



Rapid Ecological Assessment for the Pike Wild River (Marinette County)

A Rapid Ecological Assessment Focusing on Rare Plants, Selected Rare Animals, and High-quality Natural Communities

Wisconsin's Natural Heritage Inventory Program
Bureau of Endangered Resources
Department of Natural Resources
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Primary Authors: Christina Isenring and Rich Staffen

Contributors:

- Julie Bleser – data management
- Brian Collins – breeding bird surveys
- Drew Feldkirchner – report contributions
- Bob Hay – herptile surveys
- Dawn Hinebaugh – report editing, data processing
- Terrell Hyde- zoology data processing
- Christina Isenring – data processing, inventory coordination
- John Krause – forest raptor surveys
- Cynthia Malone – report editing
- Ryan O’Connor – data processing
- Stacy Rowe – ecology data processing
- David Schmoller – ecology and rare plants inventory
- Kurt Schmude – aquatic invertebrates
- Elizabeth Slivinski – maps
- William A. Smith – zoology
- Amy Staffen – data processing
- Rich Staffen – zoology data processing, zoology inventory coordination
- Todd Thayer – herptile surveys
- Roland Wang – report contributions

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The Pike Wild River At a Glance

Exceptional Characteristics of the Study Area

- **Rare Animals and Plants.** The diverse habitats of the Pike Wild River (PWR) support numerous rare species. Twenty-one rare animal species are known from the PWR, including four State Threatened and 17 Special Concern species. Two rare plant species are also known from the PWR.
- **Landscape-scale Management.** The PWR in combination with surrounding lands presents an important opportunity to manage for barrens and Northern Dry Forests at a landscape level. Two large barrens areas, Athelstane and Dunbar Barrens, are adjacent to the PWR property and offer opportunities to manage for this rare ecosystem on a landscape scale.
- **Breeding Bird Diversity.** There is a rich and diverse birdlife throughout the PWR with diverse habitats and structure present. Lowland forests make up a large percentage of the PWR, providing habitat for rare and declining forest interior birds, and supporting the greatest species richness and diversity on the property. Pine forests in the uplands add unique assemblages of birds not commonly encountered in other areas of the PWR.
- **Rare Herptiles.** The PWR provides nesting habitat for two State-Threatened turtles and additional opportunities to manage the property at a landscape scale benefitting numerous herptiles associated with globally rare barrens, dry forest, and glade habitats.

Site Specific Opportunities for Biodiversity Conservation

Three ecologically important sites were identified on the PWR. These “Primary Sites” were delineated because they generally encompass the best examples of 1) rare and representative natural communities, 2) documented occurrences of rare species populations, and/or 3) opportunities for ecological restoration or connections. These sites warrant high protection and/or restoration consideration during the development of the property master plan.

- **Pike Wild River Corridor.** The site is delineated based upon the boundaries of high-quality natural communities contained within the Wild Rivers segment of the property. The corridor is managed to protect the natural resources associated with the Pike River and preserve the river in a free-flowing natural state by preventing development adjacent to the river and restoring sections of the river to an undeveloped condition. The site also provides significant opportunities to protect and enhance old-growth forests and their associated species.
- **Little South Branch Pike River.** The primary site falls within the Amberg Conservation Opportunity Area and enlarges the adjacent Pike Wild River Corridor Primary Site by connecting it to the highest-quality block of Northern Mesic Forest found on the property. The uplands provide opportunities to manage and connect three globally rare natural communities (Bedrock Glade, Pine Barrens, and Northern Dry Forest).
- **Pike Wild River Conifer Hardwoods.** The site includes an older pine forest providing critical habitat to a regionally significant assemblage of breeding birds. There is a good-quality example of an Ephemeral Pond adding to the biodiversity of the site. Unique glacial formations are also present.

Introduction

Purpose and Objectives

This report is intended to be used as a source of information for developing a new master plan for the Pike Wild River (PWR; Figure 1). The regional ecological context for the PWR is also provided to assist in developing the Regional and Property Analysis that is part of the master plan.

The primary objectives of this project were to collect biological inventory information relevant to the development of a master plan for the PWR and to analyze, synthesize and interpret this information for use by the master planning team. This effort focused on assessing areas of documented or potential habitat for rare species and identifying natural community management opportunities.

Survey efforts for the PWR were limited to a “rapid ecological assessment” for 1) identifying and evaluating ecologically important areas, 2) documenting rare species occurrences, and 3) documenting occurrences of high quality natural communities. This report can serve as the “Biotic Inventory” document used for master planning, although inventory efforts were reduced compared to similar projects conducted on much larger properties such as state forests. There will undoubtedly be gaps in our knowledge of the biota of this property, especially for certain taxa groups; these groups have been identified as representing either opportunities or needs for future work.

Overview of Methods

The Wisconsin Natural Heritage Inventory (NHI) program is part of the Wisconsin Department of Natural Resources (DNR) Bureau of Endangered Resources and a member of an international network of natural heritage programs representing all 50 states, as well as portions of Canada, Latin America, and the Caribbean. These programs share certain standardized methods for collecting, processing, and managing data for rare species and natural communities. NatureServe, an international non-profit organization (see www.NatureServe.org for more information), coordinates the network.

Natural heritage programs track certain elements of biological diversity: rare plants, rare animals, high-quality examples of natural communities, and other selected natural features. The NHI Working List contains the elements tracked in Wisconsin. They include endangered, threatened, and special concern plants and animals, as well as the natural community types recognized by NHI. The NHI Working List is periodically updated to reflect new information about the rarity and distribution of the state’s plants, animals, and natural communities. The most recent Working List is available from the Wisconsin DNR website (*Wisconsin Natural Heritage Working List*).

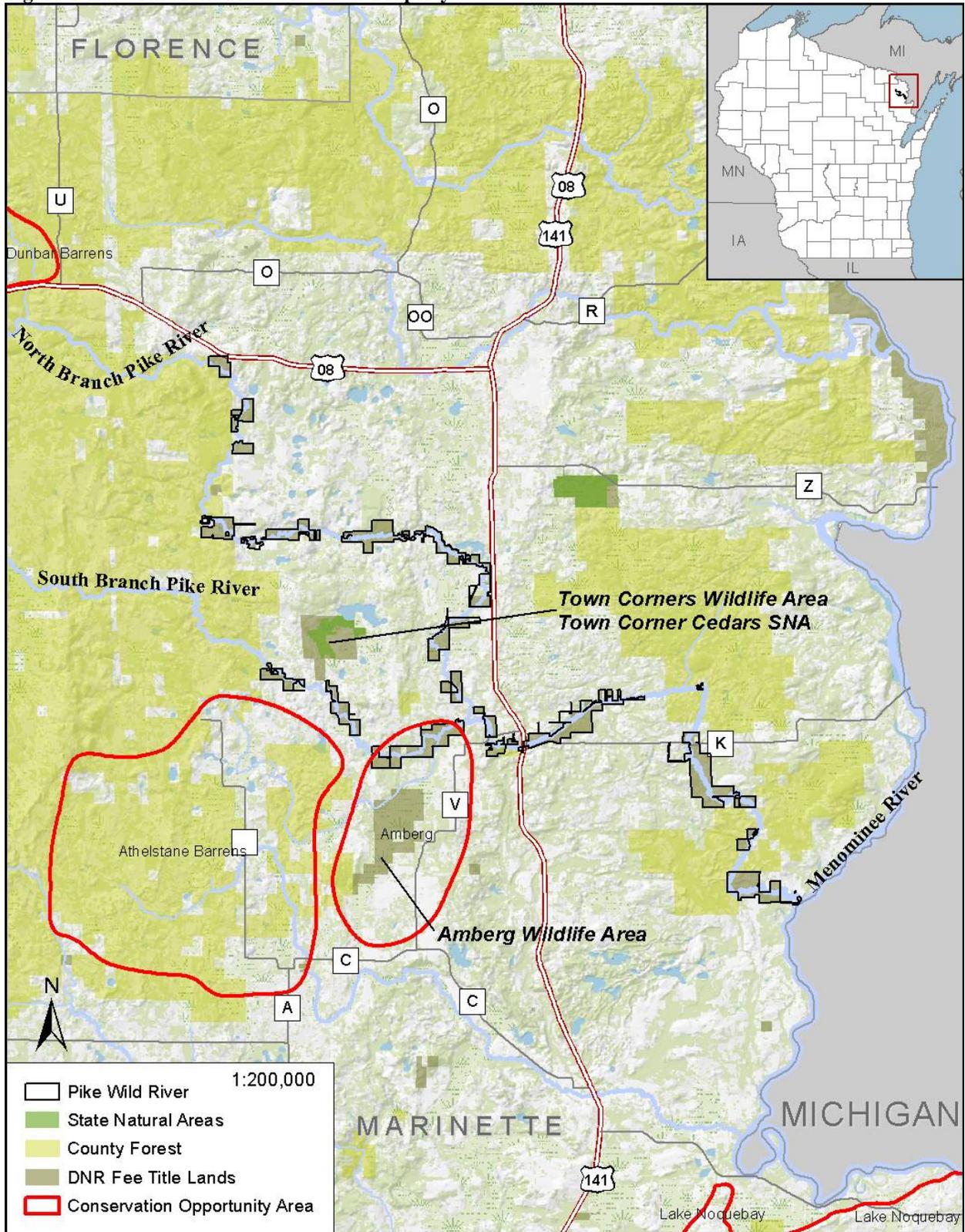
The Wisconsin NHI program uses standard methods for biotic inventory to support master planning (Appendix A). Our general approach involves collecting relevant background information, planning and conducting surveys, compiling and analyzing data, mapping rare species and high quality natural community locations into the NHI database, identifying ecologically important areas, and providing interpretation of the findings through reports and other means.

