Metzler and Barrett 2001, Midwestern Ecology Working Group n.d., NRCS 2004, Perles et al. 2004, Perles et al. 2007, Rawinski 1984, Sperduto 2000a,

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Swain and Kearsley 2001, TDNH unpubl. data, TNC and WPC 2004, Thompson 1996, Thompson and Sorenson 2000, Vanderhorst 2001a, Vanderhorst and Streets 2006

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V.A.5.N.k. Seasonally flooded temperate or subpolar grassland

A.1394 *Typha* spp. - (*Schoenoplectus* spp., *Juncus* spp.) Seasonally Flooded Herbaceous Alliance

Cattail species - (Clubrush species, Rush species) Seasonally Flooded Herbaceous Alliance

[CEGL002026] *Schoenoplectus tabernaemontani* - *Typha* spp. - (*Sparganium* spp., *Juncus* spp.) Herbaceous Vegetation

Translated Name: **Softstem Bulrush - Cattail species - (Bur-reed species, Rush species) Herbaceous Vegetation**
Common Name: **Bulrush - Cattail - Bur-reed Shallow Marsh**
Ecological System(s):
- Eastern Great Plains Wet Meadow, Prairie, and Marsh (CES205.687)
- Northern Tallgrass Prairie (CES205.686)
- Northwestern Great Plains Floodplain (CES303.676)
- Western Great Plains Open Freshwater Depression Wetland (CES303.675)
- Western Great Plains Floodplain (CES303.678)
- North-Central Interior Floodplain (CES202.694)
- Laurentian-Acadian Freshwater Marsh (CES201.594)

Circumscription Confidence: 3 - Weak
Concept Author(s): D. Faber-Langendoen

ELEMENT CONCEPT

Global Summary: This shallow marsh mixed emergent community ranges broadly over the midwestern United States and adjacent Canada. It is found in basin-like depressions, backwater areas of floodplains, and shallow margins of lakes or ponds. Soils are shallow to deep, very poorly drained, consisting of peats, mucks, or mineral materials, often found in alluvium. Vegetation varies from zones dominated by tall emergents 1-2 m tall to those with hydrophytic annual and perennial forbs <1 m tall. In the tall emergent zone, *Schoenoplectus tabernaemontani (= Scirpus tabernaemontani), Schoenoplectus fluviatilis (= Scirpus fluviatilis), Schoenoplectus acutus (= Scirpus acutus), Typha angustifolia*, and *Typha latifolia* may dominate, mixed with a variety of other herbaceous species, such as *Leersia oryzoides, Eleocharis palustris, Juncus* spp., and *Sparganium* spp. The hydrophytic annual and perennial forb zone is dominated by *Alisma subcordatum, Alisma plantago-aquatica, Sagittaria latifolia, Sparganium eurycarpum, Pontederia cordata*, along with *Bacopa rotundifolia* and *Heteranthera limosa*. Occasional floating-leaved aquatics are sometimes present, including *Azolla caroliniana, Lemna* spp., *Spirodela polyrrhiza*, and *Utricularia macrorhiza*.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Palustrine
Indiana Dunes National Lakeshore Environment: This shallow marsh mixed emergent community is found in large interdunal depressions that have standing water most of the year. Soil is very poorly drained sandy muck.
Global Environment: This community ranges broadly over the midwestern United States. It is found in basin-like depressions, backwater areas of floodplains and shallow margins of lakes or ponds. Soils are shallow to deep, very poorly drained, consisting of peats, mucks, or mineral materials, often found in alluvium (Lauver et al. 1999).

VEGETATION DESCRIPTION

Indiana Dunes National Lakeshore Vegetation: This community has no tree species, but a small amount (5% cover) of *Cephalanthus occidentalis* may be found within the stand. *Cephalanthus occidentalis* and other shrubs often border this community. There is usually some open water and herbaceous cover of 60-90%. *Schoenoplectus tabernaemontani* is a dominant species, covering 30-60% of the herbaceous layer. Common herbaceous species include *Calamagrostis canadensis, Rhynchospora macrostachya, Juncus canadensis, Juncus effusus, Cyperus strigosus*, and *Sagittaria latifolia*. Other species found are *Alisma triviale, Galium tinctorium, Ludwigia sphaerocarpa, Polygonum amphibium var. emersum, Pontederia cordata, Schoenoplectus smithii, Scirpus atrovirens*, and *Nymphaea odorata*. Invasive nonnative species include *Lythrum salicaria*. This community also supports state-critically imperiled *Ludwigia sphaerocarpa* and *Schoenoplectus smithii*, and state-vulnerable *Rhynchospora macrostachya*.
Global Vegetation: Vegetation varies from zones dominated by tall emergents 1-2 m tall to those with hydrophytic annual and perennial forbs <1 m tall. In the tall emergent zone, *Schoenoplectus tabernaemontani (= Scirpus tabernaemontani), Schoenoplectus fluviatilis (= Scirpus fluviatilis), Schoenoplectus acutus (= Scirpus acutus), Typha angustifolia*, and *Typha latifolia* may dominate, mixed with a variety of other herbaceous species, such as *Leersia oryzoides, Eleocharis palustris, Juncus* spp., and *Sparganium* spp. The hydrophytic annual and perennial forb zone is dominated by *Alisma subcordatum, Alisma plantago-aquatica, Pontederia cordata, Sagittaria latifolia*, and *Sparganium eurycarpum*, along with *Bacopa rotundifolia* and *Heteranthera limosa*. Other species that may dominate locally include *Polygonum pensylvanicum (= Polygonum bicorne), Polygonum amphibium var. emersum (= Polygonum*

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coccineum), and *Polygonum lapathifolium*. Occasional floating-leaved aquatics are sometimes present, including *Azolla caroliniana, Lemna* spp., *Spirodela polyrrhiza*, and *Utricularia macrorhiza* (Eggers and Reed 1987, Steinauer and Rolfsmeier 2000).

Global Dynamics:

INDIANA DUNES NATIONAL LAKESHORE FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform
Cephalanthus occidentalis	Tall shrub/sapling	Broad-leaved deciduous shrub
Ludwigia sphaerocarpa	Herb (field)	Forb
Polygonum amphibium var. *emersum*	Herb (field)	Forb
Sagittaria latifolia	Herb (field)	Forb
Calamagrostis canadensis	Herb (field)	Graminoid
Cyperus strigosus	Herb (field)	Graminoid
Juncus canadensis	Herb (field)	Graminoid
Juncus effusus	Herb (field)	Graminoid
Rhynchospora macrostachya	Herb (field)	Graminoid
Schoenoplectus tabernaemontani	Herb (field)	Graminoid

GLOBAL FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform

INDIANA DUNES NATIONAL LAKESHORE OTHER NOTEWORTHY SPECIES

Ludwigia sphaerocarpa, Lythrum salicaria, Rhynchospora macrostachya, Schoenoplectus smithii

GLOBAL OTHER NOTEWORTHY SPECIES

Alisma plantago-aquatica

CONSERVATION STATUS RANK

Global Rank & Reasons: G4G5

RELATED CONCEPTS

Global Similar Associations:

- *Sagittaria latifolia - Leersia oryzoides* Herbaceous Vegetation (CEGL005240)
- *Schoenoplectus acutus - (Schoenoplectus fluviatilis)* Freshwater Herbaceous Vegetation (CEGL002225)
- *Typha* spp. - *Schoenoplectus acutus* - Mixed Herbs Midwest Herbaceous Vegetation (CEGL002229)--This is the deep marsh equivalent of this type.
- *Typha* spp. - *Schoenoplectus* spp. - Mixed Herbs Great Plains Herbaceous Vegetation (CEGL002228)

Global Related Concepts:

- *Scirpus validus* herbaceous association (Hoagland 1997) ?
- Freshwater Marsh (Nelson 1985) B
- Inland Emergent Marsh (Chapman et al. 1989) B

CLASSIFICATION & OTHER COMMENTS

Indiana Dunes National Lakeshore Classification Comments:

Indiana Dunes National Lakeshore Other Comments:

Global Classification Comments: This is a very broadly defined type that intergrades between wet meadows and deep marshes. Shaw and Fredine (in Eggers and Reed 1987) define shallow marsh as "soils that are saturated to inundated by standing water up to 15 cm in depth, throughout most of the growing season." Depending on the local topographic context, the type may or may not be extensive. Any number of types could be separated within this coarsely defined type, but it is not yet clear how best to make such distinctions (e.g., the forb-dominated portions, such as *Pontederia cordata* or *Sagittaria latifolia*). [See e.g., *Sagittaria latifolia - Leersia oryzoides* Herbaceous Vegetation (CEGL005240).] See also Lee et al. (1998), who separate out a *Sparganium eurycarpum* type. Taxonomically, *Schoenoplectus tabernaemontani* is equivalent to former *Scirpus validus* (Kartesz 1999). In Minnesota, *Schoenoplectus acutus (= Scirpus acutus)* may be the more common bulrush (R. Dana pers. comm. 1999). *Eleocharis* spp. can also be typical of this type. Dominant and characteristic plants should always be described from stands to allow for adequate characterization. In Nebraska, the pond marsh extends to south-central Nebraska (Steinauer and Rolfsmeier 2000).

ELEMENT DISTRIBUTION

Indiana Dunes National Lakeshore Range: This community is found within the Great Marsh complex, including the Cowles Bog, Dunes State Park, and Keiser units. It is also found at the West Beach, Inland Marsh, and Miller units.

Global Range: This shallow marsh mixed emergent community ranges broadly over the midwestern United States and adjacent Canada, from Ohio and Ontario west to Manitoba, south to Oklahoma, and east to Indiana.

Nations: CA, US

States/Provinces: DC?, IA, IL, IN, KS, MB, MI, MN, MO, ND, NE, NM, OH, OK, ON, PA, SD, SK, WI

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USFS Ecoregions: 212Hb:CC?, 212Hm:CCC, 212Hs:CCC, 212Hv:CCC, 212Ib:C??, 212Ja:CCP, 212Jb:CC?, 212Jc:CCP, 212Jd:CCC, 212Je:CC?, 212Jf:CC?, 212Jj:CC?, 212Jk:CC?, 212Jl:CC?, 212Jm:CC?, 212Ka:CP?, 212Kb:CPP, 212La:CPP, 212Lb:CPP, 212Lc:CPP, 212Ld:CPP, 212Ma:CPP, 212Mb:CPP, 212Na:CPP, 212Nb:CPP, 212Nc:CPP, 212Nd:CPP, 221Ea:CCC, 221Ec:CCC, 221Ed:CCP, 221Ef:CCC, 221Fa:CCC, 221He:CCC, 222Ak:CP?, 222Ao:CPP, 222Db:CCC, 222Ga:CCC, 222Gb:CCC, 222Ha:CCC, 222Hc:CCC, 222Hf:CCC, 222Ji:CCC, 222Jj:CCC, 222Kf:CCC, 222Kg:CCC, 222Md:CCC, 222Na:CPP, 251Aa:CP?, 251Cc:CCC, 251Cd:CC?, 251Cf:CCC, 251Cj:CCC, 251Co:CCC, 251Dg:CCC, 332E:PP

Federal Lands: NPS (C&O Canal?, Effigy Mounds, Indiana Dunes, Isle Royale, National Capital-East?, Saint Croix); USFS (Chequamegon-Nicolet?, Chequamegon?, Chippewa?, Nicolet?, Ottawa?, Wayne); USFWS (Erie)

ELEMENT SOURCES

Indiana Dunes National Lakeshore Map Units Summary:

Indiana Dunes National Lakeshore Inventory Notes:

Indiana Dunes National Lakeshore Plots: INDU.VP064, INDU.VP156, INDU.VP162, INDU.VP164, INDU.AA040, INDU.AA168, INDU.AA182, INDU.AA241, INDU.AA304, INDU.AA477, INDU.AA593, INDU.AA653, INDU.AA664, INDU.AA698.

Local Description Author(s): N. Lehmann

Global Description Author(s): D. Faber-Langendoen

References: Baalman 1965, Chapman et al. 1989, Eggers and Reed 1987, Greenall 1996, Hoagland 1997, Hoagland 2000, INAI unpubl. data, Kartesz 1999, Lauver et al. 1999, Lee et al. 1998, Midwestern Ecology Working Group n.d., NDNHI n.d., Nelson 1985, Steinauer and Rolfsmeier 2000, WNHIP unpubl. data

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V.A.5.N.I. Semipermanently flooded temperate or subpolar grassland

A.1431 *Phragmites australis* Semipermanently Flooded Herbaceous Alliance

Common Reed Semipermanently Flooded Herbaceous Alliance

[CEGL004141] *Phragmites australis* Eastern North America Temperate Semi-natural Herbaceous Vegetation

Translated Name: **Common Reed Eastern North America Temperate Semi-natural Herbaceous Vegetation**
Common Name: **Eastern Reed Marsh**
Ecological System(s):

- Southeastern Coastal Plain Interdunal Wetland (CES203.258)
- Northern Atlantic Coastal Plain Tidal Salt Marsh (CES203.519)
- Laurentian-Acadian Wet Meadow-Shrub Swamp (CES201.582)
- Laurentian-Acadian Freshwater Marsh (CES201.594)
- North-Central Interior Freshwater Marsh (CES202.899)
- Semi-natural / Altered Vegetation and Conifer Plantations (CES203.074)

Circumscription Confidence: 1 - Strong
Concept Author(s): Great Plains Program, mod. D. Faber-Langendoen

ELEMENT CONCEPT

Global Summary: This reed marsh type is found across the east-temperate regions of the United States and Canada. Stands occur in semipermanently flooded marshes, ditches, impoundments, etc., that have often been disturbed by human activity. The vegetation is variable, as *Phragmites australis* will often invade into existing natural or semi-natural communities present on the site. Once firmly established, this community is usually strongly dominated by *Phragmites australis*, with few or no other vascular plants present.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Palustrine
Indiana Dunes National Lakeshore Environment: This reed marsh type occurs in semipermanently flooded interdunal marshes and ditches.
Global Environment: Stands occur in semipermanently flooded marshes, ditches, impoundments, etc. that have often been disturbed by human activity.

VEGETATION DESCRIPTION

Indiana Dunes National Lakeshore Vegetation: This community is dominated by the tall graminoid *Phragmites australis* with an average of 90% cover. A few shrubs of *Cephalanthus occidentalis* and/or *Salix petiolaris* may be found within a stand. *Scirpus cyperinus* and *Typha latifolia* [see Classification Comments] may be present in noticeable amounts. *Bidens coronata, Calamagrostis canadensis, Dryopteris cristata, Galium trifidum, Polygonum amphibium var. emersum, Scutellaria galericulata, Scutellaria lateriflora, Spiraea tomentosa,* and *Lemna trisulca* may also be found in small amounts. Nonnative species include *Lythrum salicaria* and *Solanum dulcamara*. This community also supports state-vulnerable *Alnus incana ssp. rugosa*.
Global Vegetation: The vegetation is often variable, as *Phragmites australis* will often invade into existing natural or semi-natural communities present on the site. Once firmly established, this community is usually strongly dominated by *Phragmites australis*, with few or no other vascular plants present.
Global Dynamics:

INDIANA DUNES NATIONAL LAKESHORE FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform
Cephalanthus occidentalis	Tall shrub/sapling	Broad-leaved deciduous shrub
Polygonum amphibium var. *emersum*	Herb (field)	Forb
Phragmites australis	Herb (field)	Graminoid
Scirpus cyperinus	Herb (field)	Graminoid

GLOBAL FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform
Phragmites australis	Herb (field)	Graminoid

INDIANA DUNES NATIONAL LAKESHORE OTHER NOTEWORTHY SPECIES

Alnus incana ssp. *rugosa, Lythrum salicaria, Solanum dulcamara*

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GLOBAL OTHER NOTEWORTHY SPECIES

CONSERVATION STATUS RANK

Global Rank & Reasons: GNA (invasive) Although almost always occurring as a naturalized type that arises from human disturbance, some stands in northern Minnesota and further north in Canada may be native. If so, they should be tracked as a separate type.

RELATED CONCEPTS

Global Similar Associations:

- *Phragmites australis* Tidal Herbaceous Vegetation (CEGL004187)
- *Phragmites australis* Western North America Temperate Semi-natural Herbaceous Vegetation (CEGL001475)

Global Related Concepts:

- *Phragmites australis* community (Metzler and Barrett 1992) ?
- *Phragmites australis* tidal marsh association (Clancy 1993b) ?
- Inland Emergent Marsh (Chapman et al. 1989) B
- Southern New England nutrient-poor streamside/lakeside marsh (Rawinski 1984) ?
- Southern New England nutrient-rich streamside/lakeside marsh (Rawinski 1984) ?

CLASSIFICATION & OTHER COMMENTS

Indiana Dunes National Lakeshore Classification Comments: The cattail species here was identified as *Typha latifolia* based on reproductive characters, but genetic studies show that the native species of *Typha* has been replaced by *Typha X glauca*.

Indiana Dunes National Lakeshore Other Comments:

Global Classification Comments: This is not a native community but is the result of the invasion of alien *Phragmites australis* into natural or semi-natural vegetation. The vegetation has variable hydrology and, unless *Phragmites* is clearly dominant, is often treated as part of other marsh and meadow types. The geographic distribution of the type is arbitrarily limited to Bailey's Humid Temperate Domain in eastern North America (Bailey 1997, 1998). Stands in northern Minnesota and farther north in Canada may represent native stands. If so, they should be tracked as a different type. Tidal vegetation of the Gulf Coast of Louisiana and Texas dominated by *Phragmites australis* is classified in the *Phragmites australis* Tidal Herbaceous Alliance (A.1477).

ELEMENT DISTRIBUTION

Indiana Dunes National Lakeshore Range: This community is found in the Great Marsh in the Cowles Bog, Dunes State Park, and Keiser units. It is also found in marshes and ditches in the West units.

Global Range: This reed marsh type is found across the east-temperate regions of the United States and Canada, ranging from Maine west to the eastern Dakotas and Manitoba, south to Texas and east to Florida.

Nations: CA, US

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

USFS Ecoregions: 212C:CP, 212Fc:CCC, 212Hw:CCC, 221Aa:CCP, 221Ai:CCC, 221Bc:CCC, 221Da:CCC, 222Ic:CCC, 222Jj:CCC, 231Fb:CCC, 232Ac:CCC, 232C:CC, 232Dc:CCC, 232E:CC, 232G:CC, 234A:PP, 255Dc:CCC, M212:C, M221:P

Federal Lands: NPS (Assateague Island, Boston Harbor Islands, Cape Cod, Indiana Dunes, Minute Man, Saint Croix, Saratoga, Sleeping Bear Dunes, Upper Delaware, Voyageurs); USFWS (Alligator River, Aransas, Bon Secour, Brazoria, Great Dismal Swamp, Great Meadows, Great Swamp, Matagorda Island, Montezuma, Nomans Land Island?, Oxbow, Parker River, Prime Hook)

ELEMENT SOURCES

Indiana Dunes National Lakeshore Map Units Summary:

Indiana Dunes National Lakeshore Inventory Notes:

Indiana Dunes National Lakeshore Plots: INDU.VP163, INDU.VP166, INDU.VP167, INDU.AA031, INDU.AA048, INDU.AA087, INDU.AA093, INDU.AA141, INDU.AA196, INDU.AA234, INDU.AA286, INDU.AA365, INDU.AA373, INDU.AA409, INDU.AA453, INDU.AA456, INDU.AA544, INDU.AA551, INDU.AA604, INDU.AA614, INDU.AA706, INDU.AA757.

Local Description Author(s): N. Lehmann

Global Description Author(s): D. Faber-Langendoen

References: Bailey 1997, Bailey 1998, Bell et al. 2002, Chapman et al. 1989, Clancy 1993b, Harris et al. 1996, INAI unpubl. data, Metzler and Barrett 1992, Metzler and Barrett 2001, NRCS 2004, Nelson 1986, Rawinski 1984, Schafale and Weakley 1990, Schotz pers. comm., Southeastern Ecology Working Group n.d., Swain and Kearsley 2001

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V.A.5.N.I. Semipermanently flooded temperate or subpolar grassland

A.1436 *Typha* (*angustifolia, latifolia*) - (*Schoenoplectus* spp.) Semipermanently Flooded Herbaceous Alliance

(Narrowleaf Cattail, Broadleaf Cattail) - (Clubrush species) Semipermanently Flooded Herbaceous Alliance

[CEGL002233] *Typha* spp. Midwest Herbaceous Vegetation

Translated Name: **Cattail species Midwest Herbaceous Vegetation**
Common Name: **Midwest Cattail Deep Marsh**
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)

Circumscription Confidence: 2 - Moderate
Concept Author(s): D. Faber-Langendoen

ELEMENT CONCEPT

Global Summary: This community type is found in deep marshes throughout the midwestern United States and Canada. The vegetation is dominated by relatively pure stands of *Typha* spp., either *Typha latifolia* or *Typha angustifolia* or both. Many associates could occur. This type may simply be a less diverse variation of *Typha* spp. - *Schoenoplectus acutus* - Mixed Herbs Midwest Herbaceous Vegetation (CEGL002229), or is a semi-natural type resulting from human disturbance to wetlands.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Palustrine
Indiana Dunes National Lakeshore Environment: This cattail marsh community is found in interdunal lowlands with very poorly drained muck soils, which are usually inundated throughout the year.
Global Environment: These wetlands are found in glacial potholes, river valleys, ponds, and on lakeplains. They are characterized by continuous inundation and are considered a deep marsh. Water depth averages 0.3-0.6 m, ranging from several centimeters to more than one meter for a significant part of the growing season.

VEGETATION DESCRIPTION

Indiana Dunes National Lakeshore Vegetation: This is a deepwater emergent marsh community dominated by perennial, coarse-leaved vegetation, especially *Typha angustifolia* and *Typha latifolia* (*Typha X glauca*? [see Classification Comments]). Stands may be a mosaic of emergents, submergents, floating mats, and open water. More common associates include *Lemna trisulca, Eupatorium perfoliatum, Phragmites australis, Polygonum punctatum, Sagittaria latifolia, Schoenoplectus pungens,* and *Scirpus cyperinus*. Shrubs such as *Salix myricoides var. myricoides, Rosa palustris, Cephalanthus occidentalis*, and *Cornus amomum* may occur sparsely. Nonnatives include *Lythrum salicaria* and *Solanum dulcamara*. This community also supports state-vulnerable *Hypericum kalmianum*.
Global Vegetation: This deepwater emergent marsh community is dominated by perennial, coarse-leaved graminoid vegetation. Stands may vary from a mosaic of emergents, submergents, and floating-leaved plants interspersed with areas of open water to dense stands of emergents (Harris et al. 1996). They may display substantial areas of open water, but vegetation covers at least 30% of the surface. The vegetation is dominated by relatively pure stands of *Typha* spp., either *Typha latifolia* or *Typha angustifolia* or both. Many associates could occur.
Global Dynamics:

INDIANA DUNES NATIONAL LAKESHORE FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform
Salix myricoides var. *myricoides*	Tall shrub/sapling	Broad-leaved deciduous shrub
Eupatorium perfoliatum	Herb (field)	Forb
Polygonum punctatum	Herb (field)	Forb
Sagittaria latifolia	Herb (field)	Forb
Phragmites australis	Herb (field)	Graminoid
Schoenoplectus pungens	Herb (field)	Graminoid
Typha angustifolia	Herb (field)	Graminoid
Typha latifolia	Herb (field)	Graminoid
Osmunda cinnamomea	Herb (field)	Fern or fern ally
Lemna trisulca	Floating aquatic	Aquatic herb (floating & submergent)

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GLOBAL FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform

INDIANA DUNES NATIONAL LAKESHORE OTHER NOTEWORTHY SPECIES

Calystegia sepium ssp. *sepium, Frangula alnus, Hypericum kalmianum, Impatiens balsamina, Lythrum salicaria, Solanum dulcamara*

GLOBAL OTHER NOTEWORTHY SPECIES

CONSERVATION STATUS RANK

Global Rank & Reasons: G5

RELATED CONCEPTS

Global Similar Associations:

- *Schoenoplectus acutus - (Schoenoplectus fluviatilis)* Freshwater Herbaceous Vegetation (CEGL002225)
- *Typha (angustifolia, latifolia) - (Schoenoplectus* spp.) Eastern Herbaceous Vegetation (CEGL006153)
- *Typha latifolia - Caltha palustris* Herbaceous Vegetation (CEGL006245)
- *Typha* spp. - *Schoenoplectus acutus* - Mixed Herbs Midwest Herbaceous Vegetation (CEGL002229)
- *Typha* spp. Great Plains Herbaceous Vegetation (CEGL002389)

Global Related Concepts:

- Freshwater Marsh (Nelson 1985) B
- Inland Emergent Marsh (Chapman et al. 1989) B

CLASSIFICATION & OTHER COMMENTS

Indiana Dunes National Lakeshore Classification Comments: Genetic studies suggest that *Typha angustifolia* and *Typha latifolia* may have been replaced by the aggressive hybrid *Typha X glauca* (J. Marburger, NPS, pers. comm.). Several plots are in areas that have been classified as pannes in the past. A few typically panne species, such as *Rhynchospora capillacea, Rhynchospora capitellata, Hypericum kalmianum*, and *Sabatia angularis* are found, but the areas are predominantly cattail.

Indiana Dunes National Lakeshore Other Comments: At Indiana Dunes the *Typha X glauca*-dominated sites are not natural communities but often were formerly a *Carex stricta* community (D. Mason, N. Pavlovic, NPS, pers. comm.).

Global Classification Comments: It is unclear whether a separate *Typha*-dominated type is needed in addition to the mixed *Typha - Scirpus* type (e.g., *Typha* spp. - *Schoenoplectus acutus* - Mixed Herbs Midwest Herbaceous Vegetation (CEGL002229)), as well as separate *Scirpus*-dominated types (e.g., *Schoenoplectus acutus - (Schoenoplectus fluviatilis)* Freshwater Herbaceous Vegetation (CEGL002225)). Pure *Typha* stands, depending on site conditions, are also perceived as degraded examples of the mixed type. In western Minnesota, where *Typha* spp. form pure stands, the species may be *Typha angustifolia* or *Typha X glauca* in culturally disturbed marshes, and *Typha latifolia* (mixed with other species, especially Carices) in more undisturbed marshes (R. Dana pers. comm. 1999). Elsewhere, *Typha angustifolia* is thought to be more typical of undisturbed marshes.

ELEMENT DISTRIBUTION

Indiana Dunes National Lakeshore Range: This community is commonly found throughout the park.

Global Range: This community type is found in deep marshes throughout the midwestern United States, from Ohio and Ontario west to North Dakota, south to Kansas, and east to Indiana.

Nations: CA, US

States/Provinces: IA, IL, IN, KS, MI, MN, MO, ND, NE, OH, ON, SD, WI

USFS Ecoregions: 212Ha:CPP, 212Hb:CPP, 212He:CPP, 212Hh:CPP, 212Hi:CPP, 212Hj:CPP, 212Hk:CPP, 212Hl:CPP, 212Hm:CPP, 212Hn:CPP, 212Ho:CPP, 212Hp:CPP, 212Hq:CPP, 212Hr:CPP, 212Hs:CPP, 212Ht:CPP, 212Hv:CPP, 212Hw:CPP, 212Hx:CPP, 212Hy:CPP, 212Ib:C??, 212Ja:CPP, 212Jb:CPP, 212Jc:CPP, 212Jf:CPP, 212Jj:CPP, 212Jk:CPP, 212Jl:CPP, 212Jm:CPP, 212Jn:CPP, 212Jo:CPP, 212Jr:CPP, 212Ka:CCP, 212Kb:CCC, 212La:CPP, 212Mb:CPP, 212Na:CPP, 212Nb:CPP, 212Nc:CPP, 221Ec:CCC, 221Eg:CCC, 222Am:CCC, 222Ge:CCC, 222Ha:CCC, 222Jc:CCC, 222Jh:CCC, 222Ji:CCC, 222Jj:CCC, 222Kf:CCC, 222Kg:CCC, 222Mb:CCC, 222Mc:CCC, 222Md:CCC, 222Me:CCC, 251Aa:CCC, 251Ba:CCC, 251Bb:CCC, 251Bd:CCC, 251Be:CCC, 251Cc:CCC, 251Cf:CCC, 251Cg:CCC, 251Dc:CCC, 251Dg:CCC, 251Ea:CCC, 251Ed:CCC, 255Aa:CCC

Federal Lands: NPS (Indiana Dunes, Voyageurs); USFS (Chequamegon, Chequamegon-Nicolet, Chippewa, Hiawatha, Nicolet, Ottawa?, Superior?)

ELEMENT SOURCES

Indiana Dunes National Lakeshore Map Units Summary:

Indiana Dunes National Lakeshore Inventory Notes:

Indiana Dunes National Lakeshore Plots: INDU.VP101, INDU.VP102, INDU.VP143, INDU.VP145, INDU.VP154, INDU.VP157, INDU.AA122, INDU.AA184, INDU.AA245, INDU.AA273, INDU.AA369, INDU.AA369a, INDU.AA396, INDU.AA403, INDU.AA424, INDU.AA428, INDU.AA439, INDU.AA454, INDU.AA474, INDU.AA480, INDU.AA480a, INDU.AA484, INDU.AA539, INDU.AA682, INDU.AA684, INDU.AA744.

Local Description Author(s): N. Lehmann

Global Description Author(s): D. Faber-Langendoen

References: Chapman et al. 1989, Harris et al. 1996, INAI unpubl. data, Lauver et al. 1999, MNNHP 1993, Midwestern Ecology Working Group n.d., NDNHI n.d., Nelson 1985, ONHD unpubl. data, WNHIP unpubl. data

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V.A.6.N.c. Tall temperate grassland with a sparse cold-deciduous tree layer

A.1492 *Quercus velutina* - (*Quercus ellipsoidalis*) Wooded Herbaceous Alliance

Black Oak - (Northern Pin Oak) Wooded Herbaceous Alliance

[CEGL002492] *Quercus velutina* - (*Quercus alba*) - *Quercus ellipsoidalis* / *Schizachyrium scoparium* - *Lupinus perennis* Wooded Herbaceous Vegetation

Translated Name: **Black Oak - (White Oak) - Northern Pin Oak / Little Bluestem - Wild Lupine Wooded Herbaceous Vegetation**

Common Name: **Black Oak / Lupine Barrens**

Ecological System(s):

- North-Central Oak Barrens (CES202.727)

Circumscription Confidence: 1 - Strong

Concept Author(s): D. Faber-Langendoen

ELEMENT CONCEPT

Global Summary: This black oak - mixed oak barrens community occurs in the central and lower Great Lakes region of the United States and adjacent Canada. Stands occur on sandy outwash or lakeplains. Soils are well-drained, coarse-textured, varying from almost pure sand to sandy loam. Canopy structure varies from a dominant herbaceous ground layer with sparse, scattered 'savanna' canopy (5-30%), through oak-dominated scrub, to a more closed 'woodland' canopy (30-80%). The canopy layer is dominated by *Quercus velutina*, with some *Quercus ellipsoidalis* and *Quercus alba*, the latter more common eastward and in woodland conditions. Occasional *Pinus banksiana* can occur in the northern parts of the range. Tree height varies from 5-15 m. A subcanopy layer may be composed of the preceding species or *Prunus serotina, Sassafras albidum*, and *Carya ovata*. Tall shrubs may include *Cornus amomum, Cornus foemina, Corylus americana*, and *Rhus glabra*. The low-shrub/scrub layer typically contains *Ceanothus americanus, Rosa* spp. (such as *Rosa carolina*), and *Rubus allegheniensis*, but may contain ericaceous shrubs, such as *Gaylussacia baccata, Vaccinium angustifolium* and *Vaccinium pallidum*. The herb layer is dominated by graminoids, such as *Andropogon gerardii, Carex pensylvanica*, and *Schizachyrium scoparium*. Typical forbs include *Antennaria neglecta, Antennaria plantaginifolia, Euphorbia corollata, Helianthemum bicknellii, Helianthemum canadense, Lespedeza capitata, Lithospermum caroliniense, Lithospermum canescens, Lupinus perennis*, and *Pteridium aquilinum*. Forb dominance may increase as woody cover increases.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Terrestrial

Indiana Dunes National Lakeshore Environment: This black oak - mixed oak barrens community occurs on well-drained sandy dune ridges and slopes. Soils are mostly loamy sand.