Existing NHI data are often the starting point for conducting a biotic inventory to support master planning. Prior to this project, NHI data for the PWR were limited to the Statewide Natural Area Inventory, a county-by-county effort conducted by WDNR’s Bureaus of Research and Endangered Resources between 1969 and 1984 that focused on natural communities, but include some surveys for rare plants and animals. The most recent taxa-specific field surveys for the study area were conducted during 2011. Surveys were limited in scope and focused on documenting high-quality natural communities, rare

plants, breeding birds, herptiles, and forest raptors. The collective results from all of these surveys were used, along with other information, to identify ecologically important areas or “Primary Sites” on the PWR.

Survey locations were identified or guided by using recent aerial photos, USGS 7.5’ topographic maps, various Geographic Information System (GIS) sources, information from past survey efforts, discussions with property managers, and the expertise of several biologists familiar with the properties or with similar habitats in the region. Based on the location and ecological setting of properties within the PWR, key inventory considerations included the identification of high-quality barrens, forests, and wetland communities and the location of habitats that had the potential to support rare species. Private lands and public lands surrounding the PWR were not surveyed. Scientific names for all species mentioned in the text are included in a list on page 39.

Figure 1. Location of the Pike Wild River Property



Background on Past Efforts

Various large-scale research and planning efforts have identified a number of locations within the PWR as being ecologically significant. The following are examples of such projects and the significant features identified.

Land Legacy Report

The Land Legacy Report (WDNR 2006a) was designed to identify Wisconsin's most important conservation and recreation needs for the next 50 years. The Pike Wild River was recognized as having high conservation significance. The site was assigned a score of four points on their five-point scale, meaning it possesses "excellent ecological qualities, is of adequate size to meet the needs of most of the critical components, and/or harbors natural communities or species of continental significance" (WDNR 2006a).

Wisconsin Wildlife Action Plan: Conservation Opportunity Areas

The Wisconsin Wildlife Action Plan (WAP; WDNR 2006b) recognized one Conservation Opportunity Area (COA) within the PWR (see Appendix B). Conservation Opportunity Areas are places in Wisconsin that contain ecological features, natural communities, or Species of Greatest Conservation Need (SGCN) habitat for which Wisconsin has a unique responsibility for protection when viewed from the global, continental, upper Midwest, or state perspective.

- The Amberg COA (Fig. 1), in the southwest part of the property along the South Branch Pike River, was recognized because of the pine-oak barrens present and the large forested wetland blocks with opportunities for focused management to perpetuate old Northern Wet-mesic Forest with some areas featuring Northern Dry-mesic Forest and Bedrock Glades. Public lands making up the Amberg COA include the PWR, Amberg State Wildlife Area, and a small portion of Marinette County Forest.

Special Management Designations

Wild River

The Wisconsin **Wild Rivers** program was established by the 1965 Legislature with the enactment of s. 30.26, Wis. Stats. in order to afford the people of the state an opportunity to enjoy natural streams, to attract out-of-state visitors and assure the well-being of the tourist industry, and to preserve some rivers in a free-flowing condition and protect them from development. Currently, four rivers, or portions of those rivers, are designated as Wild Rivers, including the Pike River. Within DNR-owned lands of a designated Wild River, state statute specifies: no vegetative control within 150 feet from the bank on either side of the river, walk-in access only, no motorized vehicles, no stream alterations, no maintained trails, and few developed parking lots or canoe put-ins. These rules are intended to preserve the wild and scenic qualities of the river.

Outstanding Resource Water

The Pike River is a designated Outstanding Resource Water (ORW), receiving the state's highest protection standards. Of Wisconsin's 53,413 streams and rivers, only 254, or less than 1%, are designated as ORW. Outstanding Resource Waters typically do not have any point sources discharging pollutants directly to the water (for instance, no industrial sources or municipal sewage treatment plants), though they may receive runoff from nonpoint sources. New discharges may be permitted only if their effluent quality is equal to or better than the background water quality of that waterway at all times—no increases of pollutant levels are allowed.

Forest Certification

All DNR-managed lands, including state parks, wildlife areas, and natural areas, are recognized by the Forest Stewardship Council and the Sustainable Forestry Initiative as being responsibly managed (WDNR 2009). This certification emphasizes the state's commitment to responsibly managing and conserving forestlands, supporting economic activities, protecting wildlife habitat, and providing recreational opportunities.

Public Lands

The PWR is within an extensive area of public lands. Surrounding public lands include the Marinette and Forest County Forests, Chequamegon-Nicolet National Forest, and State Wildlife and Natural Areas (Figure 1). Marinette County has a Memorandum of Understanding with the State of Wisconsin to abide by Wild River management practices. Additionally, a substantial acreage comprising the headwater of both branches of the Pike Wild River are privately owned forests but are enrolled in the Managed Forest Law (MFL) program. Managed Forest Law lands are open to some public use and are bound to abide to sustainable, best management forestry practices as established through Forest Certification. This provides for many opportunities to accomplish landscape management for the species and habitats that are shared among these areas.

Regional Ecological Context

Northeast Sands Ecological Landscape

This section is largely reproduced from the Ecological Landscapes of Wisconsin Handbook (WDNR In Prep.). The WDNR has mapped the state into areas of similar ecological potential and geography called Ecological Landscapes. The Ecological Landscapes are based on aggregations of smaller eco-regional units (Subsections) from a national system of delineated eco-regions known as the National Hierarchical Framework of Ecological Units (NHFEU) (Cleland et al. 1997). These eco-regional classification systems delineate landscapes of similar ecological pattern and potential for use by resource administrators, planners, and managers.

The study area is located in the Northeast Sands Ecological Landscape (WDNR In Prep.) (Figure 2). The **Northeast Sands Ecological Landscape** occupies a relatively narrow band of land running approximately north-south in northeast Wisconsin. This Ecological Landscape formed in glacial outwash sand plains (some of them pitted), and has steep outcropping Precambrian bedrock knolls of basalt, rhyolite, and granite. Sandy ground moraines and end moraines are also interspersed in the Ecological Landscape.

Historically, extensive oak/jack pine (*Pinus banksiana*) barrens and jack pine forests were found in the outwash sand portions of this Ecological Landscape. Moraines supported forests of hardwoods, red pine (*Pinus resinosa*), and eastern white pine (*Pinus strobus*). Outwash plains often contained pitted depressions, resulting in numerous wetlands and kettle lakes. Most of this Ecological Landscape is still forested; aspen (*Populus sp.*) predominates, followed by northern hardwoods. Jack pine remains on the outwash plains along with northern pin oak (*Quercus ellipsoidalis*). There are several important occurrences of jack pine/oak barren communities. A small percentage of this Ecological Landscape contains spruce-fir-cedar forest and lowland hardwood forest. The Brazeau Swamp is one of the best representations of large northern white-cedar (*Thuja occidentalis*) swamp forests in northern Wisconsin. The Northeast Sands contains several important river systems as well as extensive wetlands.

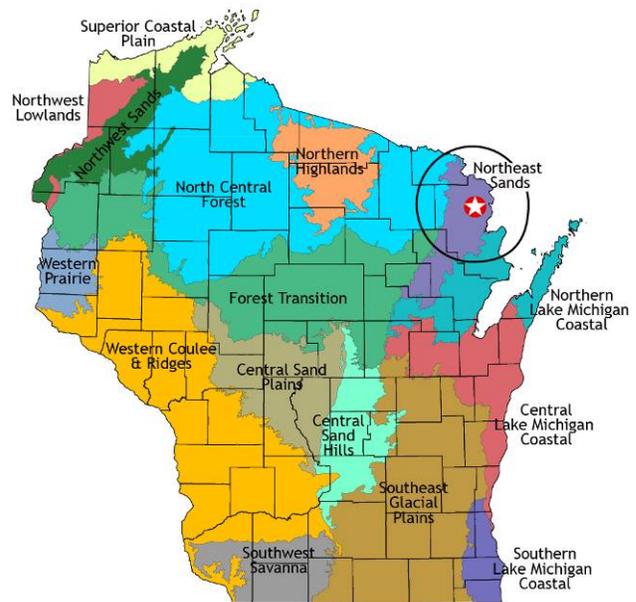


Figure 2. Ecological Landscapes of Wisconsin and the Pike Wild River

Regional Biodiversity Needs and Opportunities

Opportunities for sustaining natural communities in the Northeast Sands Ecological Landscape were developed in 2005 by the Ecosystem Management Planning Team (EMPT; not published until 2007) and later presented as wildlife Species of Greatest Conservation Need and their habitat in the Wisconsin Wildlife Action Plan (WDNR 2006a). The goal of sustaining natural communities is to manage for natural community types that 1) historically occurred in a given landscape and 2) have a high potential to maintain their characteristic composition, structure, and ecological function over a long period of time (e.g., 100 years). This list can help guide land and water management activities so that they are compatible with the local ecology of the Ecological Landscape while maintaining important components of ecological diversity and function. Based on the EMPT's criteria, these are the most appropriate community types that could be considered for management activities within the Northeast Sands Ecological Landscape.

There are management opportunities for 21 natural communities in the Northeast Sands Ecological Landscape. Of these, eight are considered “major” opportunities (Table 1) and an additional 13 natural communities are considered “important” in this landscape.

Table 1. Major Natural Communities Management Opportunities in the Northeast Sands Ecological Landscape (EMPT 2007 and WDNR 2006b)

Bracken Grassland	Coolwater Streams	Northern Dry-mesic Forest	Pine Barrens
Coldwater Streams	Northern Dry Forest	Northern Wet-mesic Forest	Warmwater Rivers

Rare Species of the Northeast Sands Ecological Landscape

Numerous rare species are known from the Northeast Sands Ecological Landscape. “Rare” species include all of those species on the WDNR’s NHI Working List (*Wisconsin Natural Heritage Working List*) that are classified as “Endangered,” “Threatened,” or “Special Concern.” Table 2 lists the number of species known to occur in the Northeast Sands Ecological Landscape based on information stored in the NHI database as of 2011.

Table 2. Listing Status for Rare Species in the Northeast Sands Ecological Landscape as of October 2011 (WDNR 2011).

Listing Status	Taxa					Total Fauna	Total Plants	Total Listed
	Mammals	Birds	Herptiles	Fishes	Invertebrates			
Federally Endangered	1	0	0	0	1	2	0	2
Federally Threatened	0	0	0	0	0	0	0	0
Federal Candidate	0	0	0	0	1	1	0	1
State Endangered	0	1	0	0	4	5	3	8
State Threatened	0	1	2	2	4	9	7	16
State Special Concern	1	7	1	1	22	32	20	52

The Wisconsin Wildlife Action Plan denoted Species of Greatest Conservation Need (SGCN). Species of Greatest Conservation Need are animals that have low and/or declining populations that are in need of conservation action. They include various birds, fish, mammals, reptiles, amphibians, and invertebrates (e.g. dragonflies, butterflies, and freshwater mussels) that are:

- Already listed as threatened or endangered;
- At risk because of threats to their life history needs or their habitats;

- Stable in number in Wisconsin, but declining in adjacent states or nationally.
- Of unknown status in Wisconsin and suspected to be vulnerable.

SGCN status is independent of State Listing Status and the NHI Working List. Nearly all SGCN's are on the NHI Working List (published June 2011); but the NHI Working List also includes rare species that are not designated as SGCN. There are 22 vertebrate SGCN significantly associated with the Northeast Sands Ecological Landscape (See Appendix D). This means that these species are (and/or historically were) significantly associated with the Ecological Landscape, and that restoration of natural communities with which they are associated would significantly improve conditions for their survival.



Least Flycatcher, a Species of Greatest Conservation Need (Photo by Brian M. Collins)

Description of the Study Area

Location and Size

Comprising approximately 4,686 acres, the PWR is located in Marinette County along the North and South Branches and the main stem of the Pike River, a tributary to the Menominee River (Figure 1). Located within the Northeast Sands Ecological Landscape, the PWR crosses United States Highway 141 where the North and South Branches meet in the town of Amberg. There are no other population bases near the remainder of the property. The PWR occurs within an extensive area of forested wetlands, upland coniferous and hardwood forests, and open barrens of grasses, shrubs, and scattered trees (see Figure 5).

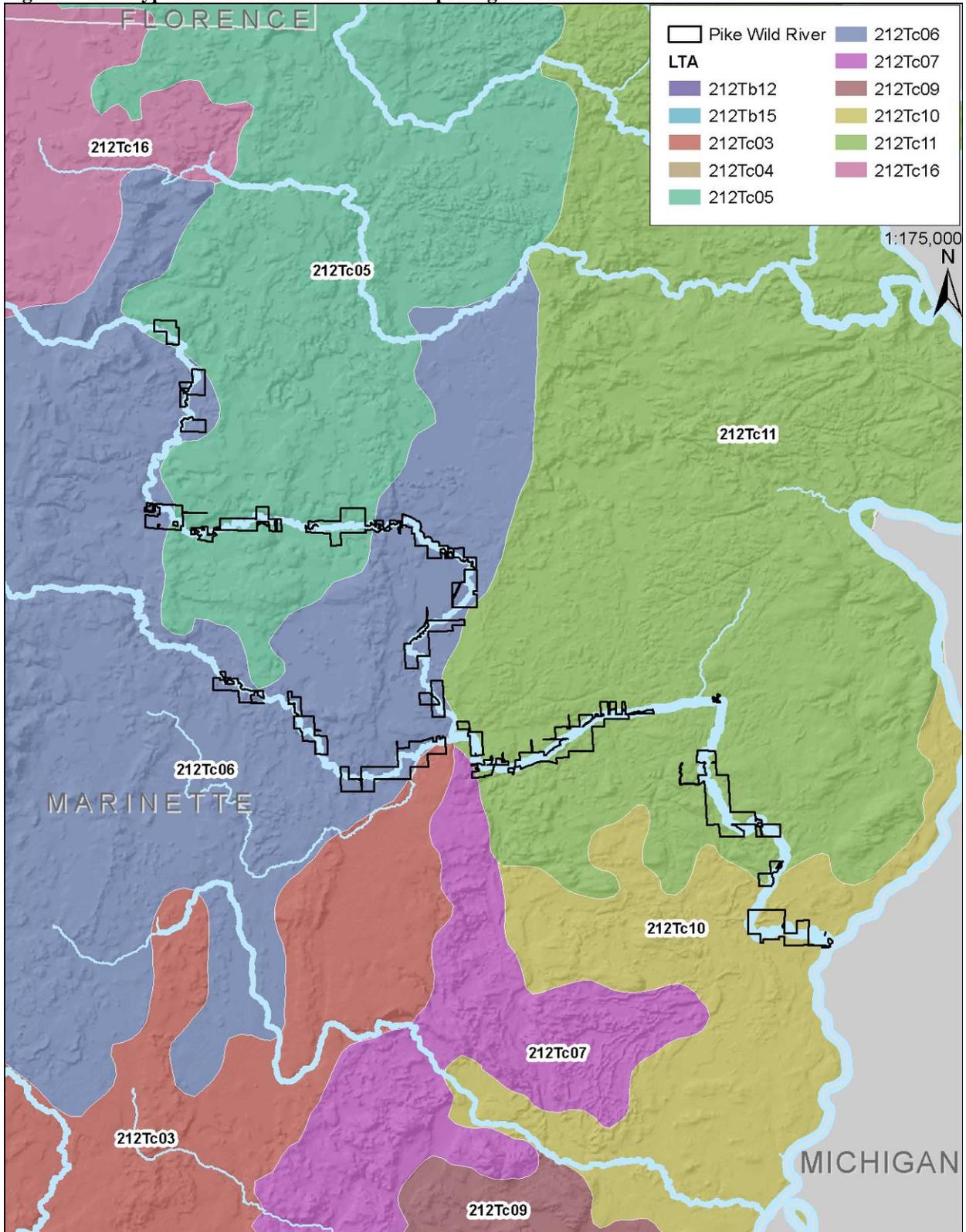
Ecoregion

Nested hierarchically within each Ecological Landscape are Subsections derived from the NHFEU and each Subsection is further divided into Landtype Associations (LTAs) (Cleland et al. 1997). The subsection that includes the PWR is the Athelstane Sandy Outwash and Moraines. Six Landtype Associations (LTA; Figure 3) are present within the PWR. Landtype Associations represent an area of 10,000 – 300,000 acres and contain similarities of landform, soil, and vegetation.