Global Environment: This community generally occurs on well-drained, coarse-textured, sandy, infertile soils derived from glacial outwash, high gravelly/sandy moraines, or lakeplain dune systems. Soils vary from almost pure sand to sandy loam.

VEGETATION DESCRIPTION

Indiana Dunes National Lakeshore Vegetation: The canopy cover varies from less than 10% to about 30%. *Quercus velutina* is the dominant and characteristic canopy tree. Rarely, *Quercus alba* is found in the shrub layer. More common species of the shrub layer are *Populus tremuloides, Quercus velutina* grubs, *Rhus copallinum, Rosa carolina, Sassafras albidum*, and *Vaccinium angustifolium*. The herbaceous layer is dominated by graminoids such as *Carex pensylvanica, Schizachyrium scoparium, Panicum virgatum, Hesperostipa spartea*, and *Poa pratensis*. Numerous forbs can be found, particularly *Lupinus perennis, Tephrosia virginiana, Euphorbia corollata, Helianthus divaricatus, Helianthus occidentalis*, and *Maianthemum stellatum*. *Toxicodendron radicans* is notably present. Common invasive exotic species are *Ailanthus altissima, Lonicera* spp., and *Poa pratensis*. In addition, this community supports state-imperiled *Hudsonia tomentosa* and *Viola pedatifida*.

Global Vegetation: Canopy structure varies from a dominant herbaceous ground layer with sparse, scattered 'savanna' canopy (5-30%), through oak-dominated scrub, to a more closed 'woodland' canopy (30-80%). The canopy layer is dominated by *Quercus velutina*, with some *Quercus ellipsoidalis* and *Quercus alba*, the latter more common eastward and in woodland conditions. Occasional *Pinus banksiana* can occur in the northern parts of the range. Tree height varies from 5-15 m. A subcanopy layer may be composed of the preceding species or *Prunus serotina, Sassafras albidum*, and *Carya ovata*. Tall shrubs may include *Cornus amomum, Cornus foemina, Corylus americana*, and *Rhus glabra*. The low-shrub/scrub layer typically contains *Ceanothus americanus, Rosa* spp. (such as *Rosa carolina*), and *Rubus allegheniensis*, but may contain ericaceous shrubs, such as *Gaylussacia baccata, Vaccinium angustifolium* and *Vaccinium pallidum*. The herb layer is dominated by graminoids, such as *Andropogon gerardii, Carex pensylvanica*, and *Schizachyrium scoparium*. Typical forbs include *Antennaria neglecta, Antennaria plantaginifolia, Euphorbia corollata, Helianthemum bicknellii, Helianthemum canadense, Lespedeza capitata, Lithospermum caroliniense* (Minnesota), *Lithospermum canescens* (Wisconsin), *Lupinus perennis*, and *Pteridium aquilinum*. Forb dominance may increase as woody cover increases (Curtis 1959, MNNHP 1993, Anderson 1996).

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Global Dynamics:

INDIANA DUNES NATIONAL LAKESHORE FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform
Quercus velutina	Tree canopy	Broad-leaved deciduous tree
Quercus velutina	Shrub/sapling (tall & short)	Broad-leaved deciduous shrub
Sassafras albidum	Shrub/sapling (tall & short)	Broad-leaved deciduous shrub
Rosa carolina	Short shrub/sapling	Broad-leaved deciduous shrub
Vaccinium angustifolium	Short shrub/sapling	Broad-leaved deciduous shrub
Toxicodendron radicans	Herb (field)	Vine/Liana
Euphorbia corollata	Herb (field)	Forb
Helianthus divaricatus	Herb (field)	Forb
Maianthemum stellatum	Herb (field)	Forb
Tephrosia virginiana	Herb (field)	Forb
Tradescantia ohiensis	Herb (field)	Forb
Carex pensylvanica	Herb (field)	Graminoid
Koeleria macrantha	Herb (field)	Graminoid
Poa pratensis	Herb (field)	Graminoid
Schizachyrium scoparium	Herb (field)	Graminoid

GLOBAL FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform

INDIANA DUNES NATIONAL LAKESHORE OTHER NOTEWORTHY SPECIES

Ailanthus altissima, Hudsonia tomentosa, Lonicera tatarica, Lonicera x *bella, Nepeta cataria, Tragopogon pratensis, Viola pedatifida*

GLOBAL OTHER NOTEWORTHY SPECIES

CONSERVATION STATUS RANK

Global Rank & Reasons: G3 Twelve occurrences have been documented in Michigan (where the community is ranked S2), 22 in Illinois (S1,S1), 57 in Indiana (S2,S2S3,S1), 42 in Minnesota (S1,S1?,S2), and 20 in Wisconsin (S2). Although no other occurrences have been documented, the community is also reported in Ohio (S1) and Ontario (S?) and may be extirpated from Iowa (SX?). It is reported in 24 ecoregional subsections. The sizes of 134 occurrences total 10,273 acres. The community occurs on a variety of sandy, well-drained soils derived from glacial outwash, moraines, or lakeplain dune systems.

RELATED CONCEPTS

Global Similar Associations:

- *Corylus americana - Salix humilis / Schizachyrium scoparium* Shrubland (CEGL005072)
- *Pinus strobus - Quercus alba - (Quercus velutina) / Andropogon gerardii* Wooded Herbaceous Vegetation (CEGL005127)
- *Quercus velutina - (Quercus ellipsoidalis) - Quercus alba / Deschampsia flexuosa* Woodland (CEGL005029)
- *Quercus velutina - Quercus alba / Vaccinium (angustifolium, pallidum) / Carex pensylvanica* Forest (CEGL005030)

Global Related Concepts:

- Oak Barren (Chapman et al. 1989) B
- Oak Barrens (Anderson 1996) =

CLASSIFICATION & OTHER COMMENTS

Indiana Dunes National Lakeshore Classification Comments: This association has a variable tree canopy cover at Indiana Dunes NL. It can range slightly into the canopy range typically considered a woodland, i.e. 25-30% canopy. Some stands may have heavy shrub canopy and a short tree canopy. This type at Indiana Dunes NL grades into the *Quercus velutina – (Quercus ellipsoidalis) – Quercus alba / Deschampsia flexuosa* Woodland (CEGL005029) in terms of both floristics and physiognomy.

Indiana Dunes National Lakeshore Other Comments:

Global Classification Comments: A black oak woodland variant or phase may occur, but because *Quercus velutina* can sprout after stems have been killed by fires, stands generally have a somewhat scrubby structure that can vary from 10-60% cover over time. Indiana reports a mesic sand savanna stand. Oak-pine barrens of Michigan, Wisconsin, and Minnesota are not included in this type.

ELEMENT DISTRIBUTION

Indiana Dunes National Lakeshore Range: This community is found in dry, sandy uplands throughout the park.

Global Range: This black oak - mixed oak barrens community occurs in the central and lower Great Lakes region of the United States and adjacent Canada, extending from Ohio and Ontario west to Iowa and Minnesota.

Nations: CA, US

States/Provinces: IA?, IL, IN, MI, MN, OH, ON, WI

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USFS Ecoregions: 212Hb:C??, 212Ka:CCC, 222Ha:CCC, 222Jc:CCC, 222Jd:CCC, 222Jh:CCC, 222Ji:CCC, 222Jj:CCC, 222Ka:CCC, 222Kb:CCC, 222Kd:CCC, 222Kg:CCC, 222La:CCC, 222Lb:CCC, 222Lc:CCC, 222Lf:CCC, 222Mb:CCC, 222Md:CCC, 222Me:CCC, 251Ba:CCC, 251Cf:CCC, 251Ci:CCC, 251Dd:CCC, 251Df:CCC, 251Dg:CCC
Federal Lands: NPS (Indiana Dunes)

ELEMENT SOURCES

Indiana Dunes National Lakeshore Map Units Summary:
Indiana Dunes National Lakeshore Inventory Notes:
Indiana Dunes National Lakeshore Plots: INDU.VP034, INDU.VP087, INDU.VP109, INDU.VP127, INDU.VP144, INDU.AA026, INDU.AA053, INDU.AA572, INDU.AA630, INDU.AA673.
Local Description Author(s): N. Lehmann
Global Description Author(s): D. Faber-Langendoen
References: Anderson 1996, Chapman et al. 1989, Curtis 1959, INAI unpubl. data, MNNHP 1993, Midwestern Ecology Working Group n.d., WNHIP unpubl. data.

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V.A.6.N.f. Medium-tall temperate or subpolar grassland with a sparse needle-leaved evergreen or mixed tree layer

A.1499 *Pinus banksiana* - (*Pinus resinosa*) Wooded Herbaceous Alliance

Jack Pine - (Red Pine) Wooded Herbaceous Alliance

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

Translated Name: **Jack Pine - (Red Pine) - Eastern White Pine / Creeping Juniper Wooded Herbaceous Vegetation**
Common Name: **Great Lakes Pine Barrens**
Ecological System(s):
- Great Lakes Wooded Dune and Swale (CES201.726)

Circumscription Confidence: 1 - Strong
Concept Author(s): J. Drake and D. Faber-Langendoen

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* is usually the single most abundant tree, but several other species, including *Pinus resinosa* and *Pinus strobus* are typically present. Much of the shrub layer is composed of evergreen species, namely *Arctostaphylos uva-ursi, Hudsonia tomentosa, Juniperus horizontalis, Juniperus communis*, and *Vaccinium angustifolium*. The most abundant species of the ground layer include *Agrostis hyemalis, Arabis lyrata, Ammophila breviligulata, Calamovilfa longifolia, Danthonia spicata, Deschampsia flexuosa*, and *Toxicodendron radicans*. 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

USFWS Wetland System: Terrestrial
Indiana Dunes National Lakeshore Environment: This pine barrens type is found on foredunes south of the Lake Michigan shoreline. Soils are sandy to slightly loamy sand and very well-drained.
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

Indiana Dunes National Lakeshore Vegetation: This community has a sparse canopy (about 20-35% cover) dominated by *Pinus banksiana* (state-imperiled). *Quercus velutina* may codominate. The shrub layer is dominate by short-statured *Pinus banksiana, Prunus pumila*, and *Juniperus communis* (state-imperiled). The herbaceous layer is mostly *Calamovilfa longifolia* and *Schizachyrium scoparium* with a cover of about 50%. This community also supports state-imperiled *Arctostaphylos uva-ursi*.
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* is usually the single most abundant tree, but several other species, including *Pinus resinosa* and *Pinus strobus* are typically present. Much of the shrub layer is composed of evergreen species, namely *Arctostaphylos uva-ursi, Hudsonia tomentosa, Juniperus horizontalis, Juniperus communis*, and *Vaccinium angustifolium*. The most abundant species of the ground layer include *Ammophila breviligulata, Agrostis hyemalis, Arabis lyrata, Calamovilfa longifolia, Danthonia spicata, Deschampsia flexuosa*, and *Toxicodendron radicans*. 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* are present in stands in Keweenaw County, MI (Chapman et al. 1989).
Global Dynamics:

INDIANA DUNES NATIONAL LAKESHORE FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform
Pinus banksiana	Tree canopy	Needle-leaved tree
Juniperus communis	Tall shrub/sapling	Needle-leaved shrub
Ptelea trifoliata var. *mollis*	Tall shrub/sapling	Broad-leaved deciduous shrub
Arctostaphylos uva-ursi	Tall shrub/sapling	Broad-leaved evergreen shrub

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Calamovilfa longifolia	Herb (field)	Graminoid
Schizachyrium scoparium	Herb (field)	Graminoid

GLOBAL FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform
Pinus banksiana	Tree canopy	Needle-leaved tree
Pinus resinosa	Tree canopy	Needle-leaved tree
Pinus strobus	Tree canopy	Needle-leaved tree
Toxicodendron radicans	Shrub/sapling (tall & short)	Vine/Liana
Juniperus communis	Short shrub/sapling	Needle-leaved tree
Shepherdia canadensis	Short shrub/sapling	Broad-leaved deciduous shrub
Arctostaphylos uva-ursi	Short shrub/sapling	Dwarf-shrub
Hudsonia tomentosa	Short shrub/sapling	Dwarf-shrub
Juniperus horizontalis	Short shrub/sapling	Dwarf-shrub
Linnaea borealis	Short shrub/sapling	Dwarf-shrub
Solidago nemoralis	Herb (field)	Forb
Ammophila breviligulata	Herb (field)	Graminoid
Calamovilfa longifolia	Herb (field)	Graminoid
Cyperus schweinitzii	Herb (field)	Graminoid
Danthonia spicata	Herb (field)	Graminoid
Deschampsia flexuosa	Herb (field)	Graminoid
Festuca saximontana	Herb (field)	Graminoid
Koeleria macrantha	Herb (field)	Graminoid

INDIANA DUNES NATIONAL LAKESHORE OTHER NOTEWORTHY SPECIES

Arctostaphylos uva-ursi, Juniperus communis, Pinus banksiana

GLOBAL OTHER NOTEWORTHY SPECIES

Cirsium pitcheri

CONSERVATION STATUS RANK

Global Rank & Reasons: G2 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).

RELATED CONCEPTS

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

CLASSIFICATION & OTHER COMMENTS

Indiana Dunes National Lakeshore Classification Comments: *Pinus strobus* may also be present but is not found in the plot. *Pinus resinosa* is considered to be south of its natural range at INDU and only occurs as a planted tree (Swink and Wilhelm 1994). It was not observed in the southern Lake Michigan foredunes.

Indiana Dunes National Lakeshore Other Comments:

Global Classification 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).

ELEMENT DISTRIBUTION

Indiana Dunes National Lakeshore Range: This community occurs in the Miller Dunes, West Beach, Cowles Bog, and Dunes State Park units.

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

USFS Ecoregions: 212Hi:CCC, 212Hj:CCP, 212Hw:CCC, 212Ia:CCC, 212Ja:CPP, 212Jb:CP?, 212Jc:CP?, 212Jl:CP?, 212Jn:CP?, 212Oa:CCC, 222Jj:CCC

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Federal Lands: NPS (Apostle Islands, Indiana Dunes, Pictured Rocks, Sleeping Bear Dunes); USFS (Hiawatha, Huron-Manistee, Huron?, Manistee)

ELEMENT SOURCES

Indiana Dunes National Lakeshore Map Units Summary:
Indiana Dunes National Lakeshore Inventory Notes:
Indiana Dunes National Lakeshore Plots: INDU.VP110.
Local Description Author(s): N. Lehmann
Global Description Author(s): 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

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V.B.2.N.f. Saturated temperate perennial forb vegetation

A.1694 *Symplocarpus foetidus - Caltha palustris* Saturated Herbaceous Alliance

Skunk-cabbage - Yellow Marsh-marigold Saturated Herbaceous Alliance

[CEGL002385] *Symplocarpus foetidus* Herbaceous Vegetation

Translated Name: **Skunk-cabbage Herbaceous Vegetation**
Common Name: **Skunk-cabbage Seepage Meadow**
Ecological System(s):

- Laurentian-Acadian Northern Hardwoods Forest (CES201.564)
- Laurentian-Acadian Pine-Hemlock-Hardwood Forest (CES201.563)
- North-Central Interior Shrub-Graminoid Alkaline Fen (CES202.702)
- North-Central Appalachian Seepage Fen (CES202.607)

Circumscription Confidence: 2 - Moderate
Concept Author(s): D. Faber-Langendoen

ELEMENT CONCEPT

Global Summary: This community is found throughout the upper midwestern region of the United States and adjacent Canada, ranging to the Northeast, where it develops around spring heads and in broader areas of groundwater discharge. The peat layer is typically less than 0.4 m deep. Tree and shrub cover may vary, particularly from overhanging upland trees, but trees and shrubs rooted in the stand are less than 25% cover. Forbs dominate the community. *Symplocarpus foetidus* and *Angelica atropurpurea* are the dominant and indicative species in the Midwest; *Impatiens capensis* is characteristic in the East. Other forbs and ferns present include *Caltha palustris, Chelone glabra, Epilobium coloratum, Impatiens capensis (= Impatiens biflora), Pedicularis lanceolata, Pilea pumila, Saxifraga pensylvanica, Solidago patula*, and *Thelypteris palustris*. Graminoid cover is generally low, less than 25%, and may include *Carex bromoides, Carex comosa, Carex lacustris, Carex stricta*, and *Carex trichocarpa*.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Palustrine
Indiana Dunes National Lakeshore Environment: The skunk-cabbage seepage meadow type occurs in saturated soil that is seasonally flooded and wet throughout the year. The soil is a sandy muck located where water seeps toward underground springs.
Global Environment: This community develops around spring heads and in broader areas of groundwater discharge, where water flows to the surface in a diffuse rather than concentrated flow. Peat may be present in some areas, and perhaps locally can be as deep as 1 m, but it is typically less than 0.4 m deep. Stands can occur along the lower slopes of glacial moraines, ravines and in deep glacial meltwater-cut river valleys at the bases of slopes separating stream terraces. Soils are seasonally to more-or-less permanently saturated (MNNHP 1993).

VEGETATION DESCRIPTION

Indiana Dunes National Lakeshore Vegetation: This community has an open canopy that contains *Fagus grandifolia, Tilia americana, Acer rubrum*, and/or *Fraxinus americana*. The shrub layer may be dominated by *Carpinus caroliniana, Lindera benzoin*, and *Alnus incana ssp. rugosa* (state-vulnerable). *Symplocarpus foetidus* covers 50-90% of the herbaceous layer, and *Carex stricta* is abundant.
Global Vegetation: This is an herbaceous-dominated community. Tree and shrub cover may vary, particularly from overhanging upland trees, but trees and shrubs rooted in the stand are less than 25% cover. Forbs dominate the community. *Symplocarpus foetidus* and *Angelica atropurpurea* are the leading dominant and indicator species. Other forbs and ferns present include *Caltha palustris, Chelone glabra, Epilobium coloratum, Impatiens capensis (= Impatiens biflora), Impatiens capensis, Pedicularis lanceolata, Pilea pumila, Saxifraga pensylvanica, Solidago patula*, and *Thelypteris palustris*. Graminoid cover is generally low, less than 25%, and may include *Carex bromoides, Carex comosa, Carex lacustris, Carex stricta*, and *Carex trichocarpa* (White and Madany 1978, MNNHP 1993).
Global Dynamics:

INDIANA DUNES NATIONAL LAKESHORE FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform
Symplocarpus foetidus	Herb (field)	Forb

GLOBAL FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform
Caltha palustris	Herb (field)	Forb
Symplocarpus foetidus	Herb (field)	Forb
Thelypteris palustris	Herb (field)	Fern or fern ally

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INDIANA DUNES NATIONAL LAKESHORE OTHER NOTEWORTHY SPECIES

Alnus incana ssp. *rugosa*

GLOBAL OTHER NOTEWORTHY SPECIES

Floerkea proserpinacoides, Hydrocotyle americana, Poa paludigena

CONSERVATION STATUS RANK

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

RELATED CONCEPTS

Global Similar Associations:

- *Acer rubrum - Fraxinus* spp. - *Betula papyrifera / Cornus canadensis* Forest (CEGL002071)--may have a similar composition.
- *Carex crinita - Osmunda* spp. / *Physocarpus opulifolius* Seep Herbaceous Vegetation (CEGL002392)
- *Carex crinita - Osmunda* spp. / *Sphagnum* spp. Herbaceous Vegetation (CEGL002263)
- *Cornus sericea - Salix* spp. - (*Rosa palustris*) Shrubland (CEGL002186)--may have a similar composition.
- *Fraxinus nigra* - Mixed Hardwoods - Conifers / *Cornus sericea / Carex* spp. Forest (CEGL002105)--may have a similar composition.

Global Related Concepts:

- Southern Swamp (Chapman et al. 1989) B

CLASSIFICATION & OTHER COMMENTS

Indiana Dunes National Lakeshore Classification Comments: The vegetation of this community is similar to the red maple swamp community classified here, and the wooded fen in older park classifications. The canopy is more open though.

Indiana Dunes National Lakeshore Other Comments:

Global Classification Comments: This community is defined as an herbaceous community, thereby excluding many closed canopy seepage meadows with trees or shrubs rooted in the stand. However, some herbaceous seepage meadows could be quite shaded because of surrounding upland forests. This type is not always separated out by state heritage programs, since it can be a zone in other wetland types. *Carex lacustris* may occur in this type. The presence of coarse-leaved sedges may be a structural difference as compared to fens, which typically have fine-leaved sedges (MNNHP 1993).

ELEMENT DISTRIBUTION

Indiana Dunes National Lakeshore Range: This community occurs in the Dunes State Park and Keiser units.

Global Range: This community is found throughout the upper midwestern region of the United States and adjacent Canada, where it develops around spring heads and in broader areas of groundwater discharge. The type extends from Indiana and possibly Ontario and Ohio, west to Minnesota and Iowa.

Nations: CA, US

States/Provinces: IA, IL, IN, MA, MI, MN, NJ, OH?, ON, PA

USFS Ecoregions: 212He:CPP, 212Hl:CP?, 212Hm:CPP, 212Hq:CPP, 212Hr:CPP, 212Ht:CPP, 212Hu:CPP, 212Hv:CP?, 212Hw:CP?, 212Hx:CP?, 212Kb:CCC, 221D:CC, 221Ec:CCC, 221Fa:CCC, 222Em:CPP, 222Ff:CCC, 222Gc:CCC, 222Ge:CCC, 222Ha:CCC, 222Hb:CCC, 222Hf:CCC, 222I:CP, 222Jb:CCC, 222Jj:CCC, 222Kg:CCC, 222Kh:CCC, 222Lc:CCC, 222Lf:CCC, 222Md:CCC, 251Cf:CCC, 251Dd:CCC, M221:?

Federal Lands: NPS (Indiana Dunes, Saint Croix, Valley Forge); USFS (Huron, Huron-Manistee, Manistee); USFWS (Erie)

ELEMENT SOURCES

Indiana Dunes National Lakeshore Map Units Summary:

Indiana Dunes National Lakeshore Inventory Notes:

Indiana Dunes National Lakeshore Plots: INDU.VP124.

Local Description Author(s): N. Lehmann

Global Description Author(s): D. Faber-Langendoen, mod. L.A. Sneddon

References: Chapman et al. 1989, Fike 1999, INAI unpubl. data, MNNHP 1993, Midwestern Ecology Working Group n.d., Newbold 1993, Newbold 1996, White and Madany 1978

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V.C.2.N.a. Permanently flooded temperate or subpolar hydromorphic-rooted vegetation

A.1984 *Nymphaea odorata - Nuphar* spp. Permanently Flooded Temperate Herbaceous Alliance

American White Water-lily - Yellow Pond-lily species Permanently Flooded Temperate Herbaceous Alliance

[CEGL002386] *Nuphar lutea* ssp. *advena - Nymphaea odorata* Herbaceous Vegetation

Translated Name: **Broadleaf Pond-lily - American White Water-lily Herbaceous Vegetation**
Common Name: **Water-lily Aquatic Wetland**
Ecological System(s):

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

Circumscription Confidence: 2 - Moderate
Concept Author(s): D. Faber-Langendoen

ELEMENT CONCEPT

Global Summary: This rooted aquatic or open marsh community occupies shallow-water depressions, oxbow ponds, backwater sloughs of river floodplains, slow-moving streams, ponds, and small lakes throughout the central and eastern United States. It is dominated by rooted, floating-leaved aquatic species, with both submergent and emergent aquatics also present. *Nuphar lutea ssp. advena* and *Nymphaea odorata* are dominants, either in combination together, or each singly. Other species present include *Brasenia schreberi*, various *Potamogeton* and *Stuckenia* spp., *Eleocharis robbinsii* and other *Eleocharis* spp., *Polygonum amphibium, Polygonum amphibium var. emersum (= Polygonum coccineum), Sparganium americanum, Lemna* spp., *Spirodela polyrrhiza, Typha latifolia*, and *Saururus cernuus*. Submerged aquatics more common in the southern part of the range include *Cabomba caroliniana, Ceratophyllum demersum*, and *Heteranthera dubia*.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Lacustrine
Indiana Dunes National Lakeshore Environment: This rooted aquatic community is found in interdunal ponds with permanently flooded, muck soils.
Global Environment: This community occupies shallow-water depressions, oxbow ponds, sluggish streams, and backwater sloughs of river floodplains, ponds (natural and artificial), and small lakes. In pools and slow-flowing stretches of river, at Obed River (TN), *Nuphar lutea ssp. advena* is rooted in sandy substrate (Schmalzer and DeSelm 1982).

VEGETATION DESCRIPTION

Indiana Dunes National Lakeshore Vegetation: This is a community dominated by rooted, floating-leaved aquatic species, with submergent and emergent aquatic species also present. *Nuphar lutea ssp. advena* and/or *Nymphaea odorata* are dominant. Other species include *Carex comosa, Ludwigia palustris, Polygonum amphibium var. emersum, Polygonum hydropiperoides, Pontederia cordata, Sparganium erectum ssp. stoloniferum, Potamogeton natans*, and *Brasenia schreberi*. The nonnative *Myriophyllum spicatum* can be present in large amounts.
Global Vegetation: This community is dominated by rooted, floating-leaved aquatic species, with both submergent and emergent aquatics also present. *Nuphar lutea ssp. advena* and *Nymphaea odorata* are dominants, either in combination together, or each singly. Other species present include *Brasenia schreberi*, various *Potamogeton* and *Stuckenia* spp., *Eleocharis robbinsii* and other *Eleocharis* spp., *Polygonum amphibium, Polygonum amphibium var. emersum (= Polygonum coccineum), Sparganium americanum, Lemna* spp., *Spirodela polyrrhiza, Typha latifolia*, and *Saururus cernuus* Anderson 1982, G. Fleming pers. comm.). Submerged aquatic species

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more common in the southern part of the range include *Cabomba caroliniana, Ceratophyllum demersum,* and *Heteranthera dubia*. This broadly conceived type may include ponds, or zones of ponds, dominated by *Nymphaea odorata,* with or without *Nuphar lutea ssp. advena*.

Global Dynamics:

INDIANA DUNES NATIONAL LAKESHORE FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform
Nuphar lutea ssp. *advena*	Floating aquatic	Aquatic herb (floating & submergent)
Nymphaea odorata	Floating aquatic	Aquatic herb (floating & submergent)

GLOBAL FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform
Nuphar lutea ssp. *advena*	Floating aquatic	Aquatic herb (floating & submergent)
Nymphaea odorata	Floating aquatic	Aquatic herb (floating & submergent)

INDIANA DUNES NATIONAL LAKESHORE OTHER NOTEWORTHY SPECIES

Lythrum salicaria, Myriophyllum spicatum

GLOBAL OTHER NOTEWORTHY SPECIES

CONSERVATION STATUS RANK

Global Rank & Reasons: G4G5 The dominant species in stands of this vegetation are widespread across the eastern and central United States and adjacent Canada. This is not a rare or imperiled vegetation type, even though its occurrence is poorly documented. Stands may occur in natural lakes and ponds or in artificial impoundments.

RELATED CONCEPTS

Global Similar Associations:

- *Equisetum fluviatile - (Eleocharis palustris)* Herbaceous Vegetation (CEGL005258)
- *Nuphar lutea ssp. advena* Tidal Herbaceous Vegetation (CEGL004472)
- *Nuphar lutea ssp. polysepala* Herbaceous Vegetation (CEGL002001)
- Semipermanent Impoundment (CEGL006581)

Global Related Concepts:

- *Nuphar advena - Nymphaea odorata* Herbaceous Vegetation (Clancy 1996) =
- Freshwater Marsh (Nelson 1985) B
- Inland Emergent Marsh (Chapman et al. 1989) B
- L5D2aI1a. *Nuphar lutea* (Foti et al. 1994) ?
- New England coastal plain pondshore (Rawinski 1984) ?
- Open Water/Aquatic Bed Veg., Natural Impoundment Pond (Ambrose 1990a) B
- Open water marsh with floating-leaved plants (NAP pers. comm. 1998) ?

CLASSIFICATION & OTHER COMMENTS

Indiana Dunes National Lakeshore Classification Comments:

Indiana Dunes National Lakeshore Other Comments:

Global Classification Comments: Can occur in mostly natural ponded wetlands as well as artifactual ones such as borrow pits. On the Conecuh National Forest (Alabama), vegetation of this association occurs in Gum Pond and Open Pond as a mix of *Nymphaea odorata* and *Nuphar lutea ssp. advena*.

ELEMENT DISTRIBUTION

Indiana Dunes National Lakeshore Range: This aquatic community is found at the Inland Marsh, West Beach, and Miller units.

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

Nations: CA, US

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

USFS Ecoregions: 212Aa:CCC, 212Ba:CCC, 212Bb:CCC, 212Ca:CCC, 212Cb:CCC, 212Da:CCC, 212Db:CCP, 212Dc:CCC, 212Fa:CCP, 212Fb:CCP, 212Fc:CCP, 212Fd:CCP, 212Ga:CCP, 212Gb:CCP, 212Hb:CPP, 212Ja:CCP, 212Jb:CCP, 212Jc:CCP, 212Je:CCP, 212Jf:CCP, 212Jj:CCP, 212Jl:CCP, 212Jm:CCC, 212Ka:CPP, 221Aa:CCP, 221Ah:CCC, 221Ai:CCC, 221Al:CCC, 221Am:CCC, 221Bd:CCP, 221Da:CCC, 221Db:CCC, 221Ea:CCC, 221Ed:CC?, 221Ef:CCC, 221Fa:CCC, 221Hc:CCC, 221He:CCC, 222Ch:CCC, 222Db:CCC, 222Gc:C??, 222Ha:CCC, 222Ja:CCC, 222Jb:CCC, 222Ji:CCC, 222Jj:CCC, 222Kf:CCC, 222Kg:CCC, 222Kh:CCC, 222Kj:CCC, 222L:CC, 231Bc:CCC, 231Bd:CCC, 231Ga:CCC, 231Gb:CCC, 231Gc:CCC, 232Bf:CCC, 232C:CC, 232D:CC, 234Aa:CCC, 234Ac:CCC, 234Ad:CCC, 234Af:CCC, 234Ag:CCC, 234Ai:CCC, 234Al:CCC, 234Am:CCC, 234An:CCC, 251Cf:CCC, 251Dd:CCC, 251Dg:CCC, 251Eb:CCC, M212Af:CCC, M212Bb:CCC, M212Bc:CCC, M212Bd:CCC, M212Cb:CCC,

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M212Cc:CCC, M212Ea:CCP, M212Eb:CCP, M221Aa:CCC, M221Ab:CCC, M221Ac:CCC, M221Ad:CCC, M221Ba:CCC, M221Bb:CCC, M221Bc:CCC, M221Bd:CCC, M221Be:CCC, M221Bf:CCC, M221Da:CCC, M221Dc:CCC

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

ELEMENT SOURCES

Indiana Dunes National Lakeshore Map Units Summary:

Indiana Dunes National Lakeshore Inventory Notes:

Indiana Dunes National Lakeshore Plots: INDU.VP106, INDU.VP107, INDU.VP155, INDU.AA078, INDU.AA130, INDU.AA178, INDU.AA206, INDU.AA267, INDU.AA294, INDU.AA383, INDU.AA389, INDU.AA470, INDU.AA478, INDU.AA491, INDU.AA597, INDU.AA597a, INDU.AA642, INDU.AA647, INDU.AA657, INDU.AA693, INDU.AA741.

Local Description Author(s): N. Lehmann

Global Description Author(s): D. Faber-Langendoen, mod. C.W. Nordman, S.C. Gawler, M. Pyne

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

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V.C.2.N.a. Permanently flooded temperate or subpolar hydromorphic-rooted vegetation

A.1754 *Potamogeton* spp. - *Ceratophyllum* spp. - *Elodea* spp. Permanently Flooded Herbaceous Alliance

Pondweed species - Coontail species - Waterweed species Permanently Flooded Herbaceous Alliance

[CEGL002282] *Potamogeton* spp. - *Ceratophyllum* spp. Midwest Herbaceous Vegetation

Translated Name: **Pondweed species - Hornwort species Midwest Herbaceous Vegetation**
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)

Circumscription Confidence: 3 - Weak
Concept Author(s): D. Faber-Langendoen

ELEMENT CONCEPT

Global Summary: This broadly defined submerged aquatic or open marsh type is found throughout the midwestern region of the United States and adjacent Canada. Based on information in the northern parts of the Midwest, several vegetation subgroups can be recognized that may be separate associations. Subgroup A is a shallow (<50 cm), sparsely vegetated, open water marsh found on sand, or organic and mineral material trapped in rocky bottoms. Stands are often exposed to wave action and found in oligotrophic lakes. Dominant plants often have basal rosettes that are resistant to wave action. Typical species include *Elatine minima, Eriocaulon aquaticum, Gratiola aurea, Isoetes tenella (= Isoetes echinospora), Isoetes lacustris (= Isoetes macrospora), Juncus pelocarpus,* and *Lobelia dortmanna*. 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, Myriophyllum* spp., *Potamogeton amplifolius, Potamogeton gramineus, Potamogeton praelongus, Potamogeton robbinsii, Sparganium fluctuans,* and *Utricularia macrorhiza (= Utricularia vulgaris).* 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, Elodea canadensis, Lemna* spp., *Myriophyllum sibiricum, Myriophyllum verticillatum, Potamogeton natans, Stuckenia pectinata (= Potamogeton pectinatus), Potamogeton richardsonii, Potamogeton zosteriformis, Ranunculus aquatilis, Utricularia macrorhiza (= Utricularia vulgaris),* and *Vallisneria americana*.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Palustrine
Indiana Dunes National Lakeshore Environment: This aquatic community occurs in permanently flooded wetlands with standing water.
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

Indiana Dunes National Lakeshore Vegetation: This is an herbaceous aquatic community. However, there may also be sparse cover by trees and shrubs, including *Acer rubrum, Cephalanthus occidentalis, Ilex verticillata,* and *Rosa palustris*. *Pontederia cordata* and *Sagittaria latifolia* are the dominant herbaceous species, which may also include *Boehmeria cylindrica, Carex* sp., *Impatiens capensis,* and *Osmunda regalis*. The surface of the water is covered by *Lemna* spp.
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, Eriocaulon aquaticum, Gratiola*

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aurea, Isoetes tenella (= Isoetes echinospora), Isoetes lacustris (= Isoetes macrospora), Juncus pelocarpus, and *Lobelia dortmanna* (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, Myriophyllum* spp., *Potamogeton amplifolius, Potamogeton gramineus, Potamogeton praelongus, Potamogeton robbinsii, Sparganium fluctuans,* and *Utricularia macrorhiza (= Utricularia vulgaris).* 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, Elodea canadensis, Lemna* spp., *Myriophyllum sibiricum, Myriophyllum verticillatum, Potamogeton natans, Stuckenia pectinata (= Potamogeton pectinatus), Potamogeton richardsonii, Potamogeton zosteriformis, Ranunculus aquatilis, Utricularia macrorhiza (= Utricularia vulgaris),* and *Vallisneria americana* (Curtis 1959, Harris et al. 1996).

Global Dynamics:

INDIANA DUNES NATIONAL LAKESHORE FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform
Acer rubrum	Tree subcanopy	Broad-leaved deciduous tree
Cephalanthus occidentalis	Shrub/sapling (tall & short)	Broad-leaved deciduous shrub
Rosa palustris	Shrub/sapling (tall & short)	Broad-leaved deciduous shrub
Ilex verticillata	Tall shrub/sapling	Broad-leaved deciduous shrub
Pontederia cordata	Herb (field)	Forb
Sagittaria latifolia	Herb (field)	Forb

GLOBAL FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform

INDIANA DUNES NATIONAL LAKESHORE OTHER NOTEWORTHY SPECIES

GLOBAL OTHER NOTEWORTHY SPECIES

CONSERVATION STATUS RANK

Global Rank & Reasons: G5

RELATED CONCEPTS

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

CLASSIFICATION & OTHER COMMENTS

Indiana Dunes National Lakeshore Classification Comments:

Indiana Dunes National Lakeshore Other Comments:

Global Classification 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).

ELEMENT DISTRIBUTION

Indiana Dunes National Lakeshore Range: This community is found in permanent ponds and lakes in the park. It was observed in Grand Boulevard, Pinhook Bog, and Miller Woods but may be elsewhere.

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, IL, IN, MI, MN, ND, OH, ON, SD, WI

USFS Ecoregions: 212Hb:CCP, 212Hi: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?)

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ELEMENT SOURCES

Indiana Dunes National Lakeshore Map Units Summary:
Indiana Dunes National Lakeshore Inventory Notes:
Indiana Dunes National Lakeshore Plots: INDU.AA095, INDU.AA236, INDU.AA355.
Local Description Author(s): M.J. Russo
Global Description Author(s): 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 n.d., Swindale and Curtis 1957

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VII. Sparse Vegetation

VII.C.1.N.a. Dunes with sparse herbaceous vegetation

A.1855 Herbaceous Dunes Sparsely Vegetated Alliance

Herbaceous Dunes Sparsely Vegetated Alliance

[A.1855] Herbaceous Dunes Sparsely Vegetated Alliance
Translated Name: **Herbaceous Dunes Sparsely Vegetated Alliance**
Common Name:
Ecological System(s):
Status: Nonstandard
Circumscription Confidence:
Concept Author(s): J. Drake

ELEMENT CONCEPT

Global Summary: This community was described based only on its characteristics at Indiana Dunes NL. It does not have a global description.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Upland
Indiana Dunes National Lakeshore Environment: Blowout communities are found when an event such as a storm or human interference has removed all the vegetation and soil from an area, leaving only bare sand. The resulting geomorphology is often a bowl-shaped depression. If this occurs in an upland area, the site will be well-drained. If it occurs in a lowland area and is at or close to the water table, it will be somewhat poorly drained.
Global Environment:

VEGETATION DESCRIPTION

Indiana Dunes National Lakeshore Vegetation: The vegetation of a blowout is influenced by the surrounding vegetation and the hydrologic status remaining. Trees are shrub height (about 2 m tall) and cover less than 10% of the area. Common tree species are *Populus deltoides* or *Quercus velutina* in upland blowouts and *Quercus palustris* in lowland blowouts. The herbaceous layer may be lacking or *Ammophila breviligulata*, *Calamovilfa longifolia*, and/or *Schizachyrium scoparium* may be present in sparse clumps. Most (>80%) of the ground is bare sand with scattered *Geastrum* spp. (earthstars) present. If the blowout remains undisturbed, more vegetation may eventually fill the area.
Global Vegetation:
Global Dynamics:

INDIANA DUNES NATIONAL LAKESHORE FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform
Quercus palustris	Tall shrub/sapling	Broad-leaved deciduous tree
Quercus velutina	Tall shrub/sapling	Broad-leaved deciduous tree
Ammophila breviligulata	Herb (field)	Graminoid
Calamovilfa longifolia	Herb (field)	Graminoid
Schizachyrium scoparium	Herb (field)	Graminoid

GLOBAL FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform

INDIANA DUNES NATIONAL LAKESHORE OTHER NOTEWORTHY SPECIES

Ulmus pumila

GLOBAL OTHER NOTEWORTHY SPECIES

CONSERVATION STATUS RANK

Global Rank & Reasons: GNR

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RELATED CONCEPTS

Global Similar Associations:
Global Related Concepts:

CLASSIFICATION & OTHER COMMENTS

Indiana Dunes National Lakeshore Classification Comments:
Indiana Dunes National Lakeshore Other Comments:
Global Classification Comments:

ELEMENT DISTRIBUTION

Indiana Dunes National Lakeshore Range: Large blowout areas exist near the shore, such as those in the Dunes State Park unit. Small blowouts occur in the Miller Dunes, West Beach, Visitor Center, and Keiser units.
Global Range:
Nations:
States/Provinces: IN
USFS Ecoregions: 222Jj:CCC
Federal Lands: NPS (Indiana Dunes)

ELEMENT SOURCES

Indiana Dunes National Lakeshore Map Units Summary:
Indiana Dunes National Lakeshore Inventory Notes:
Indiana Dunes National Lakeshore Plots: INDU.VP054, INDU.AA030, INDU.AA180, INDU.AA320, INDU.AA367, INDU.AA542, INDU.AA726.
Local Description Author(s): N. Lehmann
Global Description Author(s):
References: Midwestern Ecology Working Group n.d.

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No Alliance Placement

I.A.8.C.a. Planted/cultivated temperate or subpolar needle-leaved evergreen forest

[I.A.8.C.a.] Pine Plantation

Translated Name: **Pine Plantation**
Common Name:
Ecological System(s):
- Semi-natural / Altered Vegetation and Conifer Plantations (CES203.074)

Circumscription Confidence: 2 - Moderate
Concept Author(s): A.S. Weakley, mod. D. Faber-Langendoen

ELEMENT CONCEPT

Global Summary: This community was described based only on its characteristics at Indiana Dunes NL. It is not defined globablly and does not have a global description.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Terrestrial
Indiana Dunes National Lakeshore Environment: Pine plantations occur on gentle to moderately sloping hills with rapidly to moderately well-drained loamy sand soil. The unvegetated surface may be made up entirely of pine needles.
Global Environment:

VEGETATION DESCRIPTION

Indiana Dunes National Lakeshore Vegetation: The moderate to dense canopy (15-35 m tall) is dominated by *Pinus banksiana, Pinus nigra, Pinus resinosa, Pinus sylvestris,* and/or *Pinus strobus*. The subcanopy coverage is sparse and may include *Acer rubrum, Fraxinus pennsylvanica, Prunus virginiana, Quercus rubra,* and *Sassafras albidum.* Shrubs form a sparse to moderate understory and may include saplings of canopy species, as well as *Hamamelis virginiana, Lonicera tatarica, Rubus* spp., and *Sassafras albidum*. The herbaceous layer is generally sparse, although one stand has a dense layer of *Pteridium aquilinum*; additional herbs in small amounts include *Aquilegia canadensis, Carex muehlenbergii, Carex pensylvanica, Galium circaezans, Maianthemum stellatum, Osmorhiza claytonii, Solidago caesia,* and *Toxicodendron radicans*. Vines include *Parthenocissus quinquefolia, Smilax* spp., and *Vitis riparia*.
Global Vegetation:
Global Dynamics:

INDIANA DUNES NATIONAL LAKESHORE FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform
Pinus banksiana	Tree canopy	Needle-leaved tree
Pinus nigra	Tree canopy	Needle-leaved tree
Pinus resinosa	Tree canopy	Needle-leaved tree
Pinus strobus	Tree canopy	Needle-leaved tree
Pinus sylvestris	Tree canopy	Needle-leaved tree
Quercus rubra	Tree subcanopy	Broad-leaved deciduous tree
Sassafras albidum	Tree subcanopy	Broad-leaved deciduous tree
Hamamelis virginiana	Tall shrub/sapling	Broad-leaved deciduous shrub
Sassafras albidum	Tall shrub/sapling	Broad-leaved deciduous shrub
Lonicera tatarica	Short shrub/sapling	Broad-leaved deciduous shrub
Pteridium aquilinum	Herb (field)	Fern or fern ally

GLOBAL FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform

INDIANA DUNES NATIONAL LAKESHORE OTHER NOTEWORTHY SPECIES

Alliaria petiola, Celastrus orbiculata, Elaeagnus angustifolia, Elaeagnus umbellata, Hesperis matronalis, Lonicera tatarica, Lonicera x *bella, Pinus banksiana, Pinus nigra, Pinus strobus, Pinus sylvestris, Rhus aromatica* var. *Arenaria, Rosa multiflora, Rumex acetosella, Solanum dulcamara, Ulmus pumila*

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GLOBAL OTHER NOTEWORTHY SPECIES

CONSERVATION STATUS RANK

Global Rank & Reasons: GNA (cultural) This community represents vegetation which has been planted in its current location by humans and/or is treated with annual tillage, a modified conservation tillage, or other intensive management or manipulation. It is not a conservation priority and does not receive a conservation rank.

RELATED CONCEPTS

Global Similar Associations:
- *Pinus* spp. Planted Forest (CEGL006313)
- *Pinus strobus* Successional Forest (CEGL007944)

Global Related Concepts:

CLASSIFICATION & OTHER COMMENTS

Indiana Dunes National Lakeshore Classification Comments: This community is characterized by *Pinus* spp. dominating the overstory and occurring in clear rows. Over time, other tree species grow between the rows and in canopy gaps and the original planted rows lose their distinctiveness as windthrow, diseases, and other disturbances kill some of the original trees.
Indiana Dunes National Lakeshore Other Comments:
Global Classification Comments:

ELEMENT DISTRIBUTION

Indiana Dunes National Lakeshore Range: This community is found in the State Park and scattered locations in he environs around the park.
Global Range:
Nations: US
States/Provinces: IN
USFS Ecoregions: 222Jj:CCC
Federal Lands: NPS (Indiana Dunes)

ELEMENT SOURCES

Indiana Dunes National Lakeshore Map Units Summary:
Indiana Dunes National Lakeshore Inventory Notes:
Indiana Dunes National Lakeshore Plots: INDU.VP043, INDU.VP053, INDU.VP128, INDU.VP129, INDU.AA374.
Local Description Author(s): M.J. Russo
Global Description Author(s):
References: Midwestern Ecology Working Group n.d.

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No Alliance Placement

I.B.2.N.a. Lowland or submontane cold-deciduous forest

[I.B.2.N.a.] Mesophytic Pocket Forest
Translated Name: **Mesophytic Pocket Forest**
Common Name:
Ecological System(s):
Status: Nonstandard
Circumscription Confidence:
Concept Author(s): J. Drake

ELEMENT CONCEPT

Global Summary: This community was described based only on its characteristics at Indiana Dunes NL. It is not defined globablly and does not have a global description.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Terrestrial
Indiana Dunes National Lakeshore Environment: Mesophytic pockets occur in depressions and interdunal swales and may be flat or gently sloping. Soils are dry-mesic to mesic and include well-drained loamy sand. Leaf litter generally dominates the unvegetated surface, but bare soil/sand can also be abundant.
Global Environment:

VEGETATION DESCRIPTION

Indiana Dunes National Lakeshore Vegetation: The moderate to very dense canopy and subcanopy layers are typically dominated by oaks and basswood but may be comprised of any combination of *Acer rubrum, Acer saccharum, Liriodendron tulipifera, Pinus strobus, Quercus alba, Quercus rubra, Quercus velutina, Sassafras albidum*, and *Tilia americana*. The sparse to very dense shrub layers are dominated by *Hamamelis virginiana*, along with saplings of the tree species, particularly *Sassafras albidum*. The herbaceous layer ranges from very sparse to dense; common and/or abundant species include *Ammophila breviligulata* (state-vulnerable), *Calamovilfa longifolia, Carex pensylvanica, Elymus canadensis, Pteridium aquilinum*, and *Tradescantia ohiensis.* This community also supports state-imperiled *Pinus banksiana* and *Pinus strobus.*
Global Vegetation:
Global Dynamics:

INDIANA DUNES NATIONAL LAKESHORE FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform
Quercus alba	Tree canopy	Broad-leaved deciduous tree
Quercus rubra	Tree canopy	Broad-leaved deciduous tree
Quercus velutina	Tree canopy	Broad-leaved deciduous tree
Tilia americana	Tree canopy	Broad-leaved deciduous tree
Sassafras albidum	Tree subcanopy	Broad-leaved deciduous tree
Hamamelis virginiana	Tall shrub/sapling	Broad-leaved deciduous shrub
Sassafras albidum	Tall shrub/sapling	Broad-leaved deciduous shrub
Tradescantia ohiensis	Herb (field)	Forb
Carex pensylvanica	Herb (field)	Graminoid
Elymus canadensis	Herb (field)	Graminoid
Pteridium aquilinum	Herb (field)	Fern or fern ally

GLOBAL FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform

INDIANA DUNES NATIONAL LAKESHORE OTHER NOTEWORTHY SPECIES

Alliaria petiolata, Ammophila breviligulata, Berberis thunbergii, Celastrus orbiculata, Epipactis helleborine, Pinus banksiana,Pinus strobus, Poa pratensis, Rosa multiflora

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GLOBAL OTHER NOTEWORTHY SPECIES

CONSERVATION STATUS RANK

Global Rank & Reasons: GNR

RELATED CONCEPTS

Global Similar Associations:
Global Related Concepts:

CLASSIFICATION & OTHER COMMENTS

Indiana Dunes National Lakeshore Classification Comments:
Indiana Dunes National Lakeshore Other Comments:
Global Classification Comments:

ELEMENT DISTRIBUTION

Indiana Dunes National Lakeshore Range: This community was found in dry dunal depressions near the Lake Michigan shore.
Global Range:
Nations: US
States/Provinces: IN
USFS Ecoregions: 222Jj:CCC
Federal Lands: NPS (Indiana Dunes)

ELEMENT SOURCES

Indiana Dunes National Lakeshore Map Units Summary:
Indiana Dunes National Lakeshore Inventory Notes:
Indiana Dunes National Lakeshore Plots: INDU.VP191, INDU.AA198, INDU.AA375, INDU.AA393, INDU.AA415, INDU.AA423, INDU.AA427, INDU.AA513, INDU.AA613, INDU.AA683, INDU.AA747.
Local Description Author(s): M.J. Russo
Global Description Author(s):
References: Midwestern Ecology Working Group n.d

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No Alliance Placement

I.B.2.N.d. Temporarily flooded cold-deciduous forest

[I.B.2.N.d.] Mixed Deciduous Wetland Forest
Translated Name: **Mixed Deciduous Wetland Forest**
Common Name:
Ecological System(s):
Status: Nonstandard
Circumscription Confidence:
Concept Author(s): J. Drake

ELEMENT CONCEPT

Global Summary: This community was described based only on its characteristics at Indiana Dunes NL. It is not defined globablly and does not have a global description.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Palustrine
Indiana Dunes National Lakeshore Environment: This mixed deciduous wetland forest occurs in low-lying areas, including floodplains, with wet soils that may periodically dry out. Soils include poorly drained muck and compacted clay. Occasionally standing water can be found. Evidence of disturbance includes the presence of many invasive exotic plant species.
Global Environment:

VEGETATION DESCRIPTION

Indiana Dunes National Lakeshore Vegetation: The sparse to very dense canopy and subcanopy layers are comprised of any combination of *Acer negundo, Acer rubrum, Acer saccharinum, Fraxinus americana, Fraxinus pennsylvanica, Juglans nigra, Nyssa sylvatica, Populus deltoides, Prunus serotina, Quercus palustris, Quercus velutina, Salix nigra, Sassafras albidum,* and *Ulmus americana*. The generally sparse to moderate shrub layers include *Fraxinus pennsylvanica, Lindera benzoin, Lonicera tatarica* (exotic), *Rosa multiflora* (exotic), *Viburnum acerifolium,* and *Viburnum recognitum (= Viburnum dentatum var. lucidum).* The herbaceous layer, which can attain 100% cover, is often dominated by the invasive exotic *Alliaria petiolata*; common native herbs include *Ambrosia trifida, Ammophila breviligulata* (state-vulnerable), *Coreopsis tripteris, Onoclea sensibilis, Panicum* sp., *Pilea pumila, Polygonum hydropiperoides, Polygonum virginianum, Solidago canadensis, Verbesina alternifolia,* and many others. *Parthenocissus quinquefolia* and *Vitis riparia* are common vines. In addition, this community supports state-critically imperiled *Thuja occidentalis* and state-vulnerable *Alnus incana ssp. rugosa* and *Betula papyrifera*.
Global Vegetation:
Global Dynamics:

INDIANA DUNES NATIONAL LAKESHORE FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform
Acer negundo	Tree (canopy & subcanopy)	Broad-leaved deciduous tree
Fraxinus pennsylvanica	Tree (canopy & subcanopy)	Broad-leaved deciduous tree
Populus deltoides	Tree (canopy & subcanopy)	Broad-leaved deciduous tree
Prunus serotina	Tree (canopy & subcanopy)	Broad-leaved deciduous tree
Quercus palustris	Tree (canopy & subcanopy)	Broad-leaved deciduous tree
Ulmus americana	Tree (canopy & subcanopy)	Broad-leaved deciduous tree
Acer rubrum	Tree canopy	Broad-leaved deciduous tree
Acer saccharinum	Tree canopy	Broad-leaved deciduous tree
Fraxinus americana	Tree canopy	Broad-leaved deciduous tree
Fraxinus pennsylvanica	Tall shrub/sapling	Broad-leaved deciduous shrub
Lindera benzoin	Tall shrub/sapling	Broad-leaved deciduous shrub
Lonicera tatarica	Tall shrub/sapling	Broad-leaved deciduous shrub
Rosa multiflora	Tall shrub/sapling	Broad-leaved deciduous shrub
Viburnum recognitum	Tall shrub/sapling	Broad-leaved deciduous shrub
Parthenocissus quinquefolia	Herb (field)	Vine/Liana
Vitis riparia	Herb (field)	Vine/Liana
Alliaria petiolata	Herb (field)	Forb
Pilea pumila	Herb (field)	Forb
Polygonum virginianum	Herb (field)	Forb

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Verbesina alternifolia	Herb (field)	Forb
Onoclea sensibilis	Herb (field)	Fern or fern ally

GLOBAL FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform

INDIANA DUNES NATIONAL LAKESHORE OTHER NOTEWORTHY SPECIES

Abutilon theophrasti, Ailanthus altissima, Alliaria petiolata, Alnus incana ssp. *rugosa, Ammophila breviligulata, Betula papyrifera, Celastrus orbiculata, Cynoglossum officinale, Elaeagnus umbellate, Frangula alnus, Lonicera tatarica, Lonicera* x *bella, Morus alba, Pinus nigra, Rosa multiflora, Rubus laciniatus, Solanum dulcamara, Thuja occidentalis*

GLOBAL OTHER NOTEWORTHY SPECIES

CONSERVATION STATUS RANK

Global Rank & Reasons: GNR

RELATED CONCEPTS

Global Similar Associations:
Global Related Concepts:

CLASSIFICATION & OTHER COMMENTS

Indiana Dunes National Lakeshore Classification Comments:
Indiana Dunes National Lakeshore Other Comments:
Global Classification Comments:

ELEMENT DISTRIBUTION

Indiana Dunes National Lakeshore Range: This community is common in disturbed areas of the park. It was observed in all units of the park.
Global Range:
Nations: US
States/Provinces: IN
USFS Ecoregions: 222Jj:CCC
Federal Lands: NPS (Indiana Dunes)

ELEMENT SOURCES

Indiana Dunes National Lakeshore Map Units Summary:
Indiana Dunes National Lakeshore Inventory Notes:
Indiana Dunes National Lakeshore Plots: INDU.AA046, INDU.AA098, INDU.AA105, INDU.AA121, INDU.AA185, INDU.AA210, INDU.AA231, INDU.AA233, INDU.AA250, INDU.AA261, INDU.AA276, INDU.AA296, INDU.AA314, INDU.AA322, INDU.AA334, INDU.AA338, INDU.AA339, INDU.AA445, INDU.AA502, INDU.AA507, INDU.AA557, INDU.AA564, INDU.AA591, INDU.AA722, INDU.AA725, INDU.AA752.
Local Description Author(s): M.J. Russo
Global Description Author(s):
References: Midwestern Ecology Working Group n.d.

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No Alliance Placement

III.B.2.N.a. Temperate cold-deciduous shrubland

[III.B.2.N.a.] Mixed Deciduous Shrubland
Translated Name: **Mixed Deciduous Shrubland**
Common Name:
Ecological System(s):
Circumscription Confidence:
Concept Author(s): J. Drake

ELEMENT CONCEPT

Global Summary: This community was described based only on its characteristics at Indiana Dunes NL. It is not defined globablly and does not have a global description.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Terrestrial
Indiana Dunes National Lakeshore Environment: This successional shrub community has grown up on old homesites located on flats to gentle slopes. Soils are variable and range from very dry to wet. The unvegetated surface is dominated by leaf litter with some bare soil and wood. These highly disturbed areas are heavily infested with exotic plant species.
Global Environment:

VEGETATION DESCRIPTION

Indiana Dunes National Lakeshore Vegetation: Stands of this vegetation are generally dominated by tall shrubs (2-5 m tall). However, there may also be a spare to moderate emergent tree layer that can include *Acer negundo, Fraxinus pennsylvanica, Populus deltoides, Populus tremuloides, Prunus serotina, Quercus rubra, Ulmus pumila* (exotic), *Ulmus rubra,* and others. Dominant shrubs include *Cornus racemosa, Crataegus* spp., *Fraxinus pennsylvanica, Lonicera dioica, Prunus virginiana, Quercus* spp., *Rubus allegheniensis,* and exotics including *Ailanthus altissima, Elaeagnus* spp., *Lonicera X bella, Lonicera tatarica,* and *Rosa multiflora*. The moderate to very dense herbaceous layer may be dominated by natives *Schizachyrium scoparium, Solidago altissima (= Solidago canadensis var. scabra), Sorghastrum nutans,* and/or *Verbesina alternifolia,* but this community also contains many invasive exotic species.
Global Vegetation:
Global Dynamics:

INDIANA DUNES NATIONAL LAKESHORE FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform
Populus deltoides	Tree canopy	Broad-leaved deciduous tree
Prunus serotina	Tree canopy	Broad-leaved deciduous tree
Quercus rubra	Tree canopy	Broad-leaved deciduous tree
Fraxinus pennsylvanica	Tree subcanopy	Broad-leaved deciduous tree
Quercus rubra	Shrub/sapling (tall & short)	Broad-leaved deciduous shrub
Lonicera x *bella*	Tall shrub/sapling	Broad-leaved deciduous shrub
Prunus virginiana	Tall shrub/sapling	Broad-leaved deciduous shrub
Rosa multiflora	Tall shrub/sapling	Broad-leaved deciduous shrub
Cornus racemosa	Short shrub/sapling	Broad-leaved deciduous shrub
Cornus sericea ssp. *sericea*	Short shrub/sapling	Broad-leaved deciduous shrub
Rubus allegheniensis	Short shrub/sapling	Broad-leaved deciduous shrub
Lonicera dioica	Herb (field)	Vine/Liana
Solidago canadensis var. *scabra*	Herb (field)	Forb
Verbesina alternifolia	Herb (field)	Forb
Schizachyrium scoparium	Herb (field)	Graminoid
Sorghastrum nutans	Herb (field)	Graminoid

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GLOBAL FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform

INDIANA DUNES NATIONAL LAKESHORE OTHER NOTEWORTHY SPECIES

Ailanthus altissima, Alliaria petiolata, Ammophila breviligulata, Celastrus orbiculata, Convallaria majalis, Daucus carota, Dianthus barbatus, Elaeagnus angustifolia, Elaeagnus umbellate, Leucanthemum vulgare, Ligustrum vulgare, Lonicera tatarica, Lonicera x *bella, Lysimachia nummularia, Morus alba, Phleum pretense, Poa pratensis, Rosa multiflora, Trifolium pretense, Ulmus pumila, Verbascum thapsus, Vinca minor*

GLOBAL OTHER NOTEWORTHY SPECIES

CONSERVATION STATUS RANK

Global Rank & Reasons: GNA (ruderal)

RELATED CONCEPTS

Global Similar Associations:
Global Related Concepts:

CLASSIFICATION & OTHER COMMENTS

Indiana Dunes National Lakeshore Classification Comments:
Indiana Dunes National Lakeshore Other Comments:
Global Classification Comments:

ELEMENT DISTRIBUTION

Indiana Dunes National Lakeshore Range: This community is common in disturbed areas of the park. It was observed in all units of the park.
Global Range:
Nations: US
States/Provinces: IN
USFS Ecoregions: 222Jj:CCC
Federal Lands: NPS (Indiana Dunes)

ELEMENT SOURCES

Indiana Dunes National Lakeshore Map Units Summary:
Indiana Dunes National Lakeshore Inventory Notes:
Indiana Dunes National Lakeshore Plots: INDU.VP018, INDU.VP035, INDU.AA023, INDU.AA116, INDU.AA119, INDU.AA132, INDU.AA244, INDU.AA293, INDU.AA351, INDU.AA382, INDU.AA574, INDU.AA590, INDU.AA692, INDU.AA729.
Local Description Author(s): M.J. Russo
Global Description Author(s):
References: Midwestern Ecology Working Group n.d.