The following Landtype Associations are within the study area:

- **Athelstane Moraines (212Tc06).** The characteristic landform pattern is rolling collapsed moraines and outwash plains with bedrock knolls and ridges. Soils are predominantly excessively-drained, sand, over outwash, acid loamy sand till, or igneous/metamorphic bedrock. This LTA comprises 43% of the PWR.
- **Amberg Moraines (212Tc11).** The characteristic landforms are rolling moraines and outwash plains with bedrock knolls and ridges. Soils are predominantly well-drained, fine, sandy loam over calcareous sandy loam till, igneous/metamorphic bedrock, or calcareous outwash. This LTA comprises 31% of the PWR.
- **Aurora Moraines (212Tc05).** The characteristic landform pattern is rolling collapsed moraines and outwash plains with bedrock knolls and ridges. Soils are predominantly well-drained, fine, sandy loam over outwash, acid sandy loam till, or igneous/metamorphic bedrock. This LTA comprises 16% of the PWR.
- **Wausaukee Outwash Plains (212Tc10).** The characteristic landform pattern is nearly level outwash plain with isolated morainic knolls. Soils are predominantly somewhat excessively-drained, loamy sand over calcareous or acid outwash. This LTA comprises 8% of the PWR.
- **Butler Plains (212Tc03).** The characteristic landform pattern is nearly level outwash plain. Soils are predominantly excessively-drained, sand over outwash. This LTA comprises 2% of the PWR.
- **Mount Tom Moraines (212Tc07).** The characteristic landform pattern is rolling collapsed moraine. Soils are predominantly somewhat excessively-drained, loamy sand over calcareous outwash and well-drained, sandy loam over calcareous sandy loam till. This LTA comprises <1% of the PWR.

Figure 3. Landtype Associations for the area comprising the Pike Wild River



Physical Environment

Geology and Geography

The PWR lies within the southern portion of the Canadian Precambrian Shield which consists of granite and undifferentiated igneous and metamorphic rocks. Also present are sandstones with some dolomite and shale. Being on the edge of the Canadian Precambrian Shield, there is a distinct fall line for streams in this area resulting in rapids and falls along the Pike River (Carlson et al. 1975). The Pike River flows through a landscape that was greatly manipulated by the Green Bay lobe of the Laurentian ice sheet during the Wisconsin glaciation. Where the Green Bay lobe remained stable for an extended period of time, end moraines developed and can be seen within the area as north-south trending hills and hummocky topography (Dott and Attig 2004). Outwash plains extend out from these moraines. Along the river are areas of exposed granite that has been smoothed by glacial action.

Soils

The soils of the study area are characterized by the silt loams of the river bottoms and the Ishpeming soil and bedrock outcrops of the slopes and ridges of the river corridor (Lorenz 1991). Other soil types are generally excessively-drained sand and bedrock types. Arnheim silt loam is a deep, nearly level, poorly drained soil found in depressions and low areas on floodplains. These areas are typically dissected by old river channels and occur in an elongated shape. The Ishpeming soil and associated igneous bedrock outcrops are gently sloping to moderately steep and excessively-drained. The Ishpeming soil occurs on the side slopes of ridges, moraines, and bedrock outcrops. The sandy loams that are also present are generally found on the sides of sloping to moderately steep ridges and moraines.

Hydrology

The Pike River, including both the North and South Branches, is a medium-sized river with both coldwater and coolwater stretches within a mostly forested watershed, and is a tributary to the Menominee River. The Pike River has hard, slightly alkaline, clear water and is a self-sustaining brook (*Salvelinus fontinalis*) and brown trout (*Salmo trutta*) fishery while also supporting northern pike (*Esox lucius*), walleye (*Sander vitreus*), and smallmouth bass (*Micropterus dolomieu*) (Carlson et al. 1975). Both brook and brown trout naturally reproduce in this Class 1 trout stream with no stocking of either species having taken place in the river since 1972. Fisheries managers have identified two activities necessary to preserve the trout fisheries in the PWR coldwater tributaries including beaver management (dam and colony removal) and Spring Pond renovation (Long pers. comm.).

As a result of its location on the edge of the Canadian Precambrian Shield, nine falls and rapids are present that make this river very popular for whitewater sports. Named tributaries to the Pike River within the PWR are: Cole, Whiskey, Smeesters, and Beecher Creeks and the Little South Branch Pike River. Although no named lakes are present on the PWR, many of the tributary streams begin in spring ponds and lakes.

Vegetation

Historical Vegetation

Data from the original Public Land Surveys are often used to infer forest composition and tree species dominance for large areas in Wisconsin prior to widespread Euro-American settlement. The purpose of examining historical conditions is to identify ecosystem factors that formerly sustained species and communities that are now altered in number, size, or extent, or which have been changed functionally (for example, by constructing dams, or suppressing fires). Although data are limited to a specific snapshot in

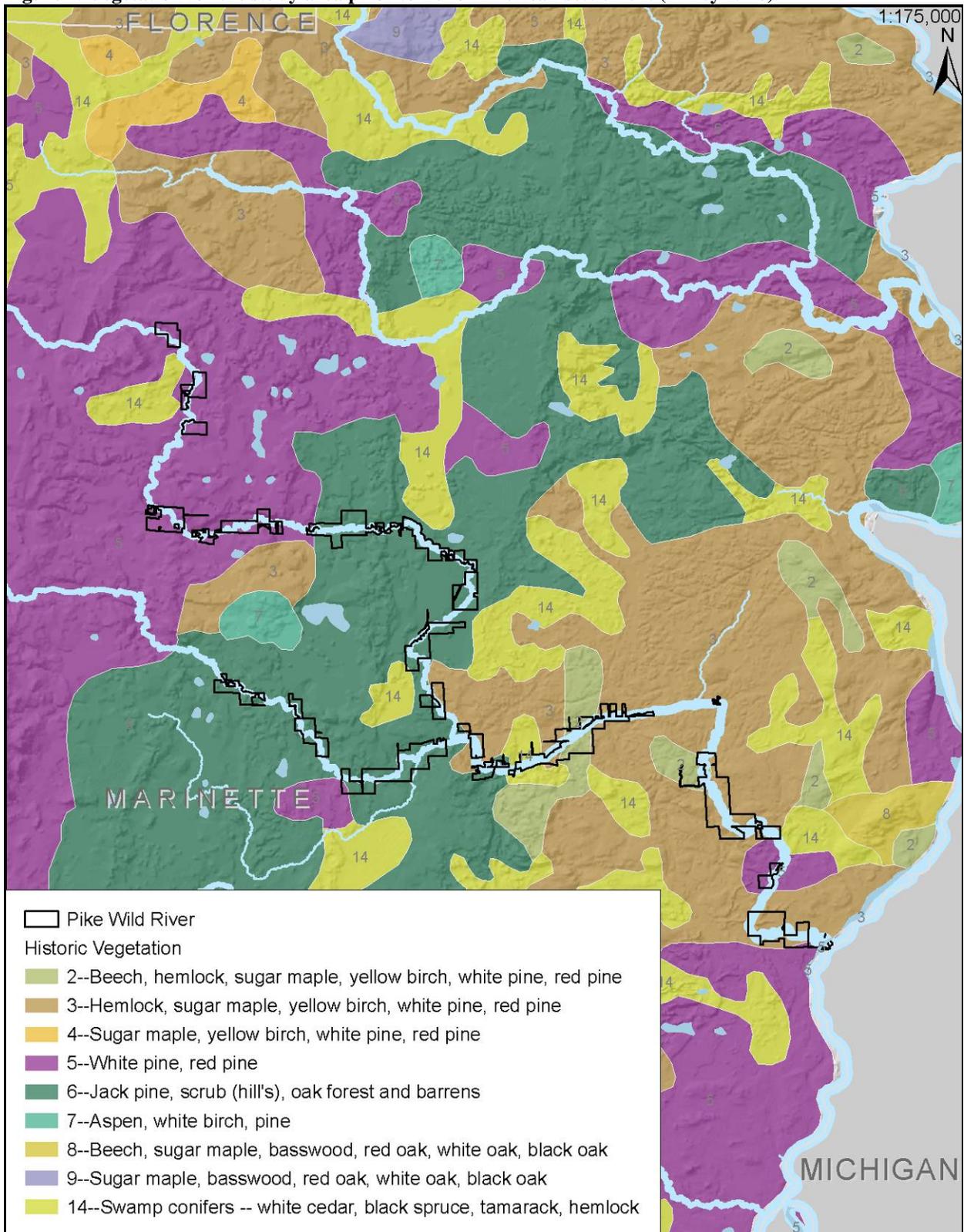
time, they provide valuable insights into Wisconsin's ecological capabilities. Maintaining or restoring some lands to more closely resemble historical systems and including some structural or compositional components of the historical landscape within actively managed lands can help conserve important elements of biological diversity (WDNR In Prep.). Public Land Surveys for the area comprising the PWR were conducted between 1841 and 1845.