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No Alliance Placement

V.A.5.N.c. Medium-tall sod temperate or subpolar grassland

[V.A.5.N.c.] Mixed Herbaceous Fallow Field
Translated Name: **Mixed Herbaceous Fallow Field**
Common Name:
Ecological System(s):
Status: Nonstandard
Circumscription Confidence:
Concept Author(s): J. Drake

ELEMENT CONCEPT

Global Summary: This community was described based only on its characteristics at Indiana Dunes NL. It is not defined globablly and does not have a global description.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Terrestrial
Indiana Dunes National Lakeshore Environment: This successional community occurs on old homesites and other disturbed areas that are undergoing vegetation restoration. These sites are generally flat to gently sloping uplands with dry, well-drained soils. Leaf litter covers nearly the entire unvegetated surface. Due to the high levels of disturbance at these sites, they have become heavily infested with exotic plant species.
Global Environment:

VEGETATION DESCRIPTION

Indiana Dunes National Lakeshore Vegetation: This is predominantly an herbaceous community with up to 100% cover. However, there are often scattered trees and shrubs that may include *Acer negundo, Acer saccharinum, Cornus racemosa, Fraxinus americana, Fraxinus pennsylvanica, Populus deltoides, Populus tremuloides, Prunus serotina, Prunus virginiana, Quercus alba, Quercus rubra, Quercus velutina, Robinia pseudoacacia, Rubus allegheniensis,* and others. Dominant herbaceous species may include *Andropogon gerardii, Eupatorium perfoliatum, Euthamia graminifolia, Phalaris arundinacea, Schizachyrium scoparium, Solidago altissima (= Solidago canadensis var. scabra), Solidago gigantea, Solidago juncea*, and *Verbesina alternifolia*. Due to high levels of disturbance, this community also contains large amounts of invasive exotic species. Vines (up to 50% cover) include *Celastrus orbiculata* (exotic). In addition, this community supports state-imperiled *Catalpa speciosa*.
Global Vegetation:
Global Dynamics:

INDIANA DUNES NATIONAL LAKESHORE FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform
Populus tremuloides	Tree canopy	Broad-leaved deciduous tree
Quercus rubra	Tree canopy	Broad-leaved deciduous tree
Acer negundo	Tree subcanopy	Broad-leaved deciduous tree
Fraxinus americana	Tree subcanopy	Broad-leaved deciduous tree
Quercus velutina	Tree subcanopy	Broad-leaved deciduous tree
Robinia pseudoacacia	Tree subcanopy	Broad-leaved deciduous tree
Elaeagnus angustifolia	Tall shrub/sapling	Broad-leaved deciduous shrub
Elaeagnus umbellata	Tall shrub/sapling	Broad-leaved deciduous shrub
Populus deltoides	Short shrub/sapling	Broad-leaved deciduous shrub
Rubus allegheniensis	Short shrub/sapling	Broad-leaved deciduous shrub
Celastrus orbiculata	Herb (field)	Vine/Liana
Eupatorium perfoliatum	Herb (field)	Forb
Euthamia graminifolia	Herb (field)	Forb
Solidago canadensis var. *scabra*	Herb (field)	Forb
Solidago gigantea	Herb (field)	Forb
Solidago juncea	Herb (field)	Forb
Urtica dioica	Herb (field)	Forb
Andropogon gerardii	Herb (field)	Graminoid
Schizachyrium scoparium	Herb (field)	Graminoid

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GLOBAL FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform

INDIANA DUNES NATIONAL LAKESHORE OTHER NOTEWORTHY SPECIES

Agrostis gigantea, Alliaria petiolata, Arctium minus, Bromus inermis, Calystegia sepium ssp. *sepium, Catalpa speciosa, Celastrus orbiculata, Daucus carota, Elaeagnus angustifolia, Elaeagnus umbellate, Glechoma hederacea, Leucanthemum vulgare, Morus alba, Phleum pretense, Poa pratensis, Rosa multiflora, Sonchus arvensis, Trifolium pretense, Trifolium repens, Urtica dioica, Verbascum thapsus*

GLOBAL OTHER NOTEWORTHY SPECIES

CONSERVATION STATUS RANK

Global Rank & Reasons: GNA (modified/managed)

RELATED CONCEPTS

Global Similar Associations:
Global Related Concepts:

CLASSIFICATION & OTHER COMMENTS

Indiana Dunes National Lakeshore Classification Comments:
Indiana Dunes National Lakeshore Other Comments:
Global Classification Comments:

ELEMENT DISTRIBUTION

Indiana Dunes National Lakeshore Range: This community is common in disturbed areas of the park. It was observed in all units of the park.
Global Range:
Nations: US
States/Provinces: IN
USFS Ecoregions: 222Jj:CCC
Federal Lands: NPS (Indiana Dunes)

ELEMENT SOURCES

Indiana Dunes National Lakeshore Map Units Summary:
Indiana Dunes National Lakeshore Inventory Notes:
Indiana Dunes National Lakeshore Plots: INDU.VP002, INDU.VP021, INDU.VP176, INDU.VP181, INDU.AA003, INDU.AA034, INDU.AA054, INDU.AA055, INDU.AA165, INDU.AA167, INDU.AA175, INDU.AA279, INDU.AA313, INDU.AA346, INDU.AA372, INDU.AA395, INDU.AA420, INDU.AA440, INDU.AA444, INDU.AA497, INDU.AA540, INDU.AA558, INDU.AA594, INDU.AA702, INDU.AA743.
Local Description Author(s): M.J. Russo
Global Description Author(s):
References: Midwestern Ecology Working Group n.d.

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No Alliance Placement

V.A.5.N.k. Seasonally flooded temperate or subpolar grassland

[V.A.5.N.k.] Mixed Herbaceous Wet Meadow
Translated Name: **Mixed Herbaceous Wet Meadow**
Common Name:
Ecological System(s):
Circumscription Confidence:
Concept Author(s): J. Drake

ELEMENT CONCEPT

Global Summary: This community was described based only on its characteristics at Indiana Dunes NL. It is not defined globablly and does not have a global description.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Palustrine
Indiana Dunes National Lakeshore Environment: The wet meadow community occurs in lowlands with wet to saturated soils, often with some standing water. These areas may also be subject to periodic drying. The unvegetated surface is dominated by leaf litter and bare soil, sometimes with small amounts of wood.
Global Environment:

VEGETATION DESCRIPTION

Indiana Dunes National Lakeshore Vegetation: This community is dominated by the herbaceous layer which may attain 100% cover. scattered trees and shrubs may occur, including *Acer rubrum, Acer saccharinum, Fraxinus pennsylvanica, Populus deltoides, Salix interior, Salix petiolaris, Spiraea tomentosa,* and others. In some cases, shrub cover may approach 40%. Common and/or dominant herbs include *Calamagrostis canadensis, Carex* spp., *Carex stricta, Erigeron annuus, Eupatorium maculatum, Juncus canadensis, Juncus effusus, Juncus tenuis, Polygonum amphibium var. emersum, Rudbeckia laciniata, Schizachyrium scoparium, Solidago altissima (= Solidago canadensis var. scabra), Solidago gigantea, Solidago uliginosa, Thelypteris palustris var. pubescens, Typha angustifolia, Typha latifolia,* and *Verbesina alternifolia*. Several exotic species also occur in this community.
Global Vegetation:
Global Dynamics:

INDIANA DUNES NATIONAL LAKESHORE FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform
Fraxinus pennsylvanica	Short shrub/sapling	Broad-leaved deciduous shrub
Salix interior	Short shrub/sapling	Broad-leaved deciduous shrub
Salix petiolaris	Short shrub/sapling	Broad-leaved deciduous shrub
Polygonum amphibium var. *emersum*	Herb (field)	Forb
Solidago canadensis var. *scabra*	Herb (field)	Forb
Solidago gigantea	Herb (field)	Forb
Verbesina alternifolia	Herb (field)	Forb
Calamagrostis canadensis	Herb (field)	Graminoid
Carex stricta	Herb (field)	Graminoid
Juncus canadensis	Herb (field)	Graminoid
Juncus effusus	Herb (field)	Graminoid
Typha latifolia	Herb (field)	Graminoid

GLOBAL FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform

INDIANA DUNES NATIONAL LAKESHORE OTHER NOTEWORTHY SPECIES

Alliaria petiolata, Cirsium vulgare, Frangula alnus, Leonurus cardiaca, Lythrum salicaria, Polygonum hydropiper, Urtica dioica

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GLOBAL OTHER NOTEWORTHY SPECIES

CONSERVATION STATUS RANK

Global Rank & Reasons: GNR

RELATED CONCEPTS

Global Similar Associations:
Global Related Concepts:

CLASSIFICATION & OTHER COMMENTS

Indiana Dunes National Lakeshore Classification Comments:
Indiana Dunes National Lakeshore Other Comments:
Global Classification Comments:

ELEMENT DISTRIBUTION

Indiana Dunes National Lakeshore Range: This community is common in disturbed areas of the park. It was observed in all units of the park.
Global Range:
Nations: US
States/Provinces: IN
USFS Ecoregions: 222Jj:CCC
Federal Lands: NPS (Indiana Dunes)

ELEMENT SOURCES

Indiana Dunes National Lakeshore Map Units Summary:
Indiana Dunes National Lakeshore Inventory Notes:
Indiana Dunes National Lakeshore Plots: INDU.AA044, INDU.AA047, INDU.AA127, INDU.AA145, INDU.AA148, INDU.AA148a, INDU.AA174, INDU.AA195, INDU.AA211, INDU.AA219, INDU.AA390, INDU.AA462, INDU.AA508, INDU.AA535, INDU.AA620, INDU.AA648, INDU.AA711.
Local Description Author(s): M.J. Russo
Global Description Author(s):
References: Midwestern Ecology Working Group n.d.

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National Park Service
Vegetation Inventory Program
Indiana Dunes National Lakeshore, Indiana

September 2009

Appendix C

Field Key to Vegetation Types of Indiana Dunes National Lakeshore

Explanation and Use of the Key

This is a key to National Vegetation Classification (NVC) System types derived from the Indiana Dunes National Lakeshore (INDU) Vegetation Mapping Project. This key depicts vegetation types to the lowest level of the NVC that could be determined during the vegetation mapping project, whether **Association**, **Alliance**, or **Formation** level. These levels are made distinct from each other by the NVC code following each vegetation type in the key.

For best results, all assessments of vegetation types in the field should be done on an area of 5,000 m^2 (e.g., 40 m radius around point) and within a single vegetation type. **Appendix B: Descriptions to Vegetation Types of Indiana Dunes National Lakeshore** is recommended to compliment this key to vegetation types to ascertain correct type assessment.

Note: all references to cover are to relative cover unless specified as absolute cover in the text.

General Key to Types

1a. Mature tree canopy >60% absolute cover. **5**
1b. Mature tree canopy <60% absolute cover. **2**

2a. Mature tree canopy 25–60% absolute cover. **23**
2b. Mature tree canopy <25% absolute cover. **3**

3a. Shrub coverage >25% absolute cover. **26**
3b. Shrub coverage <25% absolute cover. **4**

4a. Herbaceous plants >10% absolute cover. **30**
4b. Trees, shrubs, and herbaceous vegetation combined have <10% absolute cover. Soil has been blown away, leaving bare sand in a bowl-shaped depression. Trees (*Populus deltoides*, *Quercus velutina*/*Quercus palustris*) absent or stunted, *Schizachyrium scoparium* and *Calamovilfa longifolia* usually present. **Herbaceous Dunes Sparsely Vegetated Alliance (A.1855)**

Forest Types

Canopy usually >60% absolute cover.

NOTE: Upland stands dominated by *Populus tremuloides* should be considered part of the predominant forest around them. Thus a stand with 80% canopy cover of *Populus tremuloides* that is mostly surrounded by ***Quercus rubra* - (*Acer saccharum, Quercus alba*) Forest** should be considered part of the *Quercus rubra*/*Acer saccharum*-dominated community while a similar *Populus tremuloides* stand that is mostly surrounded by ***Fagus grandifolia* - *Acer saccharum* Glaciated Midwest Forest** should be considered part of the *Fagus grandifolia/Acer saccharum*-dominated community.

5a. Coniferous trees >25% canopy cover. **6**
5b. Cold-deciduous, broad-leaved hardwoods trees >75% canopy cover. **10**

6a. *Larix laricina* >50% canopy cover. *Acer rubrum*, *Photinia floribunda*, and *Vaccinium corymbosum* are common. Soil poorly drained, standing water often present. ***Larix laricina* - *Acer rubrum* / (*Rhamnus alnifolia, Vaccinium corymbosum*) Forest (CEGL005232)**
6b. *Pinus* spp. and/or *Picea* spp. >25% canopy cover. Soil dry to mesic. **7**

7a. Sandy, well-drained soil on dune ridges or dune slopes. **8**
7b. Community clearly impacted by human disturbance such as previous homesite, pasture, agricultural field, clearcut. Conifers >25% canopy cover. **9**

8a. *Pinus strobus* >25% canopy cover and *Quercus alba* and/or *Quercus velutina* >25% canopy cover. *Sassafras albidum*, *Gaylussacia baccata*, and *Corylus americana* typically found in the understory. ***Pinus strobus* - *Quercus alba* / (*Corylus americana, Gaylussacia baccata*) Forest (CEGL002481)**
8b. *Pinus strobus* and/or *Pinus banksiana* >50% canopy cover. ***Pinus banksiana* - *Pinus resinosa* - *Pinus strobus* Dune Forest (CEGL002589)**

9a. Pines (*Pinus strobus/Pinus resinosa/Pinus banksiana*) planted in rows, which may be hard to distinguish in older plantings. A few deciduous trees may be present. **Pine Plantation (I.A.8.C.b.)**
9b. *Picea* spp., *Pinus* spp., *Prunus serotina, Robinia pseudoacacia*, *Fraxinus* spp., *Acer rubrum*, and *Liriodendron tulipifera* >50% canopy cover. ***Prunus serotina* - *Liriodendron tulipifera* - *Acer rubrum* - *Fraxinus americana* - (*Robinia pseudoacacia*) Forest (CEGL006599)**

10a. *Quercus* spp. >40% canopy cover. **11**
10b. *Quercus* spp. <40% canopy cover. **14**

11a. *Quercus velutina* trees (rarely grubs) >40% canopy cover. *Quercus alba* and *Prunus serotina* are often present. Common understory species are: *Sassafras albidum, Populus tremuloides*, *Acer rubrum*, and *Nyssa sylvatica*/*Quercus palustris* (in moister soil). *Pteridium aquilinum, Cornus racemosa*, and/or *Vaccinium* spp. usually present. *Carex pensylvanica, Fragaria virginiana, Helianthus divaricatus, Maianthemum stellatum*, and *Tradescantia ohioensis* usually present. Soil sandy and well-drained. ***Quercus velutina* / *Carex pennsylvanica* Forest (CEGL002078)**
11b. *Quercus velutina* <40% canopy cover. Soil mesic to wet-mesic. **12**

12a. *Quercus alba* and *Quercus rubra* >50% canopy cover. *Carya ovata* can be codominan. Soil mesic. ***Quercus alba* - *Quercus rubra* – (*Carya ovata*) Glaciated Forest (CEGL002068)**
12b. *Quercus rubra*, *Quercus bicolor,* or *Quercus. palustris* >40% canopy cover and *Quercus alba* and/or *Carya* spp. <30% canopy cover. Soil mesic to wet. **13**

13a. *Quercus rubra* is most prevalent tree species in what can be a very diverse canopy including: *Quercus alba* (present at <30%), *Acer rubrum/saccharum*, *Prunus serotina*, *Fraxinus* spp., and *Ulmus* spp. ***Quercus rubra* - (*Acer saccharum, Q. alba*) Forest (CEGL005017)**

13b. *Quercus bicolor* and *Quercus palustris* >50% canopy cover, *Fraxinus* spp. commonly >30% canopy cover. Ferns usually present in herbaceous layer. ***Quercus palustris* - *Quercus bicolor* - *Acer rubram* Flatwoods Forest (CEGL005037)**

14a. *Carya* spp. >50% canopy cover; *Quercus alba* and *Quercus rubra* often >10% canopy cover. ***Quercus alba* - *Quercus rubra* - (*Carya ovata*) Glaciated Forest (CEGL002068)**

14b. Canopy >50% *Fagus grandifolia*, *Acer rubrum*, and/or *Acer saccharum*. **15**

15a. *Fagus grandifolia* and *Acer rubrum/saccharum* >50% canopy cover and *Fagus grandifolia* >20% canopy cover; usually present in a fairly diverse canopy. ***Fagus grandifolia* - *Acer saccharum* Glaciated Midwest Forest (CEGL005013)**

15b. *Fagus grandifolia* <20% canopy cover. **16**

16a. Community may be on young or old dunes, interdunal terraces, or morainal soils. Soil well to moderately-well drained (dry to mesic); rarely, if ever, saturated or flooded. **17**

16b. Flooded or standing water during part or all of the year. In human-impacted areas, sites are often ditched and drained. Soil moderately to poorly drained (mesic to wet). **19**

17a. Community is clearly impacted by human disturbance such as previous homesite, pasture, agricultural field, or clearcut. *Prunus serotina*, *Robinia pseudoacacia*, *Fraxinus* spp., *Acer rubrum*, and/or *Liriodendron tulipifera* >50% canopy cover. ***Prunus serotina* - *Liriodendron tulipifera* - *Acer rubrum* - *Fraxinus americana* - (*Robinia pseudoacacia*) Forest (CEGL006599)**

17b. *Tilia americana* and/or *Acer saccharum* >20% canopy cover in the moderately dense to dense canopy, and soil is mesic, rich and loamy, but well-drained. **18**

18a. Dunal forests in ravines, protected slopes, and pockets of young dunes. The canopy has >30% cover by *Liriodendron tulipifera* and/or *Pinus strobus*. Other common species include *Tilia americana, Acer saccharum/rubrum*, *Quercus velutina*, *Quercus alba*, and *Quercus rubra*. *Amelanchier arborea* and/or *Hamamelis virginiana* are common in the understory. **Mesophytic Pocket Forest (I.B.2.N.a.)**

18b. *Tilia americana* and/or *Acer saccharum* >50% canopy cover on old dunal systems or moraines. The canopy is usually diverse and may include *Acer* spp., *Fraxinus* spp, *Quercus* spp., and *Ulmus* spp. *Ostrya virginiana* and/or *Carpinus caroliniana* are common understory trees and the herbaceous layer contains numerous spring ephemerals. ***Acer saccharum* - *Tilia americana* / *Ostrya virginiana* - *Carpinus caroliniana* Forest (CEGL002062)**

19a. Area highly disturbed; former wetlands that have been ditched and drained for use as roads, farms, or homesites. The canopy may be sparse to dense and typically contains *Acer negundo*, *Acer rubrum*, *Salix* spp., *Populus deltoides*, *Fraxinus* spp. Invasive species such as *Eleagnus umbellata* and *Phalaris arundinacea* may dominate the understory. **Mixed Deciduous Wetland Forest (I.B.2.N.d.)**

19b. Mesic to wet soil that are intermittently or permanently flooded (some may dry out in summer). These sites are less disturbed than in **19a**. **20**

20a. *Acer rubrum, Acer saccharinum*, and/or *Fraxinus* spp. >50% canopy cover. **21**

20b. Canopy <50% cover by *Quercus* spp., *Fraxinus* spp., and/or *Acer* spp. Wet to wet-mesic forests. **22**

21a. *Acer rubrum* >50% canopy cover or sometimes >20% cover when the site is dominated by *Betula papyrifera* and/or *Betula alleghaniensis*. *Fraxinus* spp. and *Ulmus* spp. may be present, but are not

major canopy components. A diversity of ferns are part of the rich understory. Soil continuously wet; rarely dry out. ***Acer rubrum* - *Fraxinus* (*pennsylvanica, americana*) / *Lindera benzoin* / *Symplocarpus foetidus* Forest (CEGL006406)**

21b. *Acer rubrum* and *Fraxinus* spp. >50% canopy cover, *Ulmus* spp. often present. *Populus deltoides* is sparse or absent; found in watercourses, ravines, or basins of small creeks. Soil usually wet; may dry out in summer. ***Acer* (*rubrum, saccharinum*) - *Fraxinus* spp. - *Ulmus americana* Forest (CEGL005038)**

21c. Dense canopy with *Acer saccharinum* and *Ulmus* spp. >50% canopy cover; sometimes with *Populus deltoides* codominant. The herbaceous layer is usually sparse, but often contains *Boehmeria cylindrica, Pilea pumila, Parietaria pensylvanica,* or *Laportea Canadensis*. Found in riverine floodplains. ***Acer saccharinum* - *Ulmus* spp. Forest (CEGL002586)**

22a. Floodplain community with *Populus deltoides* and/or *Salix nigra* >50% canopy cover. *Acer saccharinum* <25% canopy cover. ***Populus deltoides* - *Salix nigra* Forest (CEGL002018)**

22b. Highly diverse canopy not dominated by *Quercus* spp. or *Acer* spp., rich in spring ephemerals. *Platanus occidentalis* present >2% canopy cover (no *Betula nigra* at INDU). Found at Heron Rookery and possibly Pinhook Bog. ***Betula nigra* - (*Platanus occidentalis*) Temporarily Flooded Forest Alliance (A.280)**

22c. *Populus tremuloides* >75% canopy cover. Found in transitional zone between marshes and upland communities. ***Populus tremuloides* Temporarily Flooded Forest Alliance (A.300)**

Woodland Types

Canopy usually 25–60% absolute cover.

23a. *Quercus macrocarpa* >40% canopy cover. Canopy may range up to 80% absolute cover. *Corylus americana* often present. Found on dry to mesic loamy to clay soil. Known only from Hobart Prairie. ***Quercus alba - Quercus macrocarpa - Quercus rubra / Corylus americana*** **Woodland (CEGL002142)**

23b. Dunal communities found on well-drained sandy soils. **24**

23c. *Quercus velutina* >50% canopy cover. Trees may be stunted or present as grubs. ***Quercus velutina - (Quercus ellipsoidalis) - Quercus alba / Deschampsia flexuosa*** **Woodland (CEGL005029)**

24a. *Populus deltoides* and/or *Juniperus virginiana* >50% canopy cover. Soil is sandy and very well-drained. ***Populus deltoides*** **- (*Juniperus virginiana*) Dune Woodland (CEGL005119)**

24b. *Pinus* spp. >25% canopy cover. **25**

25a. *Pinus banksiana* >40% canopy cover. ***Pinus banksiana - Quercus (ellipsoidalis, velutina)*** **Forest Alliance (A.391)**

25b. *Pinus strobus* >25% canopy cover and *Quercus alba* and/or *Quercus velutina* >25% canopy cover. Canopy can range from 25–100% absolute cover. *Sassafras albidum* and *Gaylussacia baccata* (occasionally, *Corylus americana*) found in the understory. Sandy, well-drained soil on dune ridges or dune slopes. ***Pinus strobus - Quercus alba / (Corylus americana, Gaylussacia baccata)*** **Forest (CEGL002481)**

Shrubland Types

Shrub heights 0.5–5 m; shrubs >25% absolute cover; trees <25% absolute cover.

26a. *Quercus velutina* grubs (short regrowth from fire-killed trees) >50% cover. **23**
26b. True shrub species >50% cover. **27**

27a. Soil well to moderately well-drained. **28**
27b. Soil poorly drained; standing water usually present, or muck soil. **29**

28a. *Prunus pumila* or *Ptelea trifoliata* >40% cover, on dunes and dune ridges. ***Prunus pumila* - (*Ptelea trifoliata*) Dune Shrubland (CEGL005075)**

28b. *Corylus americana* and *Salix humilis* >50% cover, small *Populus tremuloides* may be present, *Schizachyrium scoparium* commonly in the herbaceous layer. Soil sandy loam to loamy sand, moderately well-drained. ***Corylus americana* - *Salix humilis* / *Schizachyrium scoparium* Shrubland (CEGL005072)**

28c. Shrubs or small trees growing on areas that are greatly impacted by humans, such as old fields or previous homesites. Typical species are short *Populus* spp. or *Crataegus* spp. Typically square or rectangular shaped area. **Mixed Deciduous Shrubland (III.B.2.N.a.)**

29a. Wet shrubs or trees growing on areas that are greatly impacted by humans, such as old fields or homesite. **Mixed Herbaceous Wet Meadow (V.A.5.N.k.)**

29b. *Cornus sericea* and/or *Salix* spp. >50% cover, *Rosa palustris* often present. ***Cornus sericea* - *Salix* spp. - (*Rosa palustris*) Shrubland (CEGL002186)**

29c. *Cephalanthus occidentalis* >75% cover with wetland grasses and sedges as understory. ***Cephalanthus occidentalis* / *Carex* spp. Northern Shrubland (CEGL002190)**

29d. *Alnus incana* (Speckled alder) >50% cover. ***Alnus incana* Swamp Shrubland (CEGL002381)**

29e. *Spiraea* species >40% cover. ***Spiraea tomentosa* - *Salix humilis* / *Andropogon gerardii* - *Panicum virgatum* Shrubland (CEGL006059)**

Herbaceous Types

Herbaceous layer >25% absolute cover; may contain sparse tree or shrub layer <25% absolute cover.

30a. Sparse canopy of trees; tree grubs may be present. **31**
30b. Woody species generally not present. **33**

31a. Broad-leaved woody species >25% cover. **32**
31b. Needle-leaved woody species >75% cover. *Pinus banksiana* and *Pinus strobus* >50% cover. ***Pinus banksiana* - (*Pinus resinosa*) - *Pinus strobus* / *Juniperus horizontalis* Herbaceous Vegetation (CEGL005125)**

32a. *Quercus velutina* >50% canopy cover. *Lupinus perennis* >1% absolute cover in a diverse herbaceous layer. ***Quercus velutina* - (*Quercus alba*) - *Quercus ellipsoidalis* / *Schizachyrium scoparium* - *Lupinus perennis* Wooded Herbaceous Vegetation (CEGL002492)**
32b. *Pinus banksiana* >50% canopy cover. ***Pinus banksiana* - *Quercus (ellipsoidalis, velutina*) Forest Alliance (A.391)**

33a. Upland. Soil dry to mesic. **34**
33b. Wetland. **35**

34a. *Ammophila breviligulata* >40% cover; soil very well-drained, sandy; on dunes near beach. ***Ammophila breviligulata* - (*Schizachyrium scoparium*) Herbaceous Vegetation (CELG005098)**
34b. *Schizachyrium scoparium* >50% cover, *Lithospermum carolinense* and *Opuntia humifusa* present. Soil well-drained sand to sandy loam, not on foredunes. ***Schizachyrium scoparium* - *Carex tonsa var. rugosperma* - *Carex muhlenbergii* - *Lithospermum carolinense* - *Opuntia humifusa* Herbaceous Vegetation (CEGL005099)**
34c. *Schizachyrium scoparium*, *Sorghastrum nutans*, *Panicum virgatum*, and/or *Andropogon gerardii* >50% cover. In wetter parts of the site, patches of *Calamagrostis canadensis* and *Salix humilis* or *Populus tremuloides* occur. If *Salix humilis* >25% absolute cover return to the shrubland key. If *Populus tremuloides* >25% absolute cover return to the forest key. Soil mesic sandy loam to loamy sand. ***Schizachyrium scoparium* - *Sorghastrum nutans* - *Andropogon gerardii* - *Lespedeza capitata* Sand Herbaceous Vegetation (CEGL002210)**
34d. Dry herbaceous mix that shows signs of human-induced disturbance such as old fields, old homesites, and areas being restored. Often dominated by *Solidago* spp., *Melilotus* spp., and other exotics and invasives. **Mixed Herbaceous Fallow Field (V.A.5.N.c.)**

Wetland Herbaceous Types

Herbaceous wetlands **dominant** by forbs and/or grasses.

35a. Wet herbaceous mix that shows signs of human-induced disturbance such as ditches, previously farmed, or road construction. Tends to be dominated by *Solidago* spp. and non-native grasses and forbs. **Mixed Herbaceous Wet Meadow (V.A.5.N.k.)**
35b. Forbs >50% cover. **36**
35c. Graminoids (e.g., sedges, grasses, rushes) >50% cover. **38**

36a. *Symplocarpus foetidus* >40% cover. Standing water <50% absolute cover. ***Symplocarpus foetidus* Herbaceous Vegetation (CEGL002385)**
36b. Standing water >50% cover throughout the year. **37**

37a. Floating-leaved aquatics >10% absolute cover. *Nuphar lutea* ssp. *advena* and/or *Nymphaea odorata* >40% cover. ***Nuphar lutea* ssp. *advena* - *Nymphaea odorata* Herbaceous Vegetation (CEGL002386)**

37b. Floating-leaved aquatics <10% absolute cover. Submersed aquatics, especially *Potamogeton* spp., >10% absolute cover. ***Potamogeton* spp. - *Ceratophyllum* spp. Midwest Herbaceous Vegetation (CEGL002282)** (do not confuse with *Nuphar-Nymphaea* community type above)

38a. Grasses (e.g., species of Poaceae) >50% cover. **39**
38b. Non-grass graminoids (e.g., rushes, sedges) >50% cover. **41**

39a. *Phragmites australis* >80% cover. ***Phragmites australis* Eastern North America Temperate Semi-Natural Herbaceous Vegetation (CEGL004141)**
39b. *Phalaris arundinacea* and/or *Spartina pectinata* >20% cover. **40**

40a. In disturbed situations *Phalaris arundinacea* or *Solidago canadensis* or other weedy species of *Solidago* may dominate (>50% cover). In less disturbed sites *Carex* spp., *Spartina pectinata*, and/or *Calamagrostis canadensis* >50% cover. *Salix humilis* and *Populus tremuloides* may be present (but <25% absolute cover). ***Spartina pectinata* - *Carex* spp. - *Calamagrostis canadensis* Lakeplain Herbaceous Vegetation (CEGL005109)**
40b. *Phalaris arundinacea* >50% cover. ***Phalaris arundinacea* Eastern Herbaceous Vegetation (CEGL006044)**

Wetland Herbaceous Types

Herbaceous wetlands **not dominant** by forbs and/or grasses.

41a. *Rhynchospora* spp., *Juncus* spp., *Carex* spp., *Triglochin maritima, Cladium mariscoides* >10% cover. *Dasiphora fruticosa* ssp. *floribunda* may be present >25% absolute cover. Intradunal wetlands (pannes) with standing water. Soil mostly sand; often orange in color. ***Dasiphora fruticosa* ssp. *floribunda* / *Cladium mariscoides* - *Juncus balticus* - (*Rhynchospora capillacea*) Herbaceous Vegetation (CEGL005105)**
41b. Soil silty loam to muck, may dry out in midsummer. **42**

42a. *Typha* spp. >80% cover. ***Typha* spp. Midwest Herbaceous Vegetation (CEGL002233)**
42b. *Carex* spp. and/or *Juncus* spp. >50% cover. **43**

43a. *Carex* spp. dominant. ***Carex stricta* - *Carex* spp. Herbaceous Vegetation (CEGL002258)**
43b. *Schoenoplectus* spp. and *Juncus* spp. dominant. ***Schoenoplectus tabernaemontani* - *Typha* spp. - (*Sparganium* spp., *Juncus* spp.) Herbaceous Vegetation (CEGL002026)**

National Park Service
Vegetation Inventory Program
Indiana Dunes National Lakeshore, Indiana

September 2009

Appendix D

Species List of Indiana Dunes National Lakeshore

Explanation of the Species List

Plant species were identified and documented from vegetation sample plots and accuracy assessment sites collected for the Indiana Dunes National Lakeshore Vegetation Mapping Project. Plant species, along with other sample data, were entered into the NPS 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 project's PLOTS Database. This list is not intended to be comprehensive of every species at the Lakeshore. The plant species list is organized alphabetically scientific names. Nomenclature follows the PLANTS database (U.S. Department of Agriculture 2004).

Table D-1. Plant species list of Indiana Dunes National Lakeshore.

Scientific name	Common name	Family
Abutilon theophrasti	velvetleaf	Malvaceae
Acer	maple	Aceraceae
Acer negundo	boxelder	Aceraceae
Acer nigrum	black maple	Aceraceae
Acer rubrum	red maple	Aceraceae
Acer saccharinum	silver maple	Aceraceae
Acer saccharum	sugar maple	Aceraceae
Achillea millefolium	common yarrow	Asteraceae
Acorus calamus	calamus	Acoraceae
Agalinis tenuifolia	slenderleaf false foxglove	Scrophulariaceae
Ageratina altissima var. *altissima*	white snakeroot	Asteraceae
Agrimonia gryposepala	tall hairy agrimony	Rosaceae
Agrimonia parviflora	harvestlice	Rosaceae
Agrimonia pubescens	soft agrimony	Rosaceae
Agrimonia rostellata	beaked agrimony	Rosaceae
Agrostis gigantea	redtop	Poaceae
Ailanthus altissima	tree of heaven	Simaroubaceae
Alisma subcordatum	American water plantain	Alismataceae
Alisma triviale	northern water plantain	Alismataceae
Alliaria petiolata	garlic mustard	Brassicaceae
Allium	onion	Liliaceae
Allium canadense	meadow garlic	Liliaceae
Allium tricoccum	wild leek	Liliaceae
Alnus incana	gray alder	Betulaceae
Alnus incana ssp. *rugosa*	speckled alder	Betulaceae
Ambrosia artemisiifolia	annual ragweed	Asteraceae
Ambrosia psilostachya	Cuman ragweed	Asteraceae
Ambrosia trifida	great ragweed	Asteraceae
Amelanchier	serviceberry	Rosaceae
Amelanchier arborea	common serviceberry	Rosaceae
Amelanchier interior	Pacific serviceberry	Rosaceae
Amelanchier laevis	Allegheny serviceberry	Rosaceae
Ammophila breviligulata	American beachgrass	Poaceae
Amphicarpaea bracteata	American hogpeanut	Fabaceae
Andropogon gerardii	big bluestem	Poaceae
Anemone	anemone	Ranunculaceae
Anemone cylindrica	candle anemone	Ranunculaceae
Anemone virginiana	tall thimbleweed	Ranunculaceae
Angelica atropurpurea	purplestem angelica	Apiaceae
Antennaria plantaginifolia	woman's tobacco	Asteraceae
Apios americana	groundnut	Fabaceae
Apocynum	dogbane	Apocynaceae
Apocynum androsaemifolium	spreading dogbane	Apocynaceae

Scientific name	Common name	Family
Apocynum cannabinum	Indianhemp	Apocynaceae
Aquilegia canadensis	red columbine	Ranunculaceae
Arabis	rockcress	Brassicaceae
Arabis canadensis	sicklepod	Brassicaceae
Arabis lyallii	Lyall's rockcress	Brassicaceae
Arabis lyrata	lyrate rockcress	Brassicaceae
Aralia nudicaulis	wild sarsaparilla	Araliaceae
Arctium	burrdock	Asteraceae
Arctium minus	lesser burrdock	Asteraceae
Arctostaphylos uva-ursi	kinnikinnick	Ericaceae
Arisaema dracontium	green dragon	Araceae
Arisaema triphyllum	Jack in the pulpit	Araceae
Aristida	threeawn	Poaceae
Arnoglossum atriplicifolium	pale Indian plaintain	Asteraceae
Artemisia	sagebrush	Asteraceae
Artemisia campestris	field sagewort	Asteraceae
Artemisia campestris ssp. *caudata*	field sagewort	Asteraceae
Artemisia vulgaris	common wormwood	Asteraceae
Asarum	wildginger	Aristolochiaceae
Asarum canadense	Canadian wildginger	Aristolochiaceae
Asclepias	milkweed	Asclepiadaceae
Asclepias incarnata	swamp milkweed	Asclepiadaceae
Asclepias syriaca	common milkweed	Asclepiadaceae
Asclepias tuberosa	butterfly milkweed	Asclepiadaceae
Asclepias verticillata	whorled milkweed	Asclepiadaceae
Asimina triloba	pawpaw	Annonaceae
Aspalathus linearis	rooibos	Fabaceae
Asparagus officinalis	garden asparagus	Liliaceae
Aster	aster	Asteraceae
Aureolaria pedicularia	fernleaf yellow false foxglove	Scrophulariaceae
Baptisia	wild indigo	Fabaceae
Baptisia alba var. *macrophylla*	largeleaf wild indigo	Fabaceae
Berberis thunbergii	Japanese barberry	Berberidaceae
Betula	birch	Betulaceae
Betula alleghaniensis	yellow birch	Betulaceae
Betula alleghaniensis var. *alleghaniensis*	yellow birch	Betulaceae
Betula papyrifera	paper birch	Betulaceae
Bidens	beggarticks	Asteraceae
Bidens cernua	nodding beggartick	Asteraceae
Bidens connata	purplestem beggarticks	Asteraceae
Bidens coronata	crowned beggarticks	Asteraceae
Bidens discoidea	small beggarticks	Asteraceae
Bidens frondosa	devil's beggartick	Asteraceae
Boehmeria cylindrica	smallspike false nettle	Urticaceae
Botrychium dissectum	cutleaf grapefern	Ophioglossaceae
Botrychium virginianum	rattlesnake fern	Ophioglossaceae
Brachyelytrum erectum	bearded shorthusk	Poaceae
Brasenia schreberi	watershield	Cabombaceae
Brickellia eupatorioides var. *eupatorioides*	false boneset	Asteraceae
Bromus	brome	Poaceae
Bromus ciliatus	fringed brome	Poaceae
Bromus inermis	smooth brome	Poaceae
Bromus pubescens	hairy woodland brome	Poaceae
Bromus tectorum	cheatgrass	Poaceae
Calamagrostis	reedgrass	Poaceae
Calamagrostis canadensis	bluejoint	Poaceae
Calamovilfa	sandreed	Poaceae
Calamovilfa longifolia	prairie sandreed	Poaceae

Scientific name	Common name	Family
Caltha palustris	yellow marsh marigold	Ranunculaceae
Calystegia sepium ssp. *sepium*	hedge false bindweed	Convolvulaceae
Campanula rotundifolia	bluebell bellflower	Campanulaceae
Cardamine concatenata	cutleaf toothwort	Brassicaceae
Carex	sedge	Cyperaceae
Carex albicans var. *emmonsii*	Emmons' sedge	Cyperaceae
Carex aquatilis var. *aquatilis*	water sedge	Cyperaceae
Carex bebbii	Bebb's sedge	Cyperaceae
Carex bromoides	bromelike sedge	Cyperaceae
Carex careyana	Carey's sedge	Cyperaceae
Carex cephalophora	oval-leaf sedge	Cyperaceae
Carex communis	fibrousroot sedge	Cyperaceae
Carex comosa	longhair sedge	Cyperaceae
Carex crinita	fringed sedge	Cyperaceae
Carex diandra	lesser panicled sedge	Cyperaceae
Carex digitalis	slender woodland sedge	Cyperaceae
Carex festucacea	fescue sedge	Cyperaceae
Carex folliculata	northern long sedge	Cyperaceae
Carex glaucodea	blue sedge	Cyperaceae
Carex grayi	Gray's sedge	Cyperaceae
Carex hirtifolia	pubescent sedge	Cyperaceae
Carex intumescens	greater bladder sedge	Cyperaceae
Carex lacustris	hairy sedge	Cyperaceae
Carex laevivaginata	smoothsheath sedge	Cyperaceae
Carex lupulina	hop sedge	Cyperaceae
Carex muehlenbergii	Muhlenberg's sedge	Cyperaceae
Carex normalis	greater straw sedge	Cyperaceae
Carex pedunculata	longstalk sedge	Cyperaceae
Carex pellita	woolly sedge	Cyperaceae
Carex pensylvanica	Pennsylvania sedge	Cyperaceae
Carex projecta	necklace sedge	Cyperaceae
Carex radiata	eastern star sedge	Cyperaceae
Carex rosea	rosy sedge	Cyperaceae
Carex scoparia	broom sedge	Cyperaceae
Carex seorsa	weak stellate sedge	Cyperaceae
Carex stipata	owlfruit sedge	Cyperaceae
Carex stricta	upright sedge	Cyperaceae
Carex swanii	Swan's sedge	Cyperaceae
Carex tenera	quill sedge	Cyperaceae
Carex tonsa	shaved sedge	Cyperaceae
Carex tonsa var. *rugosperma*	parachute sedge	Cyperaceae
Carex tribuloides	blunt broom sedge	Cyperaceae
Carex umbellata	parasol sedge	Cyperaceae
Carex vulpinoidea	fox sedge	Cyperaceae
Carex vulpinoidea var. *vulpinoidea*	fox sedge	Cyperaceae
Carpinus	hornbeam	Betulaceae
Carpinus caroliniana	American hornbeam	Betulaceae
Carya	hickory	Juglandaceae
Carya cordiformis	bitternut hickory	Juglandaceae
Carya glabra	pignut hickory	Juglandaceae
Carya ovata	shagbark hickory	Juglandaceae
Catalpa	catalpa	Bignoniaceae
Catalpa bignonioides	southern catalpa	Bignoniaceae
Catalpa speciosa	northern catalpa	Bignoniaceae
Caulophyllum thalictroides	blue cohosh	Berberidaceae
Ceanothus americanus	New Jersey tea	Rhamnaceae
Celastrus	bittersweet	Celastraceae
Celastrus orbiculata	Asian bittersweet	Celastraceae

Scientific name	Common name	Family
Celastrus orbiculatus	oriental bittersweet	Celastraceae
Celastrus scandens	American bittersweet	Celastraceae
Celtis occidentalis	common hackberry	Ulmaceae
Celtis tenuifolia	dwarf hackberry	Ulmaceae
Centaurea americana	American star-thistle	Asteraceae
Centaurea biebersteinii	spotted knapweed	Asteraceae
Cephalanthus occidentalis	common buttonbush	Rubiaceae
Cerastium	mouse-ear chickweed	Caryophyllaceae
Cercis canadensis	eastern redbud	Fabaceae
Chelone glabra		Scrophulariaceae
Cicuta bulbifera	bulblet-bearing water hemlock	Apiaceae
Cicuta maculata	spotted water hemlock	Apiaceae
Cinna arundinacea	sweet woodreed	Poaceae
Circaea	enchanter's nightshade	Onagraceae
Circaea lutetiana	broadleaf enchanter's nightshade	Onagraceae
Circaea quadrisulcata		Asteraceae
Cirsium	thistle	Asteraceae
Cirsium altissimum	tall thistle	Asteraceae
Cirsium arvense	Canada thistle	Asteraceae
Cirsium discolor	field thistle	Asteraceae
Cirsium muticum	swamp thistle	Asteraceae
Cirsium vulgare	bull thistle	Asteraceae
Cladium	sawgrass	Cyperaceae
Cladium mariscoides	smooth sawgrass	Cyperaceae
Clematis virginiana	devil's darning needles	Ranunculaceae
Commelina	dayflower	Commelinaceae
Comptonia peregrina	sweet fern	Myricaceae
Conopholis americana	American squawroot	Orobanchaceae
Convallaria majalis	European lily of the valley	Liliaceae
Convolvulus arvensis	field bindweed	Convolvulaceae
Coreopsis lanceolata	lanceleaf tickseed	Asteraceae
Coreopsis major	greater tickseed	Asteraceae
Coreopsis palmata	stiff tickseed	Asteraceae
Coreopsis tripteris	tall tickseed	Asteraceae
Cornus	dogwood	Cornaceae
Cornus amomum	silky dogwood	Cornaceae
Cornus drummondii	roughleaf dogwood	Cornaceae
Cornus florida	flowering dogwood	Cornaceae
Cornus foemina	stiff dogwood	Cornaceae
Cornus obliqua	silky dogwood	Cornaceae
Cornus racemosa	gray dogwood	Cornaceae
Cornus sericea	redosier dogwood	Cornaceae
Cornus sericea ssp. *sericea*	redosier dogwood	Cornaceae
Corylus americana	American hazelnut	Betulaceae
Crataegus	hawthorn	Rosaceae
Crataegus crus-galli	cockspur hawthorn	Rosaceae
Crataegus flabellata	fanleaf hawthorn	Rosaceae
Crataegus mollis		Rosaceae
Crataegus punctata	dotted hawthorn	Rosaceae
Cryptotaenia canadensis	Canadian honewort	Apiaceae
Cuscuta	dodder	Cuscutaceae
Cuscuta coryli	hazel dodder	Cuscutaceae
Cynoglossum occidentale	western hound's tongue	Boraginaceae
Cynoglossum officinale	gypsyflower	Boraginaceae
Cyperaceae		Cyperaceae
Cyperus	flatsedge	Cyperaceae
Cyperus bipartitus	slender flatsedge	Cyperaceae
Cyperus filicinus	fern flatsedge	Cyperaceae

Scientific name	Common name	Family
Cyperus schweinitzii	Schweinitz's flatsedge	Cyperaceae
Cyperus strigosus	strawcolored flatsedge	Cyperaceae
Danthonia spicata	poverty oatgrass	Poaceae
Dasiphora	shrubby cinquefoil	Rosaceae
Dasiphora floribunda	shrubby cinquefoil	Rosaceae
Daucus carota	Queen Anne's lace	Apiaceae
Decodon verticillatus	swamp loosestrife	Lythraceae
Desmanthus illinoensis	prairie bundleflower	Fabaceae
Desmodium	ticktrefoil	Fabaceae
Desmodium canadense	showy ticktrefoil	Fabaceae
Desmodium nudiflorum	nakedflower ticktrefoil	Fabaceae
Desmodium paniculatum	panicledleaf ticktrefoil	Fabaceae
Dianthus armeria	Deptford pink	Caryophyllaceae
Dianthus barbatus	sweetwilliam	Caryophyllaceae
Dichanthelium	rosette grass	Poaceae
Dichanthelium acuminatum var. *fasciculatum*	western panicgrass	Poaceae
Dichanthelium clandestinum	deertongue	Poaceae
Dichanthelium latifolium	broadleaf rosette grass	Poaceae
Dichanthelium meridionale	matting rosette grass	Poaceae
Dichanthelium oligosanthes var. *scribnerianum*	Scribner's rosette grass	Poaceae
Dichanthelium sabulorum var. *thinium*	hemlock rosette grass	Poaceae
Dichanthelium sphaerocarpon	roundseed panicgrass	Poaceae
Dichanthelium villosissimum var. *villosissimum*	whitehair rosette grass	Poaceae
Dichanthelium wilcoxianum	fall rosette grass	Poaceae
Diervilla lonicera	northern bush honeysuckle	Caprifoliaceae
Doellingeria umbellata var. *umbellata*	parasol whitetop	Asteraceae
Drosera rotundifolia	roundleaf sundew	Droseraceae
Dryopteris	woodfern	Dryopteridaceae
Dryopteris cristata	crested woodfern	Dryopteridaceae
Echinochloa crus-galli	barnyardgrass	Poaceae
Elaeagnus angustifolia	Russian olive	Elaeagnaceae
Elaeagnus umbellata	autumn olive	Elaeagnaceae
Eleocharis	spikerush	Cyperaceae
Eleocharis acicularis	needle spikerush	Cyperaceae
Eleocharis olivacea	bright green spikerush	Cyperaceae
Eleocharis wolfii	Wolf's spikerush	Cyperaceae
Elymus	wildrye	Poaceae
Elymus canadensis	Canada wildrye	Poaceae
Elymus hystrix	eastern bottlebrush grass	Poaceae
Elymus hystrix var. *hystrix*	eastern bottlebrush grass	Poaceae
Elymus riparius	riverbank wildrye	Poaceae
Elymus virginicus	Virginia wildrye	Poaceae
Enemion biternatum	eastern false rue anemone	Ranunculaceae
Epipactis helleborine	broadleaf helleborine	Orchidaceae
Equisetum	horsetail	Equisetaceae
Equisetum arvense	field horsetail	Equisetaceae
Equisetum hyemale	scouringrush horsetail	Equisetaceae
Eragrostis spectabilis	purple lovegrass	Poaceae
Eragrostis von	lovegrass	Poaceae
Erechtites hieraciifolia	American burnweed	Asteraceae
Erigeron	fleabane	Asteraceae
Erigeron annuus	eastern daisy fleabane	Asteraceae
Erigeron strigosus	prairie fleabane	Asteraceae
Eriophorum virginicum	tawny cottongrass	Cyperaceae
Eryngium yuccifolium	button eryngo	Apiaceae
Euonymus	spindletree	Celastraceae
Euonymus alata	winged burning bush	Celastraceae
Euonymus obovata	running strawberry bush	Celastraceae

Scientific name	Common name	Family
Eupatorium	thoroughwort	Asteraceae
Eupatorium altissimum	tall thoroughwort	Asteraceae
Eupatorium fistulosum		Asteraceae
Eupatorium maculatum	spotted joepyeweed	Asteraceae
Eupatorium perfoliatum	common boneset	Asteraceae
Eupatorium purpureum	sweetscented joepyeweed	Asteraceae
Eupatorium serotinum	lateflowering thoroughwort	Asteraceae
Euphorbia	spurge	Euphorbiaceae
Euphorbia corollata	flowering spurge	Euphorbiaceae
Euphorbia cyathophora	fire on the mountain	Euphorbiaceae
Eurybia macrophylla	bigleaf aster	Asteraceae
Euthamia graminifolia var. graminifolia	flat-top goldentop	Asteraceae
Euthamia gymnospermoides	Texas goldentop	Asteraceae
Fagus grandifolia	American beech	Fagaceae
Fagus sylvatica	European beech	Fagaceae
Festuca	fescue	Poaceae
Festuca trachyphylla	hard fescue	Poaceae
Fragaria virginiana	Virginia strawberry	Rosaceae
Frangula alnus	glossy buckthorn	Rhamnaceae
Fraxinus	ash	Oleaceae
Fraxinus americana	white ash	Oleaceae
Fraxinus nigra	black ash	Oleaceae
Fraxinus pennsylvanica	green ash	Oleaceae
Fraxinus quadrangulata	blue ash	Oleaceae
Galium	bedstraw	Rubiaceae
Galium aparine	stickywilly	Rubiaceae
Galium circaezans	licorice bedstraw	Rubiaceae
Galium obtusum	bluntleaf bedstraw	Rubiaceae
Galium pilosum	hairy bedstraw	Rubiaceae
Galium tinctorium	stiff marsh bedstraw	Rubiaceae
Galium trifidum	threepetal bedstraw	Rubiaceae
Galium triflorum	fragrant bedstraw	Rubiaceae
Gaylussacia baccata	black huckleberry	Ericaceae
Geranium	geranium	Geraniaceae
Geranium maculatum	spotted geranium	Geraniaceae
Geum	avens	Rosaceae
Geum canadense	white avens	Rosaceae
Geum laciniatum	rough avens	Rosaceae
Geum vernum	spring avens	Rosaceae
Glechoma hederacea	ground ivy	Lamiaceae
Glyceria	mannagrass	Poaceae
Glyceria canadensis	rattlesnake mannagrass	Poaceae
Glyceria striata	fowl mannagrass	Poaceae
Gnaphalium	cudweed	Asteraceae
Hackelia virginiana	beggarslice	Boraginaceae
Hamamelis	witchhazel	Hamamelidaceae
Hamamelis virginiana	American witchhazel	Hamamelidaceae
Hedysarum occidentale	western sweetvetch	Fabaceae
Helianthemum	frostweed	Cistaceae
Helianthemum bicknellii	hoary frostweed	Cistaceae
Helianthus	sunflower	Asteraceae
Helianthus divaricatus	woodland sunflower	Asteraceae
Helianthus giganteus	giant sunflower	Asteraceae
Helianthus maximiliani	Maximilian sunflower	Asteraceae
Helianthus mollis	ashy sunflower	Asteraceae
Helianthus occidentalis	fewleaf sunflower	Asteraceae
Helianthus salicifolius	willowleaf sunflower	Asteraceae
Helianthus strumosus	paleleaf woodland sunflower	Asteraceae

Scientific name	Common name	Family
Hepatica nobilis	sharplobe hepatica	Ranunculaceae
Hesperis matronalis	dames rocket	Brassicaceae
Hesperostipa spartea	porcupinegrass	Poaceae
Hieracium	hawkweed	Asteraceae
Hieracium caespitosum	meadow hawkweed	Asteraceae
Hudsonia tomentosa	woolly beachheather	Cistaceae
Hydrophyllum	waterleaf	Hydrophyllaceae
Hydrophyllum virginianum		Hydrophyllaceae
Hypericum	St. Johnswort	Clusiaceae
Hypericum kalmianum	Kalm's St. Johnswort	Clusiaceae
Ilex	holly	Aquifoliaceae
Ilex verticillata	common winterberry	Aquifoliaceae
Impatiens	touch-me-not	Balsaminaceae
Impatiens balsamina	spotted snapweed	Balsaminaceae
Impatiens capensis	jewelweed	Balsaminaceae
Impatiens pallida	pale touch-me-not	Balsaminaceae
Ionactis linariifolius	flaxleaf whitetop aster	Asteraceae
Iris	iris	Iridaceae
Iris virginica	Virginia iris	Iridaceae
Iris virginica var. *shrevei*	Shreve's iris	Iridaceae
Juglans nigra	black walnut	Juglandaceae
Juncus	rush	Juncaceae
Juncus balticus	Baltic rush	Juncaceae
Juncus balticus var. *littoralis*	Baltic rush	Juncaceae
Juncus brachycarpus	whiteroot rush	Juncaceae
Juncus brachycephalus	smallhead rush	Juncaceae
Juncus canadensis	Canadian rush	Juncaceae
Juncus effusus	common rush	Juncaceae
Juncus greenei	Greene's rush	Juncaceae
Juncus pelocarpus	brownfruit rush	Juncaceae
Juncus tenuis	poverty rush	Juncaceae
Juniperus	juniper	Cupressaceae
Juniperus communis	common juniper	Cupressaceae
Juniperus virginiana	eastern redcedar	Cupressaceae
Koeleria macrantha	prairie Junegrass	Poaceae
Krigia biflora	twoflower dwarfdandelion	Asteraceae
Lactuca	lettuce	Asteraceae
Laportea canadensis	Canadian woodnettle	Urticaceae
Larix laricina	tamarack	Pinaceae
Lathyrus palustris	marsh pea	Fabaceae
Leersia	cutgrass	Poaceae
Leersia oryzoides	rice cutgrass	Poaceae
Lemna	duckweed	Lemnaceae
Lemna minor	common duckweed	Lemnaceae
Lemna trisulca	star duckweed	Lemnaceae
Leonurus cardiaca	common motherwort	Lamiaceae
Lepidium	pepperweed	Brassicaceae
Lespedeza	lespedeza	Fabaceae
Lespedeza capitata	roundhead lespedeza	Fabaceae
Lespedeza violacea	violet lespedeza	Fabaceae
Leucanthemum vulgare	oxeye daisy	Asteraceae
Liatris	blazing star	Asteraceae
Liatris aspera	tall blazing star	Asteraceae
Liatris cylindracea	Ontario blazing star	Asteraceae
Liatris spicata	dense blazing star	Asteraceae
Ligustrum vulgare	European privet	Oleaceae
Lindera benzoin	northern spicebush	Lauraceae
Linum medium var. *texanum*	stiff yellow flax	Linaceae

Scientific name	Common name	Family
Liriodendron	tuliptree	Magnoliaceae
Liriodendron tulipifera	tuliptree	Magnoliaceae
Lithospermum	stoneseed	Boraginaceae
Lithospermum canescens	hoary puccoon	Boraginaceae
Lithospermum caroliniense	Carolina puccoon	Boraginaceae
Lithospermum caroliniense var. *croceum*	Carolina puccoon	Boraginaceae
Lobelia	lobelia	Campanulaceae
Lobelia cardinalis	cardinalflower	Campanulaceae
Lobelia kalmii	Ontario lobelia	Campanulaceae
Lobelia siphilitica	great blue lobelia	Campanulaceae
Lonicera	honeysuckle	Caprifoliaceae
Lonicera ×bella	Bell's honeysuckle	Caprifoliaceae
Lonicera dioica	limber honeysuckle	Caprifoliaceae
Lonicera minutiflora		Caprifoliaceae
Lonicera tatarica	Tatarian honeysuckle	Caprifoliaceae
Ludwigia palustris	marsh seedbox	Onagraceae
Ludwigia sphaerocarpa	globefruit primrose-willow	Onagraceae
Lupinus	lupine	Fabaceae
Lupinus perennis	sundial lupine	Fabaceae
Luzula multiflora	common woodrush	Juncaceae
Lycopus	waterhorehound	Lamiaceae
Lycopus americanus	American water horehound	Lamiaceae
Lysimachia nummularia	creeping jenny	Primulaceae
Lysimachia quadriflora	fourflower yellow loosestrife	Primulaceae
Lysimachia terrestris	earth loosestrife	Primulaceae
Lythrum	loosestrife	Lythraceae
Lythrum salicaria	purple loosestrife	Lythraceae
Maianthemum	mayflower	Liliaceae
Maianthemum canadense	Canada mayflower	Liliaceae
Maianthemum racemosum	feathery false lily of the vally	Liliaceae
Maianthemum stellatum	starry false lily of the vally	Liliaceae
Maianthemum trifolium	threeleaf false lily of the vally	Liliaceae
Malus	apple	Rosaceae
Malus ioensis	prairie crabapple	Rosaceae
Medeola virginiana	Indian cucumber	Liliaceae
Melilotus alba	white sweetclover	Fabaceae
Melilotus altissima	tall yellow sweetclover	Fabaceae
Menispermum canadense	common moonseed	Menispermaceae
Mentha arvensis	wild mint	Lamiaceae
Mentha spicata	spearmint	Lamiaceae
Menyanthes trifoliata	buckbean	Menyanthaceae
Mimulus alatus	sharpwing monkeyflower	Scrophulariaceae
Mimulus ringens	Allegheny monkeyflower	Scrophulariaceae
Mitchella repens	partridgeberry	Rubiaceae
Monarda	beebalm	Lamiaceae
Monarda fistulosa	wild bergamot	Lamiaceae
Monarda punctata	spotted beebalm	Lamiaceae
Morus alba	white mulberry	Moraceae
Morus rubra	red mulberry	Moraceae
Muhlenbergia	muhly	Poaceae
Muhlenbergia frondosa	wirestem muhly	Poaceae
Muhlenbergia mexicana	Mexican muhly	Poaceae
Myosotis laxa	bay forget-me-not	Boraginaceae
Myriophyllum spicatum	spike watermilfoil	Haloragaceae
Nepeta cataria	catnip	Lamiaceae
Nuphar	pond-lily	Nymphaeaceae
Nuphar lutea	yellow pond-lily	Nymphaeaceae
Nuphar lutea ssp. *advena*	yellow pond-lily	Nymphaeaceae

Scientific name	Common name	Family
Nymphaea	waterlily	Nymphaeaceae
Nymphaea odorata	American white waterlily	Nymphaeaceae
Nyssa	tupelo	Nyssaceae
Nyssa sylvatica	blackgum	Nyssaceae
Oenothera biennis	common evening-primrose	Onagraceae
Oenothera fruticosa	narrowleaf evening-primrose	Onagraceae
Oligoneuron album	prairie goldenrod	Asteraceae
Oligoneuron rigidum var. *rigidum*	stiff goldenrod	Asteraceae
Onoclea sensibilis	sensitive fern	Dryopteridaceae
Opuntia	pricklypear	Cactaceae
Opuntia humifusa	devil's-tongue	Cactaceae
Osmorhiza	sweetroot	Apiaceae
Osmorhiza claytonii	Clayton's sweetroot	Apiaceae
Osmorhiza longistylis	longstyle sweetroot	Apiaceae
Osmunda cinnamomea	cinnamon fern	Osmundaceae
Osmunda regalis	royal fern	Osmundaceae
Osmunda regalis var. *spectabilis*	royal fern	Osmundaceae
Ostrya	hophornbean	Betulaceae
Ostrya virginiana	Chisos hophornbeam	Betulaceae
Oxalis	woodsorrel	Oxalidaceae
Oxalis stricta	common yellow oxalis	Oxalidaceae
Oxypolis rigidior	stiff cowbane	Apiaceae
Panicum	panicgrass	Poaceae
Panicum rigidulum	redtop panicgrass	Poaceae
Panicum virgatum	switchgrass	Poaceae
Parthenocissus	creeper	Vitaceae
Parthenocissus quinquefolia	Virginia creeper	Vitaceae
Pedicularis canadensis	Canadian lousewort	Scrophulariaceae
Petradoria pumila ssp. *graminea*	giant rockgoldenrod	Asteraceae
Phalaris arundinacea	reed canarygrass	Poaceae
Phegopteris hexagonoptera	broad beechfern	Thelypteridaceae
Phleum pratense	timothy	Poaceae
Phlox maculata	wild sweetwilliam	Polemoniaceae
Phlox pilosa	downy phlox	Polemoniaceae
Photinia floribunda	purple chokeberry	Rosaceae
Photinia melanocarpa	black chokeberry	Rosaceae
Phragmites	reed	Poaceae
Phragmites australis	common reed	Poaceae
Phryma leptostachya	American lopseed	Verbenaceae
Phytolacca americana	American pokeweed	Phytolaccaceae
Picea	spruce	Pinaceae
Pilea fontana	lesser clearweed	Urticaceae
Pilea pumila	Canadian clearweed	Urticaceae
Pinus	pine	Pinaceae
Pinus banksiana	jack pine	Pinaceae
Pinus nigra	Austrian pine	Pinaceae
Pinus resinosa	red pine	Pinaceae
Pinus strobus	eastern white pine	Pinaceae
Pinus sylvestris	Scotch pine	Pinaceae
Plantago major	common plantain	Plantaginaceae
Plantago patagonica	woolly plantain	Plantaginaceae
Plantago virginica	Virginia plantain	Plantaginaceae
Platanthera flava var. *herbiola*	palegreen orchid	Orchidaceae
Platanthera huronensis	Huron green orchid	Orchidaceae
Platanus occidentalis	American sycamore	Platanaceae
Poa	bluegrass	Poaceae
Poa compressa	Canada bluegrass	Poaceae
Poa palustris	fowl bluegrass	Poaceae

Scientific name	Common name	Family
Poa pratensis	Kentucky bluegrass	Poaceae
Poa trivialis	rough bluegrass	Poaceae
Podophyllum peltatum	mayapple	Berberidaceae
Polygala	polygala	Polygalaceae
Polygala polygama	racemed milkwort	Polygalaceae
Polygonatum	Solomon's seal	Liliaceae
Polygonatum biflorum	smooth Solomon's seal	Liliaceae
Polygonum	knotweed	Polygonaceae
Polygonum amphibium	water knotweed	Polygonaceae
Polygonum amphibium var. *emersum*	longroot smartweed	Polygonaceae
Polygonum amphibium var. *stipulaceum*	water smartweed	Polygonaceae
Polygonum arifolium	halberdleaf tearthumb	Polygonaceae
Polygonum cuspidatum	Japanese knotweed	Polygonaceae
Polygonum hydropiper	marshpepper knotweed	Polygonaceae
Polygonum hydropiperoides	swamp smartweed	Polygonaceae
Polygonum lapathifolium	curlytop knotweed	Polygonaceae
Polygonum punctatum	dotted smartweed	Polygonaceae
Polygonum sagittatum	arrowleaf tearthumb	Polygonaceae
Polygonum scandens	climbing false buckwheat	Polygonaceae
Polygonum virginianum	jumpseed	Polygonaceae
Polystichum acrostichoides	Christmas fern	Dryopteridaceae
Pontederia	pontederia	Pontederiaceae
Pontederia cordata	pickerelweed	Pontederiaceae
Populus	cottonwood	Salicaceae
Populus deltoides	eastern cottonwood	Salicaceae
Populus nigra	Lombardy poplar	Salicaceae
Populus tremuloides	quaking aspen	Salicaceae
Potamogeton	pondweed	Potamogetonaceae
Potamogeton natans	floating pondweed	Potamogetonaceae
Potentilla	cinquefoil	Rosaceae
Potentilla ?morefieldii	Morefield's cinquefoil	Rosaceae
Potentilla recta	sulphur cinquefoil	Rosaceae
Potentilla simplex	common cinquefoil	Rosaceae
Prenanthes	rattlesnakeroot	Asteraceae
Prenanthes serpentaria	cankerweed	Asteraceae
Proserpinaca palustris var. *crebra*	marsh mermaidweed	Haloragaceae
Prunella vulgaris	common selfheal	Lamiaceae
Prunus	plum	Rosaceae
Prunus avium	sweet cherry	Rosaceae
Prunus pensylvanica	pin cherry	Rosaceae
Prunus pumila	sandcherry	Rosaceae
Prunus serotina	black cherry	Rosaceae
Prunus virginiana	chokecherry	Rosaceae
Pseudognaphalium obtusifolium ssp. *obtusifolium*	rabbittobacco	Asteraceae
Ptelea trifoliata	common hoptree	Rutaceae
Ptelea trifoliata ssp. *trifoliata* var. *mollis*	common hoptree	Rutaceae
Pteridium	brackenfern	Dennstaedtiaceae
Pteridium aquilinum	western brackenfern	Dennstaedtiaceae
Pteridium aquilinum var. *latiusculum*	western brackenfern	Dennstaedtiaceae
Pycnanthemum tenuifolium	narrowleaf mountainmint	Lamiaceae
Pycnanthemum virginianum	Virginia mountainmint	Lamiaceae
Quercus	oak	Fagaceae
Quercus alba	white oak	Fagaceae
Quercus bicolor	swamp white oak	Fagaceae
Quercus coccinea	scarlet oak	Fagaceae
Quercus macrocarpa	bur oak	Fagaceae
Quercus muehlenbergii	chinkapin oak	Fagaceae
Quercus nigra	water oak	Fagaceae