The narrow, linear nature of the PWR does not lend itself well to interpretation of Finley's (1976) Pre-settlement Vegetation map (Figure 4). Generally, the historical vegetation of the PWR and surrounding landscape transitioned from eastern white and red pine dominated forests at the far west end of the property to jack pine, scrub (Hill's [northern pin]), oak forest and barrens in the center to eastern hemlock (*Tsuga canadensis*), sugar maple (*Acer saccharum*), yellow birch (*Betula alleghaniensis*), eastern white pine, and red pine at the eastern end of the property. There are scattered areas of forests with American beech (*Fagus grandifolia*), eastern hemlock, sugar maple, yellow birch, eastern white pine, red pine, as well as swamp conifers with northern white-cedar, black spruce (*Picea mariana*), tamarack (*Larix laricina*), and eastern hemlock.



Small Open Bog and bog lake with tamarack and black spruce (Photo by David Schmoller)

Figure 4. Vegetation for the study area prior to Euro-American settlement (Finley 1976).

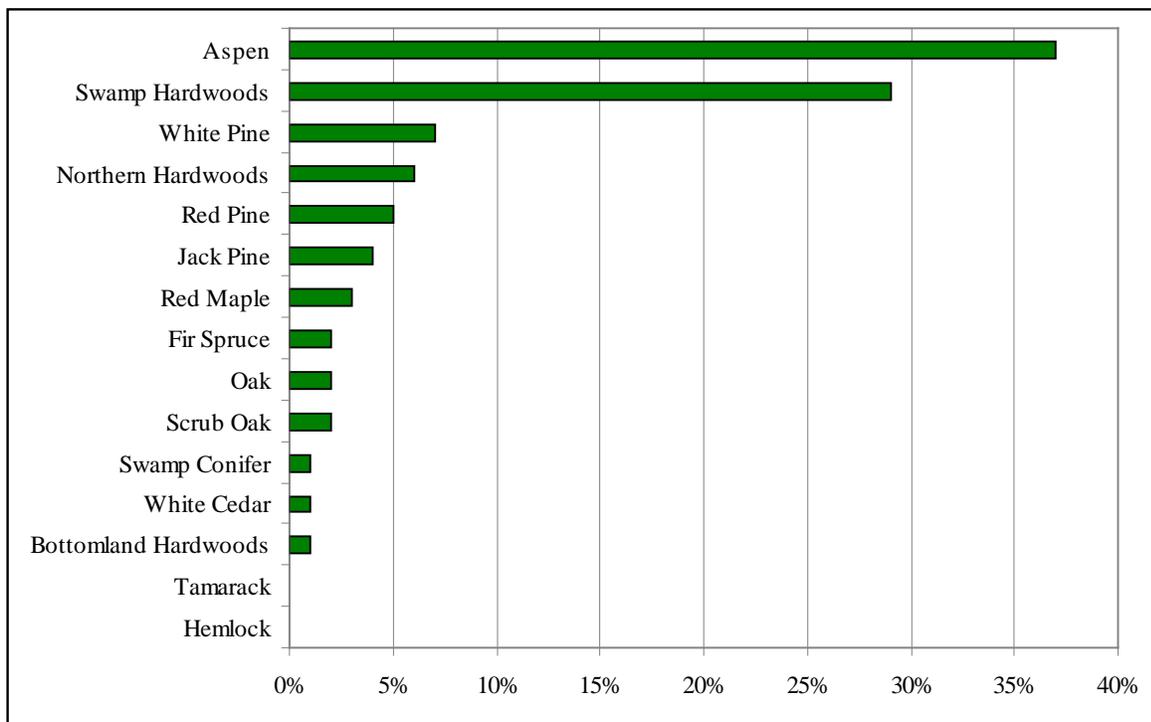


Current Vegetation

Many of the factors that historically impacted current vegetation, such as timber management and fire suppression, continue to impact the study area today. Environmental factors including geology, soils, hydrology, and climate, along with emerging threats such as non-native invasive species and deer browse, also impact vegetation. Currently, much of the landscape within the PWR and surrounding the project area is largely dominated by deciduous forest, with scattered inclusions of conifers (jack pine) and forested coniferous wetlands, and pockets of shrubland and grassland (Figure 6).

The Pike Wild River is primarily forested, with almost 80% of the stands classified as forest according to the WDNR forest reconnaissance data (WisFIRS 2011). The majority of the forests are described as either aspen or swamp hardwood cover types. Figure 5 illustrates the extent of the forest cover types from Forest Reconnaissance data for the Pike Wild River.

Figure 5. Percent of forested acres by cover type for the Pike Wild River. Data are from the Division of Forestry WISFIRS (accessed November 15, 2011).



Lowland Forests

Lowland forests of the PWR are common along the Pike River and are also found along tributaries, ponds, and seeps. Along the Pike River lowland forests are a mixture of black ash (*Fraxinus nigra*) and northern white-cedar dominated forests. Also present in the canopy is eastern hemlock, black spruce, balsam fir (*Abies balsamea*), and eastern white pine. Grasses and sedges are more dominant in the ground flora of the black ash dominated forests than the northern white-cedar dominated forests. The black ash dominated forests described here are typically characterized as Hardwood Swamps in the NHI Natural Community classification system (Epstein et al. 2002). Characteristic ground flora species of the black ash forests include blue-joint grass (*Calamagrostis canadensis*), common lake sedge (*Carex lacustris*), and common tussock sedge (*Carex stricta*). Within the northern white-cedar dominated forests, forbs (yellow clintonia [*Clintonia borealis*], crested wood fern [*Dryopteris cristata*], and American starflower [*Trientalis borealis*]) and low shrubs (grape woodbine [*Parthenocissus vitacea*] and swamp red currant

[*Ribes triste*]) are important in the ground flora. Lowland forests found along tributaries, ponds, and seeps are isolated from the Pike River and typically support a forest dominated by northern white-cedar.

Mixed Northern Hardwood Forests

Mixed northern hardwood forests of the PWR are heterogeneous in vegetative composition due to varying landscape position and management histories. These forests are relatively common on the property and appeared to be best developed on north facing slopes in areas where the Pike River runs west to east (Krause 2011). While these forests historically were probably Northern Dry-mesic Forest or hemlock-dominated Northern Mesic Forest, their current structure, composition, and quality are heavily influenced by previous timber management. Typical canopy species of today's forests include aspen, red maple (*Acer rubrum*), eastern hemlock, northern white-cedar, balsam fir, eastern white pine, and paper birch (*Betula papyrifera*). Forest stands of the PWR that most closely resemble high-quality Northern Mesic Forest are rare, and have super-canopy eastern white pine, eastern hemlock regeneration, and Canadian yew (*Taxus canadensis*).

Barrens and Northern Dry Forest

The PWR historically supported open to semi-open Pine Barrens in dry uplands and on sandy river terraces. Barrens were an important historical component of the Northeast Sands Ecological Landscape, but have become very rare following fire suppression and conversion to other cover types (WDNR In Prep.). Today's barrens are now closed-canopy forests, and can best be equated with the Northern Dry Forest natural community type. Canopy species vary for these sites and include: northern pin and red oak, jack pine, aspen, eastern white pine, balsam fir, and black cherry (*Prunus serotina*). American hazelnut (*Corylus americana*) is often abundant in the shrub layer. Small remnant openings are found in some stands with a few barrens and sand prairie species, including sweet fern (*Comptonia peregrina*). In some areas older red pine plantations also support scattered barrens vegetation.