Scientific name	Common name	Family
Quercus palustris	pin oak	Fagaceae
Quercus rubra	northern red oak	Fagaceae
Quercus velutina	black oak	Fagaceae
Ranunculus abortivus	littleleaf buttercup	Ranunculaceae
Ranunculus pensylvanicus	Pennsylvania buttercup	Ranunculaceae
Ranunculus recurvatus	blisterwort	Ranunculaceae
Rhus	sumac	Anacardiaceae
Rhus aromatica	fragrant sumac	Anacardiaceae
Rhus aromatica var. *arenaria*	fragrant sumac	Anacardiaceae
Rhus aromatica var. *aromatica*	fragrant sumac	Anacardiaceae
Rhus copallinum	flameleaf sumac	Anacardiaceae
Rhus copallinum var. *latifolia*	winged sumac	Anacardiaceae
Rhus glabra	smooth sumac	Anacardiaceae
Rhus hirta	staghorn sumac	Anacardiaceae
Rhynchospora	beaksedge	Cyperaceae
Rhynchospora capillacea	needle beaksedge	Cyperaceae
Rhynchospora capitellata	brownish beaksedge	Cyperaceae
Rhynchospora macrostachya	tall horned beaksedge	Cyperaceae
Ribes	currant	Grossulariaceae
Ribes cynosbati	eastern prickly gooseberry	Grossulariaceae
Robinia pseudoacacia	black locust	Fabaceae
Rosa	rose	Rosaceae
Rosa blanda	smooth rose	Rosaceae
Rosa carolina	Carolina rose	Rosaceae
Rosa multiflora	multiflora rose	Rosaceae
Rosa palustris	swamp rose	Rosaceae
Rubus	blackberry	Rosaceae
Rubus allegheniensis	Allegheny blackberry	Rosaceae
Rubus flagellaris	northern dewberry	Rosaceae
Rubus hispidus	bristly dewberry	Rosaceae
Rubus idaeus	American red raspberry	Rosaceae
Rubus idaeus ssp. *Strigosus*	grayleaf red raspberry	Rosaceae
Rubus laciniatus	cutleaf blackberry	Rosaceae
Rubus occidentalis	black raspberry	Rosaceae
Rubus pensilvanicus	Pennsylvania blackberry	Rosaceae
Rudbeckia	coneflower	Asteraceae
Rudbeckia hirta	blackeyed Susan	Asteraceae
Rudbeckia laciniata	cutleaf coneflower	Asteraceae
Rumex	dock	Polygonaceae
Rumex acetosella	common sheep sorrel	Polygonaceae
Rumex verticillatus	swamp dock	Polygonaceae
Sabatia angularis	rosepink	Gentianaceae
Sagittaria	arrowhead	Alismataceae
Sagittaria latifolia	broadleaf arrowhead	Alismataceae
Salix	willow	Salicaceae
Salix babylonica		Salicaceae
Salix cordata	heartleaf willow	Salicaceae
Salix discolor	pussy willow	Salicaceae
Salix eriocephala	Missouri River willow	Salicaceae
Salix humilis	prairie willow	Salicaceae
Salix interior	sandbar willow	Salicaceae
Salix myricoides var. *myricoides*	bayberry willow	Salicaceae
Salix nigra	black willow	Salicaceae
Salix petiolaris	meadow willow	Salicaceae
Salix sericea	silky willow	Salicaceae
Salix serissima	autumn willow	Salicaceae
Sambucus	elderberry	Caprifoliaceae
Sambucus nigra ssp. *canadensis*	common elderberry	Caprifoliaceae

Scientific name	Common name	Family
Sanguinaria canadensis	bloodroot	Papaveraceae
Sanicula	sanicle	Apiaceae
Sanicula canadensis	Canadian blacksnakeroot	Apiaceae
Sanicula odorata	clustered blacksnakeroot	Apiaceae
Saponaria officinalis	bouncingbet	Caryophyllaceae
Sassafras albidum	sassafras	Lauraceae
Saururus cernuus	lizard's tail	Saururaceae
Saxifraga	saxifrage	Saxifragaceae
Saxifraga pensylvanica	eastern swamp saxifrage	Saxifragaceae
Schizachyrium scoparium	little bluestem	Poaceae
Schoenoplectus	bulrush	Cyperaceae
Schoenoplectus fluviatilis	river bulrush	Cyperaceae
Schoenoplectus pungens	common threesquare	Cyperaceae
Schoenoplectus smithii	Smith's bulrush	Cyperaceae
Schoenoplectus tabernaemontani	softstem bulrush	Cyperaceae
Scirpus	bulrush	Cyperaceae
Scirpus atrovirens	green bulrush	Cyperaceae
Scirpus cyperinus	woolgrass	Cyperaceae
Scleria georgiana	slenderfruit nutrush	Cyperaceae
Scrophularia marilandica	carpenter's square	Scrophulariaceae
Scutellaria galericulata	marsh skullcap	Lamiaceae
Scutellaria lateriflora	blue skullcap	Lamiaceae
Setaria	bristlegrass	Poaceae
Sicyos angulatus	oneseed burr cucumber	Cucurbitaceae
Silphium compositum var. *reniforme*	kidneyleaf rosinweed	Asteraceae
Silphium laciniatum	compassplant	Asteraceae
Silphium perfoliatum	cup plant	Asteraceae
Sium suave	hemlock waterparsnip	Apiaceae
Smilax	greenbrier	Smilacaceae
Smilax ecirrata	upright carrionflower	Smilacaceae
Smilax herbacea	smooth carrionflower	Smilacaceae
Smilax lasioneura	Blue Ridge carrionflower	Smilacaceae
Smilax rotundifolia	roundleaf greenbrier	Smilacaceae
Smilax tamnoides	bristly greenbrier	Smilacaceae
Solanum	nightshade	Solanaceae
Solanum carolinense	Carolina horsenettle	Solanaceae
Solanum dulcamara	climbing nightshade	Solanaceae
Solidago	goldenrod	Asteraceae
Solidago caesia	wreath goldenrod	Asteraceae
Solidago canadensis	Canada goldenrod	Asteraceae
Solidago canadensis var. *scabra*	Canada goldenrod	Asteraceae
Solidago flexicaulis	zigzag goldenrod	Asteraceae
Solidago gigantea	giant goldenrod	Asteraceae
Solidago juliae	Julia's goldenrod	Asteraceae
Solidago juncea	early goldenrod	Asteraceae
Solidago nemoralis	gray goldenrod	Asteraceae
Solidago patula		Asteraceae
Solidago rugosa	wrinkleleaf goldenrod	Asteraceae
Solidago simplex ssp. *randii* var. *gillmanii*	Rand's goldenrod	Asteraceae
Solidago speciosa	showy goldenrod	Asteraceae
Solidago uliginosa	bog goldenrod	Asteraceae
Sonchus arvensis	moist sowthistle	Asteraceae
Sorghastrum nutans	Indiangrass	Poaceae
Sparganium	bur-reed	Sparganiaceae
Sparganium americanum	American bur-reed	Sparganiaceae
Sparganium erectum ssp. *stoloniferum*	simplestem bur-reed	Sparganiaceae
Sparganium eurycarpum	broadfruit bur-reed	Sparganiaceae
Spartina	cordgrass	Poaceae

Scientific name	Common name	Family
Spartina ×townsendii		Poaceae
Spartina pectinata	prairie cordgrass	Poaceae
Sphagnum	sphagnum	Sphagnaceae
Spiraea	spirea	Rosaceae
Spiraea alba	white meadowsweet	Rosaceae
Spiraea tomentosa	steeplebush	Rosaceae
Spiranthes lacera	northern slender ladies'-tresses	Orchidaceae
Sporobolus cryptandrus	sand dropseed	Poaceae
Stachys hyssopifolia		Lamiaceae
Stachys tenuifolia	smooth hedgenettle	Lamiaceae
Staphylea trifolia	American bladdernut	Staphyleaceae
Symphyotrichum	aster	Asteraceae
Symphyotrichum dumosum var. *dumosum*	rice button aster	Asteraceae
Symphyotrichum ericoides var. *ericoides*	white heath aster	Asteraceae
Symphyotrichum lanceolatum ssp. *lanceolatum* var. *lanceolatum*	white panicle aster	Asteraceae
Symphyotrichum lateriflorum var. *lateriflorum*	calico aster	Asteraceae
Symphyotrichum oblongifolium	aromatic aster	Asteraceae
Symphyotrichum oolentangiense var. *oolentangiense*	skyblue aster	Asteraceae
Symplocarpus	skunk cabbage	Araceae
Symplocarpus foetidus	skunk cabbage	Araceae
Taraxacum	dandelion	Asteraceae
Taraxacum officinale	common dandelion	Asteraceae
Tephrosia virginiana	Virginia tephrosia	Fabaceae
Thalictrum	meadow-rue	Ranunculaceae
Thalictrum dioicum	early meadow-rue	Ranunculaceae
Thelypteris	maiden fern	Thelypteridaceae
Thelypteris noveboracensis	New York fern	Thelypteridaceae
Thelypteris palustris	eastern marsh fern	Thelypteridaceae
Thelypteris palustris var. *pubescens*	eastern marsh fern	Thelypteridaceae
Thuja occidentalis	arborvitae	Cupressaceae
Thymus praecox ssp. *arcticus*	creeping thyme	Lamiaceae
Tiarella cordifolia	heartleaf foamflower	Saxifragaceae
Tilia	basswood	Tiliaceae
Tilia americana	American basswood	Tiliaceae
Tofieldia racemosa	coastal false asphodel	Liliaceae
Torreyochloa pallida var. *pallida*	pale false mannagrass	Poaceae
Toxicodendron	poison oak	Anacardiaceae
Toxicodendron pubescens	Atlantic poison oak	Anacardiaceae
Toxicodendron radicans	eastern poison ivy	Anacardiaceae
Toxicodendron radicans ssp. *radicans*	eastern poison ivy	Anacardiaceae
Toxicodendron rydbergii	western poison ivy	Anacardiaceae
Toxicodendron vernix	poison sumac	Anacardiaceae
Tradescantia	spiderwort	Commelinaceae
Tradescantia ohiensis	bluejacket	Commelinaceae
Tragopogon	goatsbeard	Asteraceae
Tragopogon pratensis	Jack-go-to-bed-at-noon	Asteraceae
Triadenum virginicum	Virginia marsh St. Johnswort	Clusiaceae
Trientalis borealis	starflower	Primulaceae
Trifolium pratense	red clover	Fabaceae
Trifolium repens	white clover	Fabaceae
Triglochin maritimum	seaside arrowgrass	Juncaginaceae
Trillium	trillium	Liliaceae
Trillium grandiflorum	snow trillium	Liliaceae
Typha	cattail	Typhaceae
Typha ×glauca		Typhaceae
Typha angustifolia	narrowleaf cattail	Typhaceae
Typha latifolia	broadleaf cattail	Typhaceae
Ulmus	elm	Ulmaceae

Scientific name	Common name	Family
Ulmus americana	American elm	Ulmaceae
Ulmus pumila	Siberian elm	Ulmaceae
Ulmus rubra	slippery elm	Ulmaceae
Urtica dioica	stinging nettle	Urticaceae
Urtica dioica ssp. *gracilis*	California nettle	Urticaceae
Utricularia	bladderwort	Lentibulariaceae
Utricularia cornuta	horned bladderwort	Lentibulariaceae
Uvularia perfoliata	perfoliate bellwort	Liliaceae
Vaccinium	blueberry	Ericaceae
Vaccinium angustifolium	lowbush blueberry	Ericaceae
Vaccinium corymbosum	highbush blueberry	Ericaceae
Vaccinium pallidum	Blue Ridge blueberry	Ericaceae
Verbascum thapsus	common mullein	Scrophulariaceae
Verbena hastata	swamp verbena	Verbenaceae
Verbena simplex	narrowleaf vervain	Verbenaceae
Verbena stricta	hoary verbena	Verbenaceae
Verbesina alternifolia	wingstem	Asteraceae
Vernonia		Asteraceae
Vernonia gigantea ssp. *gigantea*	giant ironweed	Asteraceae
Veronicastrum virginicum	Culver's root	Scrophulariaceae
Viburnum	viburnum	Caprifoliaceae
Viburnum acerifolium	mapleleaf viburnum	Caprifoliaceae
Viburnum dentatum	southern arrowwood	Caprifoliaceae
Viburnum dentatum var. *lucidum*	southern arrowwood	Caprifoliaceae
Viburnum lentago	nannyberry	Caprifoliaceae
Viburnum opulus	European cranberrybush	Caprifoliaceae
Viburnum prunifolium	blackhaw	Caprifoliaceae
Viburnum rafinesquianum	downy arrowwood	Caprifoliaceae
Vinca minor	common periwinkle	Apocynaceae
Viola	violet	Violaceae
Viola blanda var. *palustriformis*	sweet white violet	Violaceae
Viola canadensis	Canadian white violet	Violaceae
Viola hastata	halberdleaf yellow violet	Violaceae
Viola pedata	birdfoot violet	Violaceae
Viola pedatifida	prairie violet	Violaceae
Vitis	grape	Vitaceae
Vitis aestivalis	summer grape	Vitaceae
Vitis labrusca	fox grape	Vitaceae
Vitis riparia	riverbank grape	Vitaceae
Vitis vinifera	wine grape	Vitaceae
Vulpia myuros	rat-tail fescue	Poaceae
Wolffia columbiana	Columbian watermeal	Lemnaceae
Xanthium strumarium	rough cockleburr	Asteraceae
Xyris difformis	bog yelloweyed grass	Xyridaceae
Zanthoxylum americanum	common pricklyash	Rutaceae
Zizania aquatica	annual wildrice	Poaceae

National Park Service
Vegetation Inventory Program
Indiana Dunes National Lakeshore, Indiana

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Appendix E

Descriptions to Map Classes of Indiana Dunes National Lakeshore

Explanation of Map Class Descriptions

This appendix to the Main Report of the Indiana Dunes National Lakeshore (INDU, also referred as Lakeshore) Vegetation Mapping Project provides descriptions to the 66 map classes we used to map the Lakeshore and environs for the National Park Service (NPS) Vegetation Inventory Program (VIP). Fifty-five of the map classes represent National Vegetation Classification (NVC) System types; the remaining 11 map classes represent non-vegetation units. For map classes representing NVC floristic types—alliance and association—we recommend using Appendix B: Descriptions to Vegetation Types of Indiana Dunes National Lakeshore and Appendix C: Field Key to Vegetation Types of Indiana Dunes National Lakeshore to compliment these map class descriptions.

Each map class description provides the formal map class name and the map class code we derived and used for mapping. Names for map classes representing NVC floristic types—alliance and association—are the synonym names as provided by NatureServe. (For map class phases, the phase unit portion of the name is not part of the vegetation type synonym name.) Names for map classes representing NVC formation types (e.g., fallow fields, crop fields) reflect a more succinct name representing the land cover feature, not the formal NVC formation name. Those names for non-vegetated features (e.g., roads, farmsteads) are project specific and do not reflect a standardized name. However, they do echo in concept U.S. Geological Survey's land use and land cover (LULC) classification units (Anderson et al. 1976).

With these map class descriptions, we describe what each map class represents in our mapping of the Lakeshore and environs. These are brief statements and come more from a photointerpretation perspective rather than perspective of botanical and ecological concepts found within the descriptions to vegetation types. However, ecological concepts are naturally included from the mapping of NVC vegetation types. We also provide a succinct explanation of how map classes were employed with the accuracy assessment (AA). Throughout these map class descriptions, "RD" refers to relative density and "AA" refers to accuracy assessment.

Along with describing the link between map classes and NVC types, a representative ground picture is provided to give a visual description of what the map class represents. It is worth noting, the representative picture is only a signature representative; to capture all feature variations within a map class would become daunting.

We desired to organize and link map classes to the newest version of the NVC standard (FGDC 2008). Albeit the revised NVC was complete in documentation, floristic types (association and alliance) of the Great Lakes Network region had yet to be formalized into the new hierarchy structure. Thus, the INDU products and this report follow the 1997 version of the NVC. We organized map classes representing non-vegetated features (terrestrial natural and cultural units) into nonstandard, project-specific categories, yet used a hierarchical format similar to the NVC.

Map classification codes, names, and their crosswalk to NVC types are listed in Table E-1.

Minimum Mapping Units

Map classes are generally mapped to the NPS VIP minimum mapping unit (MMU) standard of 0.5 ha (1.24 acres). However, MMU of 0.1 ha (.25 acres) was applied to specific map classes for West unit mapping. Those map classes are denoted with an asterisk (*) by the map class code in Table E-1; essentially they are map classes representing many of the wet herbaceous and wet shrubland types. Also worth noting, types unique to its surroundings (e.g., emergent wetland within an upland forest setting) often were mapped down to 0.25 ha (0.62 acres). As well, we applied an MMU of 1.0 ha (2.47 acres) to capture natural/semi-natural vegetation bound by urban areas and a secondary MMU of 2.0 ha (4.94 acres) for physiognomic feature changes within a particular map class.

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- Northeastern Modified Successional Forest (coniferous phase) – FCM 16
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Table E-1. Map classification with crosswalk to National Vegetation Classification types.

Map class code	Map class name	Formation code	Alliance code	Association code
FOREST CLASS				
Rounded-crowned Temperate or Subpolar Needle-leaved Evergreen Forest Formation				
***Pinus banksiana* Forest Alliance**				
***Pinus banksiana - Pinus resinosa - Pinus strobus* Dune Forest Association**				
FPD	Great Lakes Dune Pine Forest	I.A.8.N.b.	A.116	CEGL002589
Lowland or Submontane Cold-deciduous Forest Formation				
FMP	Mesophytic Pocket Forest	I.B.2.N.a.	N/A	N/A
***Acer saccharum - Tilia americana* - (*Quercus rubra*) Forest Alliance**				
***Acer saccharum - Tilia americana / Ostrya virginiana - Carpinus caroliniana* Forest Association**				
FAT	North-central Maple - Basswood Forest	I.B.2.N.a.	A.220	CEGL002062
***Fagus grandifolia - Acer saccharum* - (*Liriodendron tulipifera*) Forest Alliance**				
***Fagus grandifolia - Acer saccharum* Glaciated Midwest Forest Association**				
FAF	Beech - Maple Glaciated Forest (beech - maple phase)	I.B.2.N.a.	A.227	CEGL005013
FBA	Beech - Maple Glaciated Forest (aspen phase)	I.B.2.N.a.	A.227	CEGL005013
***Prunus serotina - Acer rubrum - Amelanchier canadensis - Quercus* spp. Forest Alliance**				
***Prunus serotina - Liriodendron tulipifera - Acer rubrum - Fraxinus americana* - (*Robinia pseudoacacia*) Forest Association**				
FCM	Northeastern Modified Successional Forest (coniferous phase)	I.B.2.N.a.	A.237	CEGL006599
FDM	Northeastern Modified Successional Forest (deciduous phase)	I.B.2.N.a.	A.237	CEGL006599
***Quercus alba* - (*Quercus rubra, Carya* spp.) Forest Alliance**				
***Quercus alba - Quercus rubra - Carya ovata* Glaciated Forest Association**				
FWR	Midwestern White Oak - Red Oak Forest (white oak - red oak phase)	I.B.2.N.a.	A.239	CEGL002068
FOH	Midwestern White Oak - Red Oak Forest (hickory phase)	I.B.2.N.a.	A.239	CEGL002068
***Quercus rubra* - (*Acer saccharum*) Forest Alliance**				
***Quercus rubra* - (*Acer saccharum, Quercus alba*) Forest Association**				
FRO	Red Oak - Sugar Maple - Elm Forest	I.B.2.N.a.	A.251	CEGL005017
***Quercus velutina - Quercus alba* - (*Quercus coccinea*) Forest Alliance**				
***Quercus velutina / Carex pensylvanica* Forest Association**				
FBW	Black Oak Forest (black oak - white oak phase)	I.B.2.N.a.	A.1911	CEGL002078
FPF	Black Oak Forest (pin oak phase)	I.B.2.N.a.	A.1911	CEGL002078
FAO	Black Oak Forest (aspen phase)	I.B.2.N.a.	A.1911	CEGL002078

Map class code	Map class name	Formation code	Alliance code	Association code
Temporarily Flooded Cold-deciduous Forest Formation				
FDW	Mixed Deciduous Wetland Forest	I.B.2.N.d.	N/A	N/A
***Acer saccharinum* Temporarily Flooded Forest Alliance**				
***Acer saccharinum* - *Ulmus americana* Forest Association**				
FSC	Silver Maple - Elm Forest	I.B.2.N.d.	A.279	CEGL002586
***Betula nigra* - (*Platanus occidentalis*) Temporarily Flooded Forest Alliance**				
FWM	River Birch - (Sycamore) Temporarily Flooded Forest	I.B.2.N.d.	A.280	N/A
***Populus deltoides* Temporarily Flooded Forest Alliance**				
***Populus deltoides* - *Salix nigra* Forest Association**				
FCW	Midwestern Cottonwood - Black Willow Forest	I.B.2.N.d.	A.290	CEGL002018
***Populus tremuloides* Temporarily Flooded Forest Alliance**				
FWA	Quaking Aspen Temporarily Flooded Forest	I.B.2.N.d.	A.300	N/A
Seasonally Flooded Cold-deciduous Forest Formation				
***Acer rubrum* - *Fraxinus pennsylvanica* Seasonally Flooded Forest Alliance**				
***Acer* (*rubrum, saccharinum*) - *Fraxinus* spp. - *Ulmus americana* Forest Association**				
FMS	Maple - Ash - Elm Swamp Forest	I.B.2.N.e.	A.316	CEGL005038
***Quercus palustris* - (*Quercus bicolor*) Seasonally Flooded Forest Alliance**				
***Quercus palustris* - *Quercus bicolor* - *Acer rubrum* Flatwoods Forest Association**				
FPS	Northern (Great Lakes) Flatwoods (pin oak phase)	I.B.2.N.e.	A.329	CEGL005037
FSW	Northern (Great Lakes) Flatwoods (swamp white oak phase)	I.B.2.N.e.	A.329	CEGL005037
Saturated Cold-deciduous Forest Formation				
***Acer rubrum* - *Fraxinus pennsylvanica* Saturated Forest Alliance**				
***Acer rubrum* - *Fraxinus* (*pennsylvanica, americana*) / *Lindera benzoin* / *Symplocarpus foetidus* Forest Association**				
FRS	Southern New England Red Maple Seepage Swamp	I.B.2.N.g.	A.3035	CEGL006406
***Larix laricina* Saturated Forest Alliance**				
***Larix laricina* - *Acer rubrum* / (*Rhamnus alnifolia, Vaccinium corymbosum*) Forest Association**				
FTM	Central Tamarack - Red Maple Rich Swamp (tamarack - red maple phase)	I.B.2.N.g.	A.349	CEGL005232
FCR	Central Tamarack - Red Maple Rich Swamp (northern white-cedar phase)	I.B.2.N.g.	A.349	CEGL005232
Mixed Needle-leaved Evergreen - Cold-deciduous Forest Formation				
***Pinus banksiana* - *Quercus* (*ellipsoidalis, velutina*) Forest Alliance**				
FJO	Jack Pine - (Northern Pin Oak, Black Oak) Forest	I.C.3.N.a.	A.391	N/A

Map class code	Map class name	Formation code	Alliance code	Association code
***Pinus strobus* - *Quercus* (*alba, rubra, velutina*) Forest Alliance**				
***Pinus strobus* - *Quercus alba* / (*Corylus americana, Gaylussacia baccata*) Forest Association**				
FPO	White Pine - White Oak Sand Forest	I.C.3.N.a.	A.401	CEGL002481
Planted/cultivated Temparate or Subpolar Needle-leaved Evergreen Forest Formation				
FPP	Conifer Plantation	I.A.8.C.a.	N/A	N/A
Planted/cultivated Cold-deciduous Forest Formation				
FOD	Deciduous Orchard	I.B.2.C.b.	N/A	N/A
WOODLAND CLASS				
Cold-deciduous Woodland Formation				
***Quercus alba* - (*Quercus velutina*) Woodland Alliance**				
***Quercus velutina* - (*Quercus ellipsoidalis*) - *Quercus alba* / *Deschampsia flexuosa* Woodland**				
WBL	Black Oak - Northern Pin Oak / Common Hairgrass Woodland	II.B.2.N.a.	A.612	CEGL005029
***Quercus macrocarpa* - *Quercus* (*alba, ellipsoidalis, velutina*) Woodland Alliance**				
***Quercus alba* - *Quercus macrocarpa* - *Quercus rubra* / *Corylus americana* Woodland Association**				
WBO	North-central Dry-Mesic Oak Woodland	II.B.2.N.a.	A.619	CEGL002142
***Populus deltoides* Woodland Alliance**				
***Populus deltoides* - (*Juniperus virginiana*) Dune Woodland Association**				
WCF	Cottonwood Dune (natural foredune phase)	II.B.2.N.a.	A.1493	CEGL005119
WDC	Cottonwood Dune (disturbance phase)	II.B.2.N.a.	A.1493	CEGL005119
SHRUBLAND CLASS				
Temperate Cold-deciduous Shrubland Formation				
SMX	Mixed Deciduous Shrubland	III.B.2.N.a.	N/A	N/A
***Corylus americana* - (*Spiraea tomentosa, Malus ioensis*) Shrubland Alliance**				
***Spiraea tomentosa* - *Salix humilus* / *Andropogon gerardii* - *Panicum virgatum* Shrubland Association**				
SSP*	Hardhack Wet-Mesic Sand Shrub Meadow	III.B.2.N.a.	A.897	CEGL005069
***Corylus americana* - *Salix humilus* / *Schizachyrium scoparium* Shrubland Association**				
SHB	Hazelnut Sand Barrens	III.B.2.N.a.	A.897	CEGL005072
Seasonally Flooded Cold-deciduous Shrubland Formation				
***Alnus incana* Seasonally Flooded Shrubland Alliance**				
***Alnus incana* Swamp Shrubland Association**				
SAS*	Speckled Alder Swamp	III.B.2.N.e.	A.986	CEGL002381

Map class code	Map class name	Formation code	Alliance code	Association code
***Cornus sericea* - *Salix* spp. Seasonally Flooded Shrubland Alliance**				
***Cornus sericea* - *Salix* spp. - (*Rosa palustris*) Shrubland Association**				
SMS*	Dogwood - Willow Swamp	III.B.2.N.e.	A.989	CEGL002186
Semipermanently Flooded Cold-deciduous Shrubland Formation				
***Cephalanthus occidentalis* Semipermanently Flooded Shrubland Alliance**				
***Cephalanthus occidentalis* / *Carex* spp. Northern Shrubland Association**				
SBS*	Northern Buttonbush Swamp	III.B.2.N.f.	A.1011	CEGL002190
HERBACEOUS VEGETATION CLASS				
Tall Sod Temperate Grassland Formation				
***Schizachyrium scoparium* - *Sorghastrum nutans* Herbaceous Alliance**				
***Schizachyrium scoparium* - *Sorghastrum nutans* - *Andropogon gerardii* - *Lespedeza capitata* Sand Herbaceous Vegetation Association**				
HLB	Midwest Dry-Mesic Sand Prairie	V.A.5.N.a.	A.1198	CEGL002210
Medium-tall Sod Temperate or Subpolar Grassland Formation				
HMX	Mixed Herbaceous Fallow Field	V.A.5.N.c.	N/A	N/A
***Ammophila breviligulata* Herbaceous Alliance and/or *Schizachyrium scoparium* - (*Sporobolus cryptandrus*) Herbaceous Alliance**				
***Ammophila breviligulata* - (*Schizachyrium scoparium*) Herbaceous Vegetation Association and/or *Schizachyrium scoparium* - *Carex tonsa* var. *rugosperma* - *Carex muehlenbergii* - *Lithospermum caroliniense* - *Opuntia humifusa* Herbaceous Vegetation Association**				
HAB	Great Lakes Beachgrass Dune and/or Midwest Sand Barrens	V.A.5.N.c.	A.1207 / A.1224	CEGL005098 / CEGL005099
Temporarily Flooded Temperate or Subpolar Grassland Formation				
***Spartina pectinata* Temporarily Flooded Herbaceous Alliance**				
***Spartina pectinata* - *Carex* spp. - *Calamagrostis canadensis* Lakeplain Herbaceous Vegetation Association**				
HCP*	Central Cordgrass Wet Prairie	V.A.5.N.j.	A.1347	CEGL005109
Seasonally Flooded Temperate or Subpolar Grassland Formation				
HWM*	Mixed Herbaceous Wet Meadow	V.A.5.N.k.	N/A	N/A
***Cladium mariscoides* Seasonally Flooded Herbaceous Alliance**				
***Dasiphora fruticosa* ssp. *floribunda* / *Cladium mariscoides* - *Juncus balticus* - (*Rhynchospora capillacea*) Herbaceous Vegetation Association**				
HDW*	Interdunal Wetland	V.A.5.N.k.	A.1368	CEGL005105
***Carex stricta* Seasonally Flooded Herbaceous Alliance**				
***Carex stricta* - *Carex* spp. Herbaceous Vegetation Association**				
HSM*	Tussuck Sedge Wet Meadow	V.A.5.N.k.	A.1397	CEGL002258
***Phalaris arundinacea* Seasonally Flooded Herbaceous Alliance**				
***Phalaris arundinacea* Eastern Herbaceous Vegetation Association**				

Map class code	Map class name	Formation code	Alliance code	Association code
HPH*	Reed Canary Grass Eastern Marsh	V.A.5.N.k.	A.1381	CEGL006044
***Typha* spp. - (*Schoenoplectus* spp., *Juncus* spp.) Seasonally Flooded Herbaceous Alliance**				
***Schoenoplectus tabernaemontani* - *Typha* spp. - (*Sparganium* spp., *Juncus* spp.) Herbaceous Vegetation Association**				
HBC*	Bulrush - Cattail - Burreed Shallow Marsh	V.A.5.N.k.	A.1394	CEGL002026
Semipermanently Flooded Temperate or Subpolar Grassland Formation				
***Phragmites australis* Semipermanently Flooded Herbaceous Alliance**				
***Phragmites australis* Eastern North America Temperate Semi-natural Herbaceous Vegetation Association**				
HPM*	Eastern Reed Marsh	V.A.5.N.l.	A.1431	CEGL004141
***Typha* (*angustifolia, latifolia*) - (*Schoenoplectus* spp.) Semipermanently Flooded Herbaceous Alliance**				
***Typha* spp. Midwest Herbaceous Vegetation Association**				
HCM*	Midwest Cattail Deep Marsh	V.A.5.N.l.	A.1436	CEGL002233
Tall Temperate Grassland with a Sparse Cold-deciduous Tree Layer Formation				
***Quercus velutina* - (*Quercus ellipsoidalis*) Wooded Herbaceous Alliance**				
***Quercus velutina* - (*Quercus alba*) - *Quercus ellipsoidalis* / *Schizachyrium scoparium* - *Lupinus perennis* Wooded Herbaceous Vegetation Association**				
HOB	Black Oak / Lupine Barrens	V.A.6.N.c.	A.1492	CEGL002492
Medium-tall Temperate or Subpolar Grassland with a Sparse Needle-leaved Evergreen or Mixed Tree Layer Formation				
***Pinus banksiana* - (*Pinus resinosa*) Wooded Herbaceous Alliance**				
***Pinus banksiana* - (*Pinus resinosa*) - *Pinus strobus* / *Juniperus horizontalis* Wooded Herbaceous Vegetation Association**				
HPB	Great Lakes Pine Barrens	V.A.6.N.f.	A.1499	CEGL005125
Permanently Flooded Temperate or Subpolar Hydromorphic-rooted Vegetation Formation				
***Potamogeton* spp. - *Ceratophyllum* spp. - *Elodea* spp. Permanently Flooded Herbaceous Alliance**				
***Potamogeton* spp. - *Ceratophyllum* spp. Midwest Herbaceous Vegetation Association**				
HSV*	Midwest Pondweed Submerged Aquatic Wetland	V.C.2.N.a.	A.1754	CEGL002282
***Nymphaea odorata* - *Nuphar* spp. Permanently Flooded Temperate Herbaceous Alliance**				
***Nuphar lutea* ssp. *advena* - *Nymphaea odorata* Herbaceous Vegetation Association**				
HWL*	Water-lily Aquatic Wetland	V.C.2.N.a.	A.1984	CEGL002386
Perennial grass crops (hayland, pastureland) Formation				
HGC	Perennial Grass Crops	V.A.5.C.a.	N/A	N/A
Annual Close-grown Forbs and Grasses Formation and/or Annual Row-crop Forbs and Grasses Formation				
HCF	Crop Field	V.D.2.C.a. / V.D.2.C.b.	N/A	N/A

SPARSE VEGETATION CLASS

Map class code	Map class name	Formation code	Alliance code	Association code
Dunes with Sparse Herbaceous Vegetation Formation				
Herbaceous Dunes Sparsely Vegetated Alliance				
VDS	Herbaceous Dunes Sparsely Vegetated	VII.C.1.N.a.	A.1855	N/A
GENERAL LANDCOVER (Non-NVC)				
Terrestrial Natural/Semi-natural Non-vegetated				
Barren Beach				
NLB	Lakeshore Sand and Cobble Beach	N/A	N/A	N/A
NSD	Barren Sand Dune	N/A	N/A	N/A
Open Water-body				
NSR	Open Water Stream and River	N/A	N/A	N/A
NLP*	Open Water Lake and Pond	N/A	N/A	N/A
Developed Area				
Developed Area				
LID	Industrial	N/A	N/A	N/A
LRC	Residential and Commercial	N/A	N/A	N/A
LQR	Quarry	N/A	N/A	N/A
LAP	Artificial Pond	N/A	N/A	N/A
LRR	Road and Railroad	N/A	N/A	N/A
LFS	Farmstead	N/A	N/A	N/A
LBL	Barren Land	N/A	N/A	N/A

Great Lakes Dune Pine Forest (FPD)

The Great Lakes Dune Pine Forest (FPD) map class represents the NVC *Pinus banksiana - Pinus resinosa - Pinus strobus* Dune Forest Association (CEGL002589). The FPD map class captures mixed red pine, white pine, and/or jack pine stands on active sand dunes having >60% tree canopy cover; those stands having <60% cover are captured by the Great Lakes Pine Barrens (HPB) map class. The understory vegetation is of typical sandscape species, such as American beachgrass, sand cherry, and beach heather. The deciduous tree component is <25% RD to conifer trees.

Worth noting, the Jack Pine - (Northern Pin Oak, Black Oak) Forest (FJO) map class, which is typically located along the lakeside of the foredune, can have the oak component as short scrub-like trees that are somewhat obscured by the jack pine tree canopy. Therefore, some overlap between FPD and FJO is thought inherent.

For AA purposes, we assessed the FPD and HPB map classes together. At the time of field AA, plant community concepts represented by these map classes were not fully developed; the concepts matured from other park units being sampled in the Great Lakes region. Post AA, those concepts were applied to the vegetation map layer based on physiognomic modifier attributes already built into the map layer.



Mesophytic Pocket Forest (FMP)

The Mesophytic Pocket Forest (FMP) map class represents mesophytic forests within the NVC Lowland or Submontane Cold-deciduous Forest Formation (I.B.2.N.a.). Because this map class represents forests of topographic setting rather than on an ecological scale, it represents forests across a range of alliance and association types, therefore this map class is kept at the Formation level. Note, however, the six map classes to follow represent association types that also nest in this same Formation type, yet they are mapped independently with their own map classes.

The FMP map class captures forests found in mesic pockets or ravines of sand dunes. Typical tree species consist of red oak, white oak, tuliptree, and basswood. A primary clue in the mapping was the presence of tuliptree and/or American basswood. To identify this map class, mappers looked for the white tops of the tulip tree or the leaf from the basswood during photointerpretation mapping.

Because the FMP map class was showing confusion with the North-central Maple - Basswood Forest (FAT) map class—being it was locale-driven rather than community-driven—we merged the two types for AA to attain NPS VIP accuracy standard. They are left, however, as separate map class entities in the vegetation map layer.



North-central Maple - Basswood Forest (FAT)

The North-central Maple - Basswood Forest (FAT) map class represents the NVC *Acer saccharum - Tilia americana* / *Ostrya virginiana - Carpinus caroliniana* Forest Association (CEGL002062). This map class captures forests that are dominant sugar maple and American basswood in a dry to mesic dunal or ravine setting. Other tree component species include white ash, green ash, and red oak.

As noted in the Mesophytic Pocket Forest (FMP) map class description above, the FMP map class was showing confusion with the FAT map class—being FMP was locale-driven rather than community-driven—thus we merged the two types for AA to attain NPS VIP standard accuracy. They are left, however, as separate map class entities in the vegetation map layer.



Beech - Maple Glaciated Forest (FAF and FBA)

The Beech - Maple Glaciated Forest map class represents the NVC *Fagus grandifolia - Acer saccharum* Glaciated Midwest Forest Association (CEGL005013). Two map class phases are used to map the Beech - Maple Glaciated Forest: beech - maple (FAF) phase and aspen (FBA) phase.

We combined these two map class phases (FAF and FBA) for AA because they collectively represent one association type.

Beech - Maple Glaciated Forest (beech - maple phase) – FAF

The beech - maple (FAF) map class phase represents the pristine version of the Beech - Maple Glaciated Forest (as described above). Located in upland mesic moraine settings, although occasionally encroaches ravines, the FAF captures these forests having large-crowned and closed tree canopy consisting mostly of sugar maple with American beech. (Typical mature stands of this map class are in the Pinhook Bog and Heron Rookery units.) Other trees species may include tuliptree and red oak. With mixed forests of sugar maple, American beech, and red oak trees, the FAF map class was used to capture the forest when beech was >40% RD over red oak. When beech was <40% RD to oak, then the Red Oak - Sugar Maple - Elm Forest (FRO) map class was used to map the forest.



Beech - Maple Glaciated Forest (aspen phase) – FBA

The aspen (FBA) map class phase represents the disturbance version of the Beech - Maple Glaciated Forest (as described above) and is juxtaposition to the more pristine version, the beach - maple (FAF) map class phase. The FBA captures these forests with aspen as the dominant tree component, often growing clonally. (Typical example exists in the Heron Rookery unit.)

Representative picture is not available.

Northeastern Modified Successional Forest (FCM and FDM)

The Northeastern Modified Successional Forest map class represents the NVC *Prunus serotina - Liriodendron tulipifera - Acer rubrum - Fraxinus americana -* (*Robinia pseudoacacia*) Forest Association (CEGL006599). Two map class phases are used to map the Northeastern Modified Successional Forest: coniferous phase (FCM) and deciduous (FDM) phase. This map class captures early successional to mature forests having apparent human disturbance. It is common to old home sites, old pastures and fallow fields, and clear-cut logging. Typical tree species include white ash, green ash, black cherry, black locust, red maple, and tuliptree. When oak trees >20% RD to other trees, then the appropriate oak map class captures the forest stand.

We combined these two map class phases (FCM and FDM) for AA because they collectively represent one association type. In addition, because this map class (FCM and FDM phases collectively) was showing confusion with the Mixed Deciduous Wetland Forest (FDW) map class—having a similar tree composition, but in a wetland context—we merged the two types for AA to attain NPS VIP accuracy standard. They are left, however, as separate map class entities in the vegetation map layer.

Northeastern Modified Successional Forest (coniferous phase) – FCM

The coniferous (FCM) map class phase represents the Northeastern Modified Successional Forest (as described above) having >25% conifer trees RD to deciduous trees, yet still deciduous dominant forest. This includes areas of planted conifers at old home sites, or old pine plantations where the deciduous obscure the planted row pattern. The conifers are typically of pine, occasionally of spruce.



Northeastern Modified Successional Forest (deciduous phase) – FDM

The deciduous (FDM) map class phase represents the Northeastern Modified Successional Forest (as described above) having >75% deciduous trees RD to conifer trees. The FDM captures heterogeneous stands (e.g., ash-cherry-maple-locust-tuliptree mix) and monotypic stands (e.g., black locust). The mature stands are often of maple-cherry or cherry-tuliptree mixes and have a more uniform canopy. Other mixed stands are typically patchy and broken up and are reflected in the physiognomic modifier assignments.



Midwestern White Oak - Red Oak Forest (FWR and FOH)

The Midwestern White Oak - Red Oak Forest map class represents the NVC *Quercus alba - Quercus rubra - Carya ovata* Glaciated Forest Association (CEGL002068). Two map class phases are used to map the Midwestern White Oak - Red Oak Forest: white oak - red oak (FWR) phase and hickory (FOH) phase. This map class typically captures mesic forests dominated by red and white oaks and/or shagbark hickory. In addition, any forest stand having white oak >30% RD to other deciduous trees, this map class becomes default. Other tree species such as maples, elm, ash, and cherry are a minor component to the Midwestern White Oak - Red Oak Forest. These forests are often situated on moraine outwash areas.

We combined these two map class phases (FWR and FOH) for AA because they collectively represent one association type. In addition, because this map class (FWR and FOH phases collectively) was showing confusion with the North-central Dry-Mesic Oak Woodland (WBO) map class—a closed bur oak woodland that can have a white oak, red oak, and hickory mixed tree component within—we merged the two types for AA to attain NPS VIP accuracy standard. They are left, however, as separate map class entities in the vegetation map layer.

Midwestern White Oak - Red Oak Forest (white oak - red oak phase) – FWR

The white oak - red oak (FWR) map class phase represents the Midwestern White Oak - Red Oak Forest (as described above) having either red oak or a mix of red and white oaks, as the dominant tree species. Shagbark hickory trees are a less than dominant component, and can even be absent. These forests are typically mature having large-crowned canopies.



Midwestern White Oak - Red Oak Forest (hickory phase) – FOH

The hickory (FOH) map class phase represents the Midwestern White Oak - Red Oak Forest (as described above) having hickory >50% RD to other deciduous trees, in particular red and white oaks. With shagbark hickory being the dominant tree in these stands (bitternut hickory being only a minor part), these forests are typically of small-crowned canopies. The FOH map class phase captures the Midwestern White Oak - Red Oak Forest of having greater human disturbance in contrast to the white oak - red oak (FWR) map class phase.



Red Oak - Sugar Maple - Elm Forest (FRO)

The Red Oak - Sugar Maple - Elm Forest (FRO) map class represents the NVC *Quercus rubra* - (*Acer saccharum*, *Quercus alba*) Forest Association (CEGL005017). This map class typically captures mesic and wet-mesic forests dominated by red oak and sugar maple trees along with a diversity of tree species. Although an upland forest, these forests are generally found in ravines and basin settings. Component tree species are diverse, including red maple, American elm, green ash, black cherry, and white oak (although white oak <30% RD to deciduous trees, otherwise Midwestern White Oak - Red Oak Forest, the white oak - red oak (FWR) map class phase in particular).

For AA, we assessed the FRO map class independently of all other map classes.



Black Oak Forest (FBW, FPF, and FAO)

The Black Oak Forest map class represents the NVC *Quercus velutina* / *Carex pensylvanica* Forest Association (CEGL002078). Three map class phases are used to map the Black Oak Forest: black oak - white oak (FBW) phase, pin oak (FPF) phase, and aspen (FAO) phase. This map class typically captures forests dominated by black oak with some presence of white oak, and is common to dry-mesic sandy locations. The forests are often closed with a shrub layer present, although the shrub density can be low. When open, the understory persists with shrubs, and less so with grass and forb vegetation; otherwise, the Black Oak - Northern Pin Oak / Common Hairgrass Woodland (WBL) map class better captures the stand, even with tree canopy >60%.

It is worth noting here that the WBL map class was added post mapping and AA as a result from decisions made at the project wrap-up meeting. Many areas now mapped as WBL were originally mapped as either a more open canopy version of the FBW map class phase or a more closed canopy version of the Black Oak / Lupine Barrens (HOB) map class. Within FBW, it is inevitable to have overlapping with and inclusions of the vegetation type represented by WBL. Likewise, it is to be expected within WBL to have overlapping with and inclusions of the vegetation type represented by FBW. Making visual distinctions from aerial photographs between these vegetation types can be challenging, given that black oak is the dominant canopy tree and that floristics is as much a determining factor of these types as is canopy cover. Because of this, even though most WBL were for practical reasons determined by percent canopy cover, some credence was given to the floristic component (e.g., in disturbance settings, an open canopy stand with shrub density high remained FBW).

We combined these three map class phases (FBW, FPF, and FAO) for AA because they collectively represent one association type. In addition, because WBL was added posterior to AA random site selection, we merged the Black Oak Forest map class (FBW, FPF, and FAO phases collectively) with WBL and HOB to preserve the NPS VIP accuracy standard. However, the map classes and their phases are kept as separate entities in the vegetation map layer.

Black Oak Forest (black oak - white oak phase) – FBW

The black oak - white oak (FBW) map class phase represents the Black Oak Forest (as described above) having black oak as the dominant tree on non-active well-established dunal and dry settings; a white oak presence increases when in more mesic settings. Pin oak is <40% RD to the black and white oaks.



Black Oak Forest (pin oak phase) – FPF

The pin oak (FPF) map class phase represents the Black Oak Forest (as described above) having pin oak >40% RD over other deciduous trees, particularly black and white oak. The shrub layer tends to be less evident. Often located interior to its counterpart, the black oak - white oak (FBW) map class phase, the FPF phase is situated in small, mesic depressions. For clarification, these pin oak basins are typically smaller and much dryer than those of the Northern (Great Lakes) Flatwoods map class, which is a true pin oak wetland forest type. Lupine Lane provides some good examples of the FPF map class phase.



Black Oak Forest (aspen phase) – FAO

The aspen (FAO) map class phase represents the Black Oak Forest (as described above) having aspen as its primary tree species, often growing in a clonal pattern. Adjacent to areas described by the black oak - white oak (FBW) map class phase, it fundamentally identifies intense disturbance scenarios of the Black Oak Forest.

Representative picture is not available.

Mixed Deciduous Wetland Forest (FDW)

The Mixed Deciduous Wetland Forest (FDW) map class represents human-impacted wetland forests within the NVC Temporarily Flooded Cold-deciduous Forest Formation (I.B.2.N.d.). Because of the disturbance factor, alliance and association level classification were not derived for this map class. It captures wet-lowland mixed deciduous forests having human disturbance, thus leading to a broken and patchy open forest canopy. It likens to the Northeastern Modified Successional Forest map class, where deciduous trees are in response to disturbance, and can be a mixed variety or monotypic in species. Yet it differs in tree species, consisting typically of box elder, willows, red maple, and cottonwood, showing the wetland nature of FDW rather than mesic upland. However, there is certainly an ecotonal transition between these upland and wetland disturbance forests, as our AA analysis showed. Calumet Prairie offers a good example of the FDW map class.

Because the FDW map class was showing confusion with the Northeastern Modified Successional Forest map class (FCM and FDM phases collectively)—being they are both mixed deciduous forests having prominent human disturbance—we merged the two types for AA to attain NPS VIP accuracy standard. They are left, however, as separate map class entities in the vegetation map layer.



Silver Maple - Elm Forest (FSC)

The Silver Maple - Elm Forest (FSC) map class represents the NVC *Acer saccharinum - Ulmus americana* Forest Association (CEGL002586). The FSC map class captures floodplain-style forests dominated by silver maple (at least 25% RD to other deciduous trees) with a minor presence of cottonwood, red maple, green ash, and American elm.

For AA, we assessed the FSC map class independently of all other map classes.

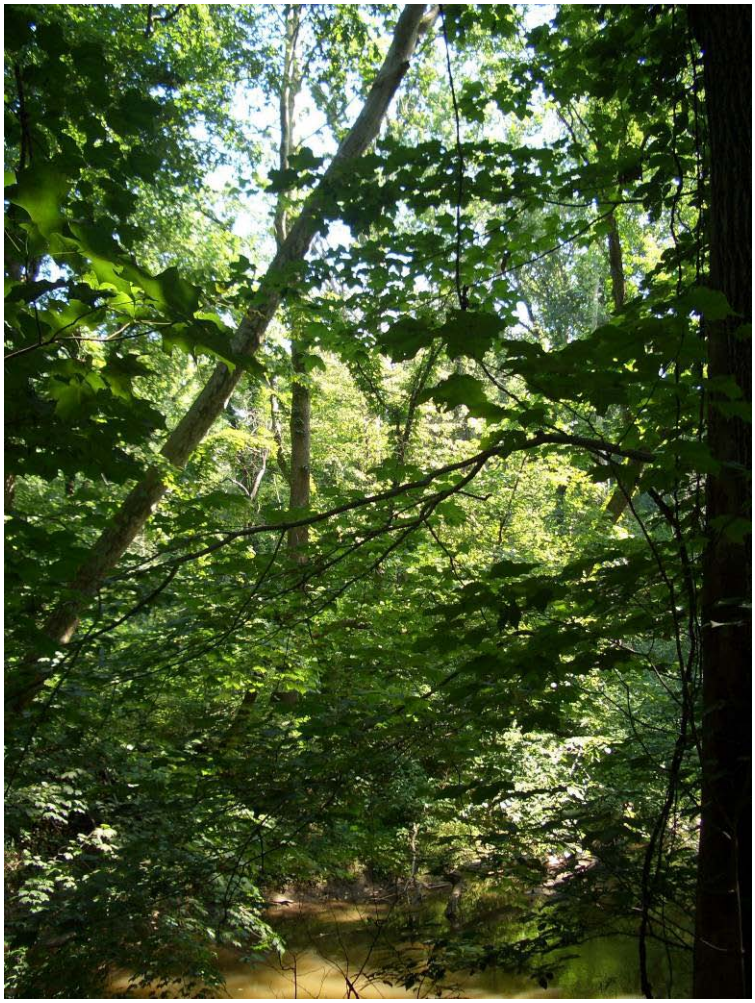


River Birch - (Sycamore) Temporarily Flooded Forest (FWM)

The River Birch - (Sycamore) Temporarily Flooded Forest (FWM) map class represents the NVC *Betula nigra* - (*Platanus occidentalis*) Temporarily Flooded Forest Alliance (A.280). Because of the diversity of tree species this map class captures, association level classification could not be derived with confidence for this map class.

The FWM map class captures a wetland forest in basin and riparian settings. A variety of tree species make up this forest, including green ash, tuliptree, silver maple, red maple, American basswood, American elm, sugar maple, cottonwood, sycamore, black cherry, white oak, and red oak. Not one tree species really dominates. Although many of these tree species also occur in other vegetation types captured by other map classes, when sycamore trees or tuliptree existed in basin or riparian settings, the forest was best captured with the FWM map class. The FWM map class differentiates from the Mixed Deciduous Wetland Forest (FDW) map class, as FDW represents mixed deciduous forests having high human disturbance, where FWM does not have such evidence of disturbance. The FWM map class also differentiates from the Maple - Ash - Elm Swamp Forest (FMS) map class, where cottonwood trees are sparse. Some primary examples of FWM are in the Heron Rookery unit and also along Dune Creek.

For AA, we assessed the FWM map class independently of all other map classes.



Midwestern Cottonwood - Black Willow Forest (FCW)

The Midwestern Cottonwood - Black Willow Forest (FCW) map class represents the NVC *Populus deltoides* - *Salix nigra* Forest Association (CEGL002018). The FCW map class captures a wetland forest having cottonwood and/or black willow; the forest can be mixed or monotypic of one or the other tree species. Silver maple is <25% RD to other deciduous trees, particularly cottonwood and black willow.

Because the FCW map class was showing confusion with the Quaking Aspen Temporarily Flooded Forest (FWA) map class, we merged the two types for AA to attain NPS VIP accuracy standard. They are left, however, as separate map class entities in the vegetation map layer.



Quaking Aspen Temporarily Flooded Forest (FWA)

The Quaking Aspen Temporarily Flooded Forest (FWA) map class represents the NVC *Populus tremuloides* Temporarily Flooded Forest Alliance (A.300). Because of the disturbance factor, association level classification was not derived for this map class. The FWA map class captures a wet ecotonal transition between marsh and upland areas where trembling aspen grows along the wetland margin.

Because the FWA map class was showing confusion with the Midwestern Cottonwood - Black Willow Forest (FCW), we merged the two types for AA to attain NPS VIP accuracy standard. They are left, however, as separate map class entities in the vegetation map layer.



Maple - Ash - Elm Swamp Forest (FMS)

The Maple - Ash - Elm Swamp Forest (FMS) map class represents the NVC *Acer* (*rubrum, saccharinum*) - *Fraxinus* spp. - *Ulmus americana* Forest Association (CEGL005038). The FMS map class captures wetland swamp forests dominated by red maple and green ash, with a minor component of American elm and sparse amount, if any, of cottonwood.

The FMS map class differentiates from the Southern New England Red Maple Seepage Swamp (FRS) map class, where FMS is often positioned in small watercourses, ravines, and basins having greater heterogeneity of tree species than the dominant red maple component of the FRS map class. The FMS map class also differentiates from the River Birch - (Sycamore) Temporarily Flooded Forest (FWM) map class, where cottonwoods are more common with the FWM map class.

Noteworthy, the *Symplocarpus foetidus* Herbaceous Vegetation (CEGL002385, Skunk Cabbage Seepage Meadow) is likely an inclusion to the FMS map class, as well as other seepage-like map classes.

For AA, we assessed the FMS map class independently of all other map classes.



Northern (Great Lakes) Flatwoods (FPS and FSW)

The Northern (Great Lakes) Flatwoods map class represents the NVC *Quercus palustris - Quercus bicolor - Acer rubrum* Flatwoods Forest Association (CEGL005037). Two map class phases are used to map the Northern (Great Lakes) Flatwoods: pin oak (FPS) phase and swamp white oak (FSW) phase. This map class captures wetland forests dominant by pin oak and/or swamp white oak. Although these wetland oak forests are typically swamp-like with wetland understory species, it may also be considerably drier from extensive man-made drainage ditches.

For clarification, the Northern (Great Lakes) Flatwoods are typically larger, wetter, and more extensive than the pin oak (FPF) map class phase of the Black Oak Forest map class.

We combined these two map class phases (FPS and FSW) for AA because they collectively represent one association type.

Northern (Great Lakes) Flatwoods (pin oak phase) – FPS

The pin oak (FPS) map class phase represents the Northern (Great Lakes) Flatwoods (as described above) having pin oak as the dominant tree in large basin swamp forest settings. Other tree components may include swamp white oak and red maple.

Representative picture is not available.

Northern (Great Lakes) Flatwoods (swamp white oak phase) – FSW

The swamp white oak (FSW) map class phase represents the Northern (Great Lakes) Flatwoods (as described above) having swamp white oak as the dominant tree in large basin swamp forest settings. Other tree components may include pin oak, red maple, and green ash.



Southern New England Red Maple Seepage Swamp (FRS)

The Southern New England Red Maple Seepage Swamp (FRS) map class represents the NVC *Acer rubrum - Fraxinus* (*pennsylvanica, americana*) / *Lindera benzoin* / *Symplocarpus foetidus* Forest Association (CEGL006406). It is in the same alliance type as the Central Tamarack - Red Maple Rich Swamp (FTM and FCR collectively) map class. The FRS map class captures wetland swamp forests dominated with red maple within broad basin-oriented and seepage swamp settings. Often, cattail grows amongst the red maple. A prime example of FRS is at Cowell's Bog.

The FRS map class differentiates from the Maple - Ash - Elm Swamp Forest (FMS) map class, where FMS is often positioned in small watercourses, ravines, and basins having greater heterogeneity of tree species than the dominant red maple component of the FRS map class.

Noteworthy, the *Symplocarpus foetidus* Herbaceous Vegetation (CEGL002385, Skunk Cabbage Seepage Meadow) is likely an inclusion of the FRS map class, as well as other seepage-like map classes or map classes with inclusions of seeps. Also, small pockets of paper birch may be included with the FRS map class.

For AA, we assessed the FRS map class independently of all other map classes.



Central Tamarack - Red Maple Rich Swamp (FTM and FCR)

The Central Tamarack - Red Maple Rich Swamp map class represents the NVC *Larix laricina - Acer rubrum* / (*Rhamnus alnifolia, Vaccinium corymbosum*) Forest Association (CEGL005232). Two map class phases are used to map the Central Tamarack - Red Maple Rich Swamp: tamarack-red maple (FTM) phase and northern white-cedar (FCR) phase.

We combined these two map class phases (FTM and FCR) for AA because they collectively represent one association type.

Central Tamarack - Red Maple Rich Swamp (tamarack - red maple phase) – FTM

The tamarack-red maple (FTM) map class phase represents the Central Tamarack - Red Maple Rich Swamp (as described above) having tamarack and red maple as the dominant trees within fen basin settings. The red maple is typically of shrub height, although the dominant shrub layer is blueberry. Scattered mature white pines are common. The most obvious example of this map class phase is the Pinhook Bog.



Central Tamarack - Red Maple Rich Swamp (northern white-cedar phase) – FCR

The northern white-cedar (FCR) map class phase represents the Central Tamarack - Red Maple Rich Swamp (as described above) having white-cedar as the dominant tree over tamarack. An isolated area exists in Cowles Bog, which is along side the more typical Central Tamarack - Red Maple Rich Swamp version, tamarack-red maple (FTM).

Representative picture is not available.

Jack Pine - (Northern Pin Oak, Black Oak) Forest (FJO)

The Jack Pine - (Northern Pin Oak, Black Oak) Forest (FJO) map class represents the NVC *Pinus banksiana - Quercus* (*ellipsoidalis, velutina*) Forest Alliance (A.391). An association level classification was not derived for this map class. The FJO map class captures mixed conifer and deciduous forests made up of jack pine and black oak and are typically located along the lakeside of the foredune adjacent to a corridor of American beachgrass before the sandy shoreline. Noteworthy, on the aerial photographs, the Jack Pine - (Northern Pin Oak, Black Oak) Forest was often obscured by the shadow of the foredune. The conifer and deciduous tree components are each >25% RD to each other. The oak component, however, can be short and scrub-like within the jack pine canopy, adding yet another obscurity. Being juxtaposition to dunal sites, some overlap with the Great Lakes Dune Pine Forest (FPD) map class is assumed.

For AA, we assessed the FJO map class independently of all other map classes.



White Pine - White Oak Sand Forest (FPO)

The White Pine - White Oak Sand Forest (FPO) map class represents the NVC *Pinus strobus* - *Quercus alba* / (*Corylus americana*, *Gaylussacia baccata*) Forest Association (CEGL002481). The FPO map class captures mixed conifer and deciduous forests made up of black oak, white oak, and white pine, often found on the tops and hillsides of established dunes. The conifer and deciduous tree components are often an even mix to each other; each component is >25% RD to each other.

For AA, we assessed the FPO map class independently of all other map classes.



Conifer Plantation (FPP)

The Conifer Plantation (FPP) map class represents the NVC Planted/cultivated Temparate or Subpolar Needle-leaved Evergreen Forest Formation (I.A.8.C.a.). The FPP map class captures conifer tree plantations, typically of red pine. Some of the older pine plantations may have a component of deciduous trees mixed in.

Because of cultural influences, no AA was performed on the FPP map class.



Deciduous Orchard (FOD)

The Deciduous Orchard (FOD) map class represents the NVC Planted/Cultivated Cold-deciduous Forest Formation (I.B.2.C.b.). The FOD map class captures orchards of deciduous fruit-bearing trees.

Because of cultural influences, no AA was performed on the FOD map class.

Representative picture is not available.

Black Oak - Northern Pin Oak / Common Hairgrass Woodland (WBL)

The Black Oak - Northern Pin Oak / Common Hairgrass Woodland (WBL) map class represents the NVC *Quercus velutina* - (*Quercus ellipsoidalis*) - *Quercus alba* / *Deschampsia flexuosa* Woodland Association (CEGL005029). It typically captures black oak dominant stands having 25–60% canopy cover with herbaceous vegetation the primary understory vegetation and with shrub density low, and is common to dry-mesic sandy locations. The WBL map class was added post mapping and AA as a result from decisions made at the project wrap-up meeting. Most areas mapped as WBL were originally mapped as either a more closed canopy version of the Black Oak / Lupine Barrens (HOB) map class or a more open canopy version of the black oak - white oak (FBW) phase of the Black Oak Forest map class.

Within WBL, it is inevitable to have overlapping with and inclusions of vegetation types represented by HOB and FBW. Likewise, it is to be expected within HOB and FBW to have overlapping with and inclusions of the vegetation type represented by WBL. Making visual distinctions from aerial photographs between these vegetation types can be challenging, given that black oak is the dominant canopy tree and that floristics is as much a determining factor of these types as is canopy cover. Because of this, even though most WBL were for practical reasons determined by percent canopy cover, some credence was given to the floristic component (e.g., in disturbance settings, an open canopy stand with shrub density high remained FBW).

We merged WBL with the Black Oak Forest (FBW, FPF, FAO) and the HOB map classes for AA because 1) WBL was originally mapped as either HOB or FBW and 2) WBL was added posterior to AA random site selection. However, all map classes and their phases are kept as separate entities in the vegetation map layer.