Bedrock Glade

The Bedrock Glades of the PWR are formed on Precambrian granite bedrock that is 1.75 million years old. These areas have been worn smooth through glacial action and are common within larger upland natural community types. Typically small and rarely up to seven acres, Bedrock Glades are open to semi-open, moss and lichen covered with scattered pines (*Pinus* spp.), cherries (*Prunus* spp.), scrub oaks (*Quercus* spp.), and sumacs (*Rhus* spp.). Prairie grass species, sedges, and blueberry plants (*Vaccinium* spp.) are often present. The herb pale corydalis (*Corydalis sempervirens*) is generally restricted to these locations, but can be locally abundant. Low cliff faces occur on some outcrops which generally face down slope, toward the river corridor.

Peatland Communities

Although rare on the PWR, peatland natural communities are found in small depressions. One area has open water surrounded by stunted tamarack and black spruce over an abundant layer of Sphagnum moss (*Sphagnum* sp.). Other characteristic species include American woolly-fruit sedge (*Carex lasiocarpa*), bogbean (*Menyanthes trifoliata*), and leather-leaf (*Chamaedaphne calyculata*).

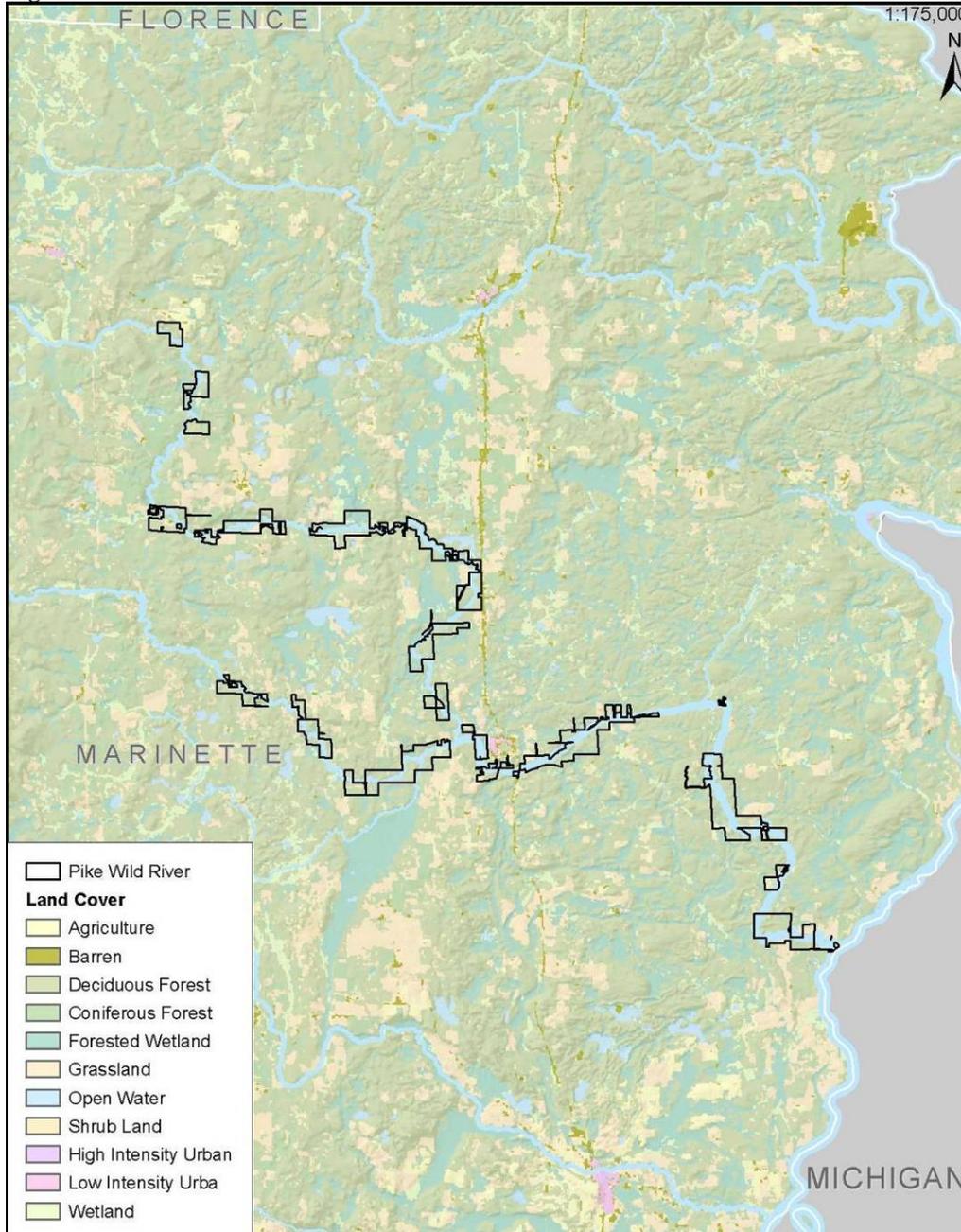
Northern Sedge Meadow

Small Northern Sedge Meadows are present along small tributary streams and have a dense herbaceous layer of forbs, sedges, and rushes. Characteristic species in the herbaceous layer include blue-joint grass, common tussock sedge, common lake sedge, Wool-grass (*Scirpus cyperinus*), spotted Joe-Pye-weed (*Eupatorium maculatum*), Canadian goldenrod (*Solidago canadensis*), and common boneset (*Eupatorium perfoliatum*). Shrubs present include Bebb's willow (*Salix bebbiana*), speckled alder (*Alnus incana*), white meadowsweet (*Spiraea alba*), and red osier dogwood (*Cornus stolonifera*).

Ephemeral Pond

Examples of Ephemeral Ponds are scattered throughout the mesic forests of the PWR, adding greatly to the biological diversity of the property. Ephemeral Ponds are depressions with impeded drainage, holding water for a period of time following snowmelt and typically drying out by mid-summer. They provide critical habitat for aquatic invertebrates like fairy shrimp (*Eubranchipus* spp.), amphibians like wood frogs (*Rana sylvatica*) and several species of salamanders. Detailed vegetation data within and immediately surrounding each pond was not collected. However, stand data from areas surrounding the ponds should be considered during forest management activities, as closed canopy forests with good amounts of downed woody debris are important structural components for making these attractive as amphibian breeding and foraging areas.

Figure 6. Landcover for the Pike Wild River from the Wisconsin DNR Wisland GIS coverage (WDNR 1993)



Township-level Rare Species and High-Quality Natural Communities

Numerous rare species and high-quality examples of natural communities have been documented within the townships comprising the Pike Wild River property. Table 3 shows the rare species and high-quality natural communities currently known from these townships (Dunbar, Athelstane, Beecher, Amberg, Wausaukee). See Appendix C for summary descriptions of these rare species and natural communities.

Table 3. Documented Rare Species and High-Quality Natural Communities. For an explanation of state and global ranks, as well as state status, see Appendix A. Species with a “W” in the “Tracked by NHI” column are on the Watch List (see Appendix E) and are not mapped in the NHI database. Various sources were used to determine the Watch List species and SGCN present and this may not be a complete list. Listing status is based on the NHI Working List published June 2011.