North-central Dry-Mesic Oak Woodland (WBO)

The North-central Dry-Mesic Oak Woodland (WBO) map class represents the NVC *Quercus alba - Quercus macrocarpa - Quercus rubra* / *Corylus americana* Woodland Association (CEGL002142). The WBO map class captures bur oak woodlands in the Hobart Prairie Grove unit. The bur oak woodlands are typically mature, having large crowns and a somewhat closed canopy. Bur oak is the dominant tree, with other tree components of red oak, white oak, and hickory and similar overstory trees characterizing the Midwestern White Oak - Red Oak Forest map class.

Because the WBO map class was showing confusion with the Midwestern White Oak - Red Oak Forest map class (FWR and FOH phases collectively)—a forest of white oak, red oak, and hickory tree; something similar to an overstory expression of WBO—we merged the two types for AA to attain NPS VIP accuracy standard. They are left, however, as separate map class entities in the vegetation map layer.



Cottonwood Dune (WCF and WDC)

The Cottonwood Dune map class represents the NVC *Populus deltoides* - (*Juniperus virginiana*) Dune Woodland Association (CEGL005119). Two map class phases are used to map the Cottonwood Dune: natural foredune (WCF) phase and disturbance (WDC) phase. The map class captures sandscape woodlands dominated by cottonwood trees. Total tree cover are typically >25%, often short scrub-like in stature, with an understory of typical dune vegetation (e.g., beachgrass, sand cherry). When understory vegetation (herbaceous and shrub layers) become <25% total cover, Cottonwood Dune is mapped to 10% total tree cover. However, when the cottonwood tree layer was 10–25% total cover and understory dune vegetation became >25% total cover, the classification was to revert to the understory type, namely the types represented by the Great Lakes Beachgrass Dune and/or Midwest Sand Barrens (HAB) map class.

However, we missed the mark on this mapping convention, and the AA subsequently showed the confusion. We incorrectly used the Cottonwood Dune map class to capture the woodlands down to 10% total cover even though the herbaceous understory vegetation was >25% total cover.

Because the Cottonwood Dune map class (WCF and WDC phases collectively) was misapplied, the confusion with HAB was obvious in the initial AA results. Thus, we merged the two map classes for AA to attain NPS VIP accuracy standard. They are left, however, as separate map class entities in the vegetation map layer.

We do believe, however, the majority of the errors between the Cottonwood Dune map class (WCF and WDC phases collectively) and HAB are found in Cottonwood Dunes mapped with the 10–25% density cover physiognomic modifier. Those having >25% dunal understory vegetation should be assigned the HAB map class, and those <25% should remain the Cottonwood Dune map class.

Those mapped with the 25–60% density cover should not be affected by this misapplication of the mapping convention, except for those where the interpretation of cottonwood cover was overestimated and dune vegetation was >25% total cover. Therefore, we expect the accuracy of the Cottonwood Dune map class greater for those mapped with 25–60% density cover and even greater for those mapped with 60–100% density cover.

This misapplied mapping convention was discovered post final AA analysis and into the project's wrap-up process. To attribute the polygons correctly would require reinterpreting the individual polygons in question, making the necessary reassignments, and then rerunning the AA. Unfortunately, we were not able to do this and keep the project on schedule. We give our sincere apologies for the confusion.

Cottonwood Dune (natural foredune phase) – WCF

The natural foredune (WCF) map class phase represents the Cottonwood Dune (as described above) occurring on active dunes, most typically on foredunes. These woodlands are naturally derived from sand dune formations.



Cottonwood Dune (disturbance phase) – WDC

The disturbance (WDC) map class phase represents the Cottonwood Dune (as described above) occurring on sandy locations, typically inland from the active dunes, where the landscape has received past human disturbance, such as an old sand mine.



Mixed Deciduous Shrubland (SMX)

The Mixed Deciduous Shrubland (SMX) map class represents human-impacted shrublands within the NVC Temperate Cold-deciduous Shrubland Formation (III.B.2.N.a.). Because of the disturbance, alliance and association level classification were not derived for this map class. Noteworthy, other map classes representing floristic levels within the Temperate Cold-deciduous Shrubland Formation also exist. The SMX map class captures a variety of native and non-native shrubs and short trees growing in fields left fallow or near steel mills. The shrub layer is often open canopy and patchy, but can also be closed and in high density. Common short trees and shrubs consist of trembling aspen, cottonwood, and hawthorn.

For AA, we assessed the SMX map class independently of all other map classes.



Hardhack Wet-Mesic Sand Shrub Meadow (SSP)

The Hardhack Wet-Mesic Sand Shrub Meadow (SSP) map class represents the NVC *Spiraea tomentosa* - *Salix humilus* / *Andropogon gerardii* - *Panicum virgatum* Shrubland Association (CEGL005069). It is in the same alliance type as the Hazelnut Sand Barrens (SHB) map class. The SSP map class captures shrublands consisting mainly of spirea located in mesic to wet-mesic locations. A prime example of SSP is near Beverly Shores.

In the West unit, the SSP map class was mapped to a 0.1 ha MMU. No AA was performed on the SSP map class; areas of SSP were located on private lands and were not accessible.



Hazelnut Sand Barrens (SHB)

The Hazelnut Sand Barrens (SHB) map class represents the NVC *Corylus americana - Salix humilus* / *Schizachyrium scoparium* Shrubland Association (CEGL005072). It is in the same alliance type as the Hardhack Wet-Mesic Sand Shrub Meadow (SSP) map class. The SHB map class captures shrublands located on prairies in a natural setting. Shrubs typically consist of willow, spirea, and hazelnut with a scattering of short aspen and oak trees. The herbaceous understory is of prairie grasses.

For AA, we assessed the SHB map class independently of all other map classes.



Speckled Alder Swamp (SAS)

The Speckled Alder Swamp (SAS) map class represents the NVC *Alnus incana* Swamp Shrubland Association (CEGL002381). The SAS map class captures one alder-dominant wetland on the north side of Beverly Drive. Mostly a monotypic and dense stand of alder, however, some willow shrubs and short trembling aspen trees are scattered throughout.

In the West unit, the SAS map class was mapped to a 0.1 ha MMU. For AA, we assessed the SAS map class independently of all other map classes.



Dogwood - Willow Swamps (SMS)

The Dogwood - Willow Swamp (SMS) map class represents the NVC *Cornus sericea* - *Salix* spp. - (*Rosa palustris*) Shrubland Association (CEGL002186). The SMS map class captures shrub wetlands consisting of dogwood and willow species, either a mix of both species or more monotypic of one, and usually in dense stands. Buttonbush may also be present, even up to 75% RD to other shrubs. The herbaceous layer is of various wetland emergents including cattail and sedges.

In the West unit, the SMS map class was mapped to a 0.1 ha MMU. For AA, we assessed the SMS map class independently of all other map classes.



Northern Buttonbush Swamp (SBS)

The Northern Buttonbush Swamp (SBS) map class represents the NVC *Cephalanthus occidentalis* / *Carex* spp. Northern Shrubland Association (CEGL002190). The SBS map class captures shrub wetlands strongly dominated by buttonbush; buttonbush is >75% RD over other shrubs, including dogwood and willow species. When buttonbush was <75% RD to other shrubs, the Dogwood - Willow Swamp (SMS) map class was used to map the shrubland.

In the West unit, the SBS map class was mapped to a 0.1 ha MMU. For AA, we assessed the SBS map class independently of all other map classes.



Midwest Dry-Mesic Sand Prairie (HLB)

The Midwest Dry-Mesic Sand Prairie (HLB) map class represents the NVC *Schizachyrium scoparium - Sorghastrum nutans - Andropogon gerardii - Lespedeza capitata* Sand Herbaceous Vegetation Association (CEGL002210). The HLB map class captures prairie grasslands dominated by little bluestem; cover density is typically high. These prairies are distanced from the lakeshore dunes where soil development is more organic and mesic. A prime example of HLB is at the Gaylord Butterfly Preserve.

For AA, we assessed the HLB map class independently of all other map classes.



Mixed Herbaceous Fallow Field (HMX)

The Mixed Herbaceous Fallow Field (HMX) map class represents human-impacted herbaceous lands within the NVC Medium-tall Sod Temperate or Subpolar Grassland Formation (V.A.5.N.c.). Because of the disturbance factor, alliance and association level classification were not derived for this map class. Noteworthy, the Great Lakes Beachgrass Dune and/or Midwest Sand Barrens (HAB) map class is also in the Medium-tall Sod Temperate or Subpolar Grassland Formation, yet has floristic (alliance and association) classification assignments. The HMX map class captures a variety of mostly non-native herbaceous vegetation growing in fields and old home sites left fallow. Scattered trees and shrubs are often present, but <25% total cover. The map class also captures early grassland restoration sites. These upland fields usually show obvious signs of man-induced disturbance. They are typically dominated by goldenrod, sweet clover, and other exotic and invasive vegetation; grasses are a minor component to the herbaceous mix. A primary example is at Menoke Prairie.

Like most herbaceous map classes, the HMX map class is used on lands having >25% total herbaceous cover. However, an exception was made for HMX to map down to 10% cover of areas in development flux in vicinity of heavy industrial-commercial-residential areas.

For AA, we assessed the HMX map class independently of all other map classes.



Great Lakes Beachgrass Dune and/or Midwest Sand Barrens (HAB)

The Great Lakes Beachgrass Dune and/or Midwest Sand Barrens (HAB) map class represents two NVC types: *Ammophila breviligulata* - (*Schizachyrium scoparium*) Herbaceous Vegetation Association (CEGL005098) and/or *Schizachyrium scoparium* - *Carex tonsa* var. *rugosperm*a - *Carex muehlenbergii* - *Lithospermum caroliniense* - *Opuntia humifusa* Herbaceous Vegetation Association (CEGL005099). The HAB map class captures mostly the former listed association, primarily because it is more common at the Lakeshore. The two associations are mapped together because they are not discernable on the aerial photographs. Furthermore, the exposed sand of the dunes saturates, or overexposes the CIR imagery, and diffuses (or bleaches out) even moderate density covers of herbaceous vegetation, as well as short-shrubs such as sand cherry. Therefore, our mapping was aggressive in order to capture those types recognized by the HAB map class. Even the faintest of vegetative appearance on the aerial photos proved to be a significant amount (30–50% cover) of beachgrass and bluestem.

The HAB map class is common to active sand dunes and other sandscape settings. True to the association types, other shrubs such as beach heather juniper and sand cherry may persist, however, <25% total cover. Yet, also captured with the HAB map class is the *Prunus pumila* - (*Ptelea trifoliata*) Dune Shrubland (CEGL005075, Sand Cherry Dune Shrubland), where the short-shrub type is >25% total cover, albeit herbaceous dune vegetation can be abundant. The Sand Cherry Dune Shrubland Association is not captured with its own map class for two reasons, 1) it cannot be discerned on the aerial photographs because of the diffused exposure from the sand dune and 2) accounts of this type are <MMU, thus left as an inclusion to the HAB map class.

Because we misapplied a mapping convention for the Cottonwood Dune map class (WCF and WDC phases collectively), for AA we merged the two map classes to attain NPS VIP accuracy standard—please refer to the Cottonwood Dune map class description for further explanation. They are left, however, as separate map class entities in the vegetation map layer.



***Ammophila breviligulata* - (*Schizachyrium scoparium*) Herbaceous Vegetation Association**



***Schizachyrium scoparium - Carex tonsa* var. *rugosperma - Carex muehlenbergii - *
Lithospermum caroliniense - Opuntia humifusa Herbaceous Vegetation Association**



Inclusion example of *Prunus pumila* - (*Ptelea trifoliata*) Dune Shrubland

Central Cordgrass Wet Prairie (HCP)

The Central Cordgrass Wet Prairie (HCP) map class represents the NVC *Spartina pectinata* - *Carex* spp. - *Calamagrostis canadensis* Lakeplain Herbaceous Vegetation Association (CEGL005109). The HCP map class captures herbaceous wet lowlands dominated with Canada bluejoint with some component of cordgrass. These lowlands receive flooding in the spring and remain saturated for much of the growing season. Small trees and shrubs can be scattered throughout, but <25% total cover each.

In the West unit, the HCP map class was mapped to a 0.1 ha MMU. Because the HCP map class was showing confusion with the Tussuck Sedge Wet Meadow (HSM) map class, we merged the two types for AA to attain NPS VIP accuracy standard. They are left, however, as separate map class entities in the vegetation map layer.



Mixed Herbaceous Wet Meadow (HWM)

The Mixed Herbaceous Wet Meadow (HWM) map class represents human-impacted herbaceous wetlands within the NVC Seasonally Flooded Temperate or Subpolar Grassland Formation (V.A.5.N.k.). Because of the disturbance factor, alliance and association level classification were not derived for this map class. Noteworthy, several other map classes are also in the Seasonally Flooded Temperate or Subpolar Grassland Formation, yet have floristic (alliance and association) classification assignments to them. The HWM map class captures a variety of native and non-native herbaceous vegetation growing in wet meadows. Scattered trees and shrubs can be present, but <25% total cover. They are typically dominated by goldenrod, cattail, common reed, sedges, bluejoint, reed canary grass, and a myriad of other forbs and grasses. A primary example is at Calumet Prairie.

In the West unit, the HWM map class was mapped to a 0.1 ha MMU. For AA, we assessed the HWM map class independently of all other map classes.



Interdunal Wetland (HDW)

The Interdunal Wetland (HDW) map class represents the NVC *Dasiphora fruticosa* ssp. *floribunda* / *Cladium mariscoides* - *Juncus balticus* - (*Rhynchospora capillacea*) Herbaceous Vegetation Association (CEGL005105). The HDW map class captures small pannes within active dune locations. These small wetland pockets are comprised of emergents such as rushes and cinquefoil, and often have shallow water present.

In the West unit, the HDW map class was mapped to a 0.1 ha MMU. For AA, we assessed the HDW map class independently of all other map classes.



Tussuck Sedge Wet Meadow (HSM)

The Tussuck Sedge Wet Meadow (HSM) map class represents the NVC *Carex stricta* - *Carex* spp. Herbaceous Vegetation Association (CEGL002258). The HSM map class captures sedge-dominant meadows of small basin wetlands or along margins of large wetland complexes.

In the West unit, the HSM map class was mapped to a 0.1 ha MMU. As noted with the Central Cordgrass Wet Prairie (HCP) map class, because the HSM map class was showing confusion with the HCP map class, we merged the two types for AA to attain NPS VIP accuracy standard. They are left, however, as separate map class entities in the vegetation map layer.



Reed Canary Grass Eastern Marsh (HPH)

The Reed Canary Grass Eastern Marsh (HPH) map class represents the NVC *Phalaris arundinacea* Eastern Herbaceous Vegetation Association (CEGL006044). The HPH map class captures herbaceous wetlands often in transition, and is dominated by dense stands of reed canary grass.

In the West unit, the HPH map class was mapped to a 0.1 ha MMU. For AA, we assessed the HPH map class independently of all other map classes.



Bulrush - Cattail - Burreed Shallow Marsh (HBC)

The Bulrush - Cattail - Burreed Shallow Marsh (HBC) map class represents the NVC *Schoenoplectus tabernaemontani* - *Typha* spp. - (*Sparganium* spp., *Juncus* spp.) Herbaceous Vegetation Association (CEGL002026). The HBC map class captures shallow marsh wetlands with a mix of emergents consisting of bulrush, cattail, and burreed. Cattail is <80% RD to emergents, otherwise the Midwest Cattail Deep Marsh (HCM) map class is used. Many times, these marshes are dominated by bulrush, and common reed can be present.

In the West unit, the HBC map class was mapped to a 0.1 ha MMU. For AA, we assessed the HBC map class independently of all other map classes.



Eastern Reed Marsh (HPM)

The Eastern Reed Marsh (HPM) map class represents the NVC *Phragmites australis* Eastern North America Temperate Semi-natural Herbaceous Vegetation Association (CEGL004141). The HPM map class captures deep marsh wetlands dominant with eastern reed, often growing in monotypic stands. Eastern reed is >80% RD to other emergents, unless merely mixed with cattail, where eastern reed is >50% RD to cattail.

In the West unit, the HPM map class was mapped to a 0.1 ha MMU. For AA, we assessed the HPM map class independently of all other map classes.





Midwest Cattail Deep Marsh (HCM)

The Midwest Cattail Deep Marsh (HCM) map class represents the NVC *Typha* spp. Midwest Herbaceous Vegetation Association (CEGL002233). The HCM map class captures deep marsh wetlands dominant with cattail, often growing in monotypic stands. Cattail is >80% RD to other emergents, unless merely mixed with eastern reed, where cattail is >50% RD to eastern reed.

In the West unit, the HCM map class was mapped to a 0.1 ha MMU. For AA, we assessed the HCM map class independently of all other map classes.



Black Oak / Lupine Barrens (HOB)

The Black Oak / Lupine Barrens (HOB) map class represents the NVC *Quercus velutina* - (*Quercus alba*) - *Quercus ellipsoidalis* / *Schizachyrium scoparium* - *Lupinus perennis* Wooded Herbaceous Vegetation Association (CEGL002492). The HOB map class captures dry wooded herbaceous lands having a sparse layer of trees dominated by black oak over prairie herbaceous species (e.g., lupine); a scrub oak layer is often present, with shrub species of low density. Occurring on dry sandy locations, it is common to hilltops and south-faced slopes. As a wooded herbaceous type, the tree canopy is open and sparse, typically of 10–25%. When more closed, HOB resembles the Black Oak - Northern Pin Oak / Common Hairgrass Woodland (WBL) map class.

It is worth noting here that the WBL map class was added post mapping and AA as a result from decisions made at the project wrap-up meeting. Many areas now mapped as WBL were originally mapped as either a more closed canopy version of the HOB map class or a more open canopy version of the black oak - white oak (FBW) phase of the Black Oak Forest map class. Within HOB, it is inevitable to have overlapping with and inclusions of the vegetation type represented by WBL. Likewise, it is to be expected within WBL to have overlapping with and inclusions of the vegetation type represented by HOB. Making visual distinctions from aerial photographs between these vegetation types can be challenging, given that black oak is the dominant canopy tree and that floristics is as much a determining factor of these types as is canopy cover. For practical reasons, however, much of the WBL mapping was determined by percent canopy cover.

Because WBL was added posterior to AA random site selection, we merged HOB with the Black Oak Forest (FBW, FPF, and FAO phases collectively) and WBL map classes for AA to preserve the NPS VIP accuracy standard. However, the map classes and their phases are kept as separate entities in the vegetation map layer.



Great Lakes Pine Barrens (HPB)

The Great Lakes Pine Barrens (HPB) map class represents the NVC *Pinus banksiana* - (*Pinus resinosa*) - *Pinus strobus* / *Juniperus horizontalis* Wooded Herbaceous Vegetation Association (CEGL005125). The HPB map class captures a mix of red pine, white pine, and/or jack pine stands on active sand dunes having 10–60% tree canopy cover; those stands having >60% cover are captured by the Great Lakes Dune Pine Forest (FPD) map class. Small swales subsist within the dunes where they are often close enough to the water table to support more mesophytic and sometimes even semi-aquatic plants. The understory vegetation of dune sites is of typical sandscape species, such as American beach grass, sand cherry, and beach heather. Of mesophytic swale sites within dunes, understory vegetation is mesophytic and aquatic species, such as Baltic rush, horned bladderwort, Kalm's St-John's wort, and rose pogonia.

Two other subtypes possibly exist, a barren type having 10–25% tree canopy cover and a woodland type having 25–60% tree canopy cover. These subtypes are not directly separated in the geodatabase layer. However, one can select on the HPB map class and determine these subtypes based on the density cover physiognomic modifier.

For AA purposes, we assessed the FPD and HPB map classes together. At the time of field AA, plant community concepts represented by these map classes were not fully developed; the concepts matured from other park units being sampled in the Great Lakes region. Post AA, those concepts were applied to the vegetation map layer based on physiognomic modifier attributes already built into the map layer. However, the map classes are kept as separate entities in the vegetation map layer.



Midwest Pondweed Submerged Aquatic Wetland (HSV)

The Midwest Pondweed Submerged Aquatic Wetland (HSV) map class represents the NVC *Potamogeton* spp. - *Ceratophyllum* spp. Midwest Herbaceous Vegetation Association (CEGL002282). The HSV map class captures submersed vegetation having >10% cover and RD of each floating aquatic and emergent vegetation <10% to the submergent vegetation. Because of the time of year the aerial photos were collected (October), most submergent vegetation had senesced, thus appearance on the aerial photos was minimal. An aggressive effort to map the HSV map class was based on likely location. When waters were recognized as too deep for submergent plants, the Open Water Lake and Pond (NLP) map class was used.

In the West unit, the HSV map class was mapped to a 0.1 ha MMU. Because the HSV and Water-lily Aquatic Wetland (HWL) map classes showed confusion—due to the difficulty of viewing submersed and rooted-floating aquatic vegetation on the senesced-date of aerial photos—the HSV and HWL map classes were merged for AA to attain NPS VIP accuracy standard. They are left, however, as separate map class entities in the vegetation map layer.



Water-lily Aquatic Wetland (HWL)

The Water-lily Aquatic Wetland (HWL) map class represents the NVC *Nuphar lutea* ssp. *advena* - *Nymphaea odorata* Herbaceous Vegetation Association (CEGL002386). The HWL map class captures rooted-floating aquatics in deep water marshes with white water lily and yellow pond-lily >10% total cover and RD of emergent vegetation <10%; submergent vegetation may be of high density. Because of the time of year the aerial photos were collected (October), much of the water lily had senesced, thus appearance on the aerial photos were minimal.

Arrowhead and pickerelweed may be included, but appear senesced along with the white water lily and yellow pond-lily.

In the West unit, the HWL map class was mapped to a 0.1 ha MMU. Because the HWL and Midwest Pondweed Submerged Aquatic Wetland (HSV) map classes showed confusion—due to the difficulty of viewing submersed and floating aquatic vegetation on the senesced-date of aerial photos—the HWL and HSV map classes were merged for AA to attain NPS VIP accuracy standard. They are left, however, as separate map class entities in the vegetation map layer.



Perennial Grass Crops (HGC)

The Perennial Grass Crops (HGC) map class represents the NVC Perennial grass crops (hayland, pastureland) Formation (V.A.5.C.a.). Because this type is of persistent cultural influence, alliance and association level classification are not derived for this map class. The HGC map class captures perennial grasses and forbs used for pasturing and an occasional cutting for hay. The vegetation is of perennial growth form, and the vegetation is not a result of an agricultural planting (e.g., alfalfa). Many of these areas were once forested and have been cleared for cultural use.

Because of cultural influences, no AA was performed on the HGC map class.

Representative picture is not available.

Crop Field (HCF)

The Crop Field (HCF) map class represents two NVC types, Annual Close-grown Forbs and Grasses Formation (V.D.2.C.a.) and/or Annual Row-crop Forbs and Grasses Formation (V.D.2.C.b.). The HCF map class captures lands cultivated for row crops (e.g., corn, soybeans) of monotypic annual or biennial herbaceous vegetation (e.g., alfalfa, clover).

Because of cultural influences, no AA was performed on the HCF map class.



Herbaceous Dunes Sparsely Vegetated (VDS)

The Herbaceous Dunes Sparsely Vegetated (VDS) map class represents the NVC Herbaceous Dunes Sparsely Vegetated Alliance (A.1855). Association level classification was not derived for this map class. The VDS map class captures sand blowout areas with very sparse vegetation consisting of small black or northern pin oak trees. Trees are typically <10% cover.

For AA, we assessed the VDS map class independently of all other map classes.



Lakeshore Sand and Cobble Beach (NLB)

The Lakeshore Sand and Cobble Beach (NLB) map class captures sand and cobble beaches lacking enough vegetation for an NVC type (essentially <10% total vegetation cover). The NLB map class is typically found between the lake shoreline and the transition to the American beachgrass and little bluestem types as described by the Great Lakes Beachgrass Dune and/or Midwest Sand Barrens (HAB) map class.

Being a non-vegetation map class, no AA was performed on the NLB map class.



Barren Sand Dune (NSD)

The Barren Sand Dune (NSD) map class captures exposed sand dunes—interior to the beach lakeshore—having <10% vegetation cover and no tree/shrub cover. (If tree/shrub cover within sand blowouts, then the Herbaceous Dunes Sparsely Vegetated (VDS) map class was employed.) One of the best examples of NSD is Mount Baldy.

Being a non-vegetation map class, no AA was performed on the NSD map class.



Open Water Stream and River (NSR)

The Open Water Stream and River (NSR) map class captures open water streams and rivers, such as the little Calumet River. Sparse aquatic submergent vegetation may be present, but <10% vegetated and usually in shallower waters closer to shorelines.

Being a non-vegetation map class, no AA was performed on the NSR map class.



Open Water Lake and Pond (NLP)

The Open Water Lake and Pond (NLP) map class captures open water lakes and ponds. Sparse aquatic submergent vegetation may be present, but <10% vegetated and usually in shallower waters closer to shorelines or in transition into beds of aquatic macrophytes.

In the West unit, the NLP map class was mapped to a 0.1 ha MMU. Being a non-vegetation map class, no AA was performed on the NLP map class.



Industrial (LID)

The Industrial (LID) map class captures large industrial settings such as power plants, steel mills, and other large manufacturers. This class may include transitional areas to other land use map classes, such as the Residential and Commercial (LRC) map class.



Residential and Commercial (LRC)

The Residential and Commercial (LRC) map class captures lands used primarily for residential and commercial purposes in populated areas or rural settings, with the exception of farmsteads. The park headquarters is included in the LRC map class.

Representative picture is not available.

Quarry (LQR)

The Quarry (LQR) map class captures sand quarries or strip mines.

Representative picture is not available.

Artificial Pond (LAP)

The Artificial Pond (LAP) map class captures artificial ponds, borrow pits, and other impoundments of water. These open water-body ponds have <10% vegetation cover.

Representative picture is not available.

Road and Railroad (LRR)

The Road and Railroad (LRR) map class captures roads and railroads and their established rights-of-ways, as well as, parking and rest areas along road sides; rights-of-ways may include herbaceous and shrubs types. When the rights-of-ways are forested, the appropriate Forest map class was used when >1 ha in size.



Farmstead (LFS)

The Farmstead (LFS) map class captures farmhouses, barns, outbuildings, and farm ponds within the farmstead area.

Representative picture is not available.

Barren Land (LBL)

The Barren Land (LBL) map class captures landscapes at commercial, residential or industrial sites having <10% vegetation cover.

Representative picture is not available.

National Park Service
Vegetation Inventory Program
Indiana Dunes National Lakeshore, Indiana

September 2009

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

National Park Service
Vegetation Inventory Program
Indiana Dunes National Lakeshore, Indiana

September 2009

Appendix G

Accuracy Assessment Contingency Table

Explanation of the Contingency Matrix

The accuracy assessment contingency matrix for Indiana Dunes 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 to Map Classes of Indiana Dunes National Lakeshore. The crosswalk reveals the various vegetation types assigned to the map class codes we used to label vegetation types in this contingency table.)

The columns represent National Vegetation Classification (NVC) System vegetation types (at Association, Alliance, and Formation levels). These tabulate the producer's accuracy 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 crosswalk for map class names and link to vegetation types.) These tabulate the users' accuracy showing errors of inclusion (commission errors) present in the map.

The following pages are formatted to a tabloid-size page (11" x 17") in landscape position.

		FIELD SAMPLES - REFERENCE DATA																															COMISSION			
	MAP CODES	FAT, FMP	FAF, FBA	FCM, FDM, FDW	FOH, FWR, WBO	FRO	FAO, FBW, FPF, WBL, HOB	FSC	FWM	FCW, FWA	FMS	FPS, FSW	FRS	FCR, FTM	FPO	FPD, HPB	HAB, WCF, WDC	FJO	SMX	SHB	SAS	SMS	SBS	HLB	HMX	HCP, HSM	HWM	HDW	HPH	HBC	HPM	HCM	HSV, HWL	VDS	TOTAL	USERS' ACCUR-ACY	90% Confidence Intervals	
																																					-	+
MAP DATA - PREDICTION DATA	FAT, FMP	8																	1																9	89%	66%	112%
	FAF, FBA		12			1																													13	92%	76%	108%
	FCM, FDM, FDW	1		38	1		2				6																							48	79%	68%	90%
	FOH, FWR, WBO			1	24		1				2															1								29	83%	69%	96%
	FRO					2																													2	100%	75%	125%
	FAO, FBW, FPF, WBL, HOB	1		1	1		44			1		1																							49	90%	82%	98%
	FSC			2				1		1																									4	25%	-23%	73%
	FWM								1		1																									2	50%	-33%	133%
	FCW, FWA			2						21	1	1											1	1	2	1									30	70%	55%	85%
	FMS			2							18	1																					1		22	82%	66%	98%
	FPS, FSW					1	1	2				17																							21	81%	64%	97%
	FRS			1						1			2																						4	50%	-4%	104%
	FCR, FTM													2																					2	100%	75%	125%
	FPO	1													4																				5	80%	41%	119%
	FPD, HPB	1														2																			3	67%	5%	128%
	HAB, WCF, WDC	1		1													30							2											34	88%	78%	99%
	FJO						1											1																	2	50%	-33%	133%
	SMX			1			1												12							1									15	80%	60%	100%
	SHB																			3				1	1										5	60%	14%	106%
	SAS																				1														1	100%	50%	150%
	SMS			1														1				10	1			1	2				2		1		19	53%	31%	74%
	SBS			1															1				15							1	1		1		20	75%	57%	93%
	HLB																							6											6	100%	92%	108%
	HMX																1								20	1									22	91%	79%	103%
	HCP, HSM									1												1		4	1	22	3			1					33	67%	52%	82%
	HWM																					1					7				1				9	78%	49%	106%
	HDW																											3						3	100%	83%	117%
	HPH																												2						2	100%	75%	125%
	HBC																													2					2	100%	75%	125%
	HPM																														8		1		9	89%	66%	112%
	HCM																					2	1			1	1			1	2	12	1		21	57%	37%	77%
	HSV, HWL																						1			1				1	2		13		18	72%	52%	92%
	VDS																																	4	4	100%	88%	113%
OMISSION	Total	13	12	51	26	4	50	3	1	25	28	20	2	2	4	2	31	2	14	3	1	14	19	14	24	28	14	3	2	6	16	13	17	4	468			
	PRODUCERS' ACCURACY	62%	100%	75%	92%	50%	88%	33%	100%	84%	64%	85%	100%	100%	100%	100%	97%	50%	86%	100%	100%	71%	79%	43%	83%	79%	50%	100%	100%	33%	50%	92%	76%	100%	367			
	90% Confidence Interval -	35%	96%	63%	82%	-4%	79%	-28%	50%	70%	48%	69%	75%	75%	88%	75%	90%	-33%	67%	83%	50%	48%	61%	18%	69%	64%	24%	83%	75%	-7%	26%	76%	57%	88%	Total Samples = 469			
	90% Confidence Interval +	88%	104%	86%	103%	104%	97%	95%	150%	98%	81%	101%	125%	125%	113%	125%	104%	133%	105%	117%	150%	95%	97%	68%	98%	93%	76%	117%	125%	73%	74%	108%	96%	113%	Total Correct = 367			

OVERALL ACCURACY = 78.2% KAPPA INDEX = 76.9% KAPPA INDEX LOWER 90% CONFIDENCE LEVEL = 73.6% KAPPA INDEX UPPER 90% CONFIDENCE LEVEL = 80.2%

*SSP was not assessed for accuracy and thus, is not shown in this matrix.