Common Name	Scientific Name	State Rank	Global Rank	State Status	SGCN	Tracked by NHI
Animals						
Aquatic Invertebrates						
A Caddisfly	<i>Agarodes distinctus</i>	S3S4	G5	SC/N	Y	W
Delicate Emerald	<i>Somatochlora franklini</i>	S3	G5	SC/N	N	W
Forcinate Emerald	<i>Somatochlora forcipata</i>	S2S3	G5	SC/N	Y	Y
Pronghorned Clubtail	<i>Gomphus graslinellus</i>	S2S3	G5	SC/N	N	Y
Pygmy Snaketail	<i>Ophiogomphus howei</i>	S4	G3	THR	Y	Y
Round Pigtoe	<i>Pleurobema sintoxia</i>	S3	G4G5	SC/P	N	W
Ski-tailed Emerald	<i>Somatochlora elongata</i>	S2S3	G5	SC/N	N	W
Slaty Skimmer	<i>Libellula incesta</i>	S2S3	G5	SC/N	Y	Y
Birds						
American Woodcock	<i>Scolopax minor</i>	S3S4B	G5	SC/M	Y	W
Bald Eagle	<i>Haliaeetus leucocephalus</i>	S4B, S4N	G5	SC/P	Y	Y
Black-billed Cuckoo	<i>Coccyzus erythrophthalmus</i>	S3S4B	G5	SC/M	Y	W
Brown Thrasher	<i>Toxostoma rufum</i>	S3S4B	G5	SC/M	Y	W
Canada Warbler	<i>Wilsonia canadensis</i>	S3S4B	G5	SC/M	Y	W
Field Sparrow	<i>Spizella pusilla</i>	S3S4B	G5	SC/M	Y	W
Golden-winged Warbler	<i>Vermivora chrysoptera</i>	S3S4B	G4	SC/M	Y	W
Hooded Warbler	<i>Wilsonia citrina</i>	S2S3B	G5	THR	Y	Y
Least Flycatcher	<i>Empidonax minimus</i>	S4B	G5	SC/M	Y	W
Merlin	<i>Falco columbarius</i>	S3B, S2N	G5	SC/M	N	W
Osprey	<i>Pandion haliaetus</i>	S4B	G5	SC/M	Y	W
Red-headed Woodpecker	<i>Melanerpes erythrocephalus</i>	S3B	G5	SC/M	Y	W
Red-shouldered Hawk	<i>Buteo lineatus</i>	S3S4B, S1N	G5	THR	Y	Y
Veery	<i>Catharus fuscescens</i>	S3S4B	G5	SC/M	Y	W
Wood Thrush	<i>Hylocichla mustelina</i>	S4B	G5	SC/M	Y	W
Yellow-bellied Flycatcher	<i>Empidonax flaviventris</i>	S3S4B	G5	SC/M	N	W
Fishes						
Banded Killifish	<i>Fundulus diaphanous</i>	S3	G5	SC/N	Y	W
Lake Sturgeon	<i>Acipenser fulvescens</i>	S3	G3G4	SC/H	Y	Y
Mammals						
Gray Wolf	<i>Canis lupus</i>	S4	G4	SC/P	Y	Y
Reptiles						

Blanding's Turtle	<i>Emydoidea blandingii</i>	S3S4	G4	THR	Y	Y
Eastern Hog-nosed Snake	<i>Heterodon platirhinos</i>	S3S4	G5	SC/H	N	W
Wood Turtle	<i>Glyptemys insculpta</i>	S2	G4	THR	Y	Y
Terrestrial Invertebrates						
A Tiger Beetle	<i>Cicindela patruela patruela</i>	S2	G3T3	SC/N	Y	Y
Dorcas Copper	<i>Lycaena dorcas</i>	S3S4	G5	SC/N	N	W
Tawny Crescent Spot	<i>Phyciodes batesii</i>	S3S4	G4	SC/N	N	W
Plants						
Butternut	<i>Juglans cinerea</i>	S3?	G4	SC	NA	W
Canadian Yew	<i>Taxus canadensis</i>	S4	G5	SC	NA	W
Dwarf Milkweed	<i>Asclepias ovalifolia</i>	S3	G5?	THR	NA	Y
Large-flowered Ground-cherry	<i>Leucophysalis grandiflora</i>	S1	G4?	SC	NA	Y
Limestone Oak Fern	<i>Gymnocarpium robertianum</i>	S1S2	G5	SC	NA	Y
Marsh Valerian	<i>Valeriana sitchensis</i> ssp. <i>Uliginosa</i>	S2	G4Q	THR	NA	Y
Missouri Rock-cress	<i>Arabis missouriensis</i>	S2	G5	SC	NA	Y
Ram's-head Lady's-slipper	<i>Cypripedium arietinum</i>	S2	G3	THR	NA	Y
Showy Lady's-slipper	<i>Cypripedium reginae</i>	S4	G4	SC	NA	W
Natural Community						
Bedrock Glade		S3	G2	NA	NA	Y
Black Spruce Swamp		S3?	G5	NA	NA	Y
Ephemeral Pond		SU	GNRQ	NA	NA	Y
Hardwood Swamp		S3	G4	NA	NA	
Lake—deep, hard, seepage		S2	GNR	NA	NA	Y
Lake—shallow, hard, seepage		SU	GNR	NA	NA	Y
Lake—shallow, soft, seepage		S4	GNR	NA	NA	Y
Lake—spring		S3	GNR	NA	NA	Y
Northern Dry-mesic Forest		S3	G4	NA	NA	Y
Northern Hardwood Swamp		S3	G4	NA	NA	Y
Northern Mesic Forest		S4	G4	NA	NA	Y
Northern Sedge Meadow		S3	G4	NA	NA	Y
Northern Wet-mesic Forest		S3S4	G3?	NA	NA	Y
Northern Wet Forest		S4	G4	NA	NA	Y
Open Bog		S4	G5	NA	NA	Y
Pine Barrens		S2	G2	NA	NA	Y
Poor Fen		S3	G3G4	NA	NA	Y
Shrub-carr		S4	G5	NA	NA	Y
Spring Pond		S3	GNR	NA	NA	Y
Stream—fast, hard, cold ¹		SU	GNR	NA	NA	Y
Tamarack (poor) Swamp		S3	G4	NA	NA	Y

¹ This species or natural community is not yet mapped in the NHI database or does not meet some NHI methodology for inclusion.

Management Considerations and Opportunities for Biodiversity Conservation

Older Forests and Old-growth Forests

Older forests (greater than 100-120 years old) in Wisconsin are rare and declining, largely due to timber harvesting and conversion to other land uses (WDNR 2010b). The WDNR has identified a need to conserve, protect, and manage old-growth forests (WDNR 2004, WDNR 1995), and old-growth management is a required component of Forest Certification (FSC 2009). The age and structure of an old-growth natural community varies with species and site, but, in general, old-growth characteristics do not significantly develop until a stand has remained undisturbed for at least 200 years. Old-growth stands are sometimes characterized by a multi-layered, uneven age and size class structure; a high degree of compositional and structural patchiness and heterogeneity; significant amounts of coarse woody debris, and pit-and-mound microtopography (WDNR In Prep.). Older forests and old-growth forests provide structural diversity that supports unique assemblages of plants, birds, and other animals.

Old-growth forest management is one important facet of providing the diverse range of habitats needed for sustainable forest management (WDNR 2010b). Although recent timber management practices have occurred, the potential for old-growth and older forests exists, and examples are found on the PWR. According to forest reconnaissance data, the forests within the Pike Wild River Conifer Hardwoods Primary Site are some of the oldest forest stands on the property with a white cedar stand at 119 years old and two white pine stands at 123 years old (WisFIRS 2011). Forests stands over 100 years old are also present in the Pike Wild River Corridor Primary Site. On average, forest stands within the river corridor, and subsequently the Pike Wild River Corridor Primary Site, represent the greatest overall opportunity to develop old-growth forests. These forests have the highest average age and because of the protection afforded them by the Wild Rivers Program (s.30.26, Wis. Stats.) present the greatest opportunity to promote old-growth characteristics.

Landscape-scale Management and Ecological Connections

The PWR presents opportunities to maintain or re-establish connectivity between ecologically significant sites (as identified in this report) and adjacent tracts within this landscape (WDNR 2008). It is important to recognize forest patterns and processes, as well as the context of ecologically important areas and how forest stands function within the regional landscape. For example, the PWR contains a mosaic of sandy barrens, glades, and Northern Dry Forest in portions of the uplands and wet, lowland forests in a mostly remote, forested context. These areas offer opportunities to connect with other larger barrens complexes and remote forested wetlands surrounding the PWR and to provide habitat for a diverse group of species. Both forested wetlands and barrens at varying successional stages provide important niche habitats for groups of rare plants and animals. The harsh conditions of these unique communities have led to unusual and interesting adaptations by the plants and animals that live within these systems. This part of the state has the potential to provide an important corridor for movement between populations of rare barrens butterflies and moths, as well as vertebrate species including wide-ranging mammals. Opportunities exist to provide connections through protecting forested wetlands along river corridors and large peatland sites, connecting aquatic resources allowing for uninhibited movement of aquatic organisms, and expanding the management of uplands for barrens and Northern Dry Forests, across successional stages. These landscape scale management approaches would enhance the viability of numerous uncommon plant and animal populations associated with these habitats. More specific information on opportunities for landscape-scale management of these communities is found below.

Barrens, Bedrock Glades, and Northern Dry Forests

Pine and Oak Barrens were historically common (covering a combined 4.1 million acres) in Wisconsin but are now rare throughout the entire state with only an estimated 50,000 acres remaining (WDNR In Prep.). Wisconsin has a unique responsibility for preserving and restoring this community, because one of the highest percentages of barrens in North America is found in the state (WDNR 2006b). Major opportunities for sustaining these barrens communities exist within the Northeast Sands Ecological Landscape (WDNR In Prep.). Historically, barrens sites occurred on sandy glacial outwash plains, extinct glacial lake beds, and outwash terraces along rivers (WDNR 1995). Regardless of location or land type, this is a community type dependant upon disturbance, and fire has been consistently important in maintaining barrens.

Two large barrens areas, Athelstane and Dunbar Barrens, are adjacent to the PWR property and offer opportunities to manage for this rare ecosystem on a landscape scale. The best opportunities for barrens or dry forest management observed during this inventory appeared to be in the central portions of the PWR. The state-owned parcels noted are west of US Highway 141 and along Beecher Lake, Pike River, and Lily Lake roads for the North Branch and south and west of Smiley and Dow Dam roads on the South Branch Pike River. Identification of suitable restoration practices should be considered during the master planning process to provide for various successional stages of these communities. Management that provides connectivity of open to semi-open barrens, Bedrock Glades, and Northern Dry Forests would benefit both plants and animals found in these communities by enhancing functional patch sizes of these habitats. Bedrock Glades are found on the property in small patches and are sensitive features providing unique opportunities to protect associated rare plants, mosses, and lichens. Management activities that enhance the openness of all three of these globally rare habitats should be considered including prescribed burning.

Forested Wetlands

Opportunities to manage for large forested blocks of old Northern Wet-mesic Forest within a matrix of upland forests (Northern Dry-mesic and Mesic Forests) are present on the PWR (WDNR 2008). Management is taking place at the adjacent Amberg Wildlife Area to perpetuate the large acreages of old Northern Wet-mesic Forest, Northern Dry-mesic, and Northern Mesic Forests. Coordinating management to connect these properties to similar habitat types on Town Corner Wildlife Area, Miscauno Cedar Swamp SNA, and extensive habitat on Marinette County Forest lands would be beneficial to unique plants and animals across the landscape.

Aquatic Resources

There are approximately 225 road/stream crossings within the Pike River watershed that have been inventoried and prioritized based on their impediment to the movement of aquatic organisms (Long pers. comm.). Replacement and monitoring of degraded road/stream crossings within the PWR should be incorporated into the new master plan. This could benefit the movement of common game fishes as well as rare fishes and enable fish host species to move mussel glochidia to new reaches within the PWR from the highly diverse Menominee River.

Breeding Bird Diversity

The PWR supports significant populations of Neotropical migrant birds, filling many habitat niches including forest interior areas, open woodlands, wetlands, and shrubby areas. These migrants breed in North America during the spring and early summer and spend the winter in Mexico, the Caribbean, and Central and South America. There are more than 200 species of Neotropical migrants, including songbirds, shorebirds, waterfowl, and some raptors such as hawks and vultures. A total of 33 species of

neotropical migratory birds, or 41% of the total number of bird species supported on the PWR, were detected during the 2011 breeding bird surveys.

Table 4. Neotropical Migrant Birds of the Pike Wild River

Alder Flycatcher	Eastern Kingbird	Northern Waterthrush
American Redstart	Eastern Wood Pewee	Ovenbird
Baltimore Oriole	Golden-winged Warbler	Red-eyed Vireo
Barn Swallow	Great Crested Flycatcher	Rose-breasted Grosbeak
Black-and-white Warbler	Hooded Warbler	Ruby-throated Hummingbird
Black-billed Cuckoo	Indigo Bunting	Scarlet Tanager
Blackburnian Warbler	Least Flycatcher	Veery
Black-throated Green Warbler	Magnolia Warbler	Wood Thrush
Broad-winged Hawk	Mourning Warbler	Yellow Warbler
Canada Warbler	Nashville Warbler	Yellow-bellied Flycatcher
Chestnut-sided Warbler	Northern Parula	Yellow-throated Vireo

An important consideration for maintaining or enhancing habitat for these diverse assemblages of forest birds includes maintaining vertical structural diversity within intact forest stands. This structural diversity is important for species which utilize a dense shrub layer for nesting (WDNR 2006b). Deer browse could pose a potential issue for these bird species if it results in the loss of a suitable shrub component (WDNR 2006b). Tree species composition is also an important variable for birds at the PWR. A conifer component can add greatly to an area's bird diversity. The PWR supports upland pine forests (Northern Dry Forest), which Collins (2011) found to support higher abundances of pine warbler (*Dendroica pinus*) and blackburnian warbler (*Dendroica fusca*). Lowland forests with eastern hemlock, northern white-cedar, and tamarack appeared important for golden-crowned kinglet (*Regulus satrapa*), Nashville warbler (*Oreothlypis ruficapilla*), northern parula (*Parula americana*), and winter wren (*Troglodytes hiemalis*) (Collins 2011).

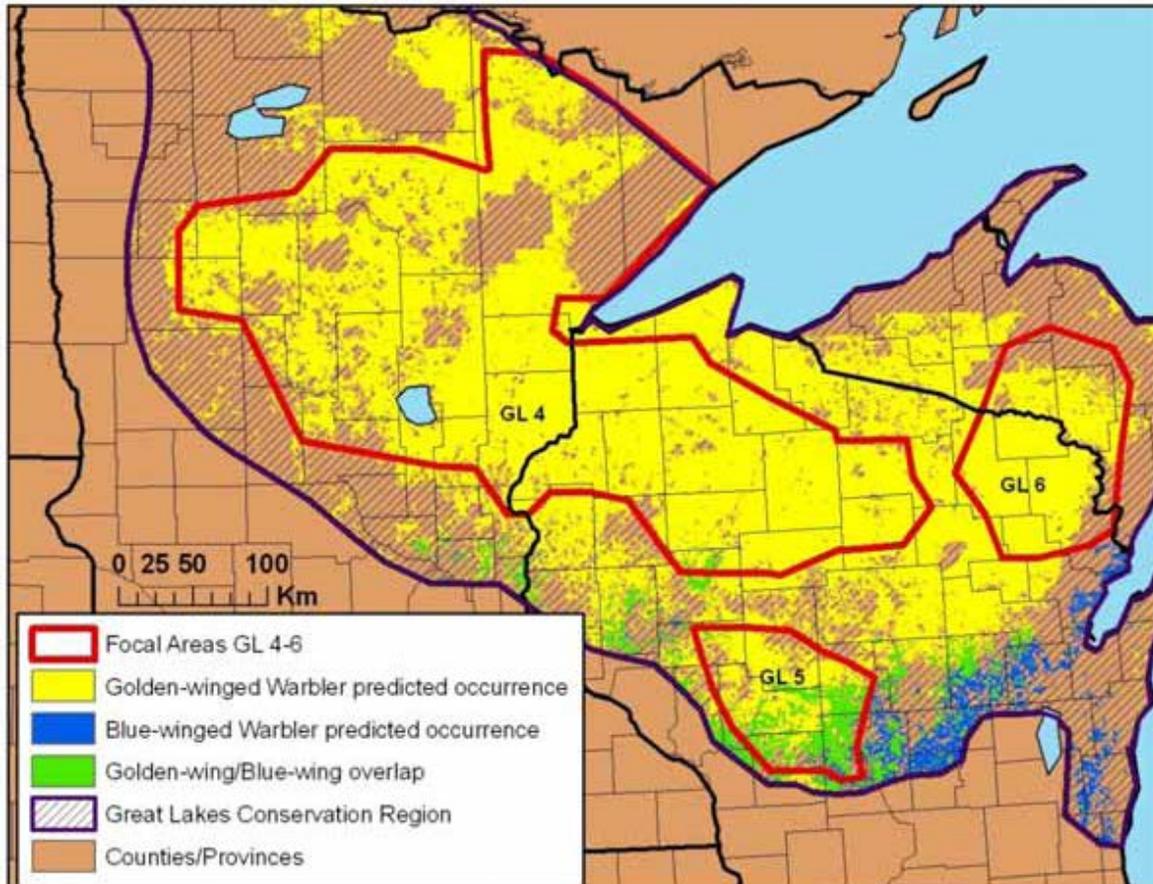
Patch size is also important for forest interior birds and other area sensitive species. Forest fragmentation and the overall loss of forests have been identified as major threats to northern forests in the Lake States (Hawbaker et al. 2006, Radeloff et al. 2005). As many forested areas in the state become parcelized and developed, the PWR and substantial forests of the adjacent Marinette County Forest collectively represent an important opportunity to maintain an intact forested landscape, serving critical functions on a statewide and regional level. Opportunities exist to expand the acreage of older-aged forest types and increase their average patch size. This would greatly benefit forest raptors and a wide variety of other wildlife species dependent on mature forest conditions as well. Multiple red-shouldered hawk (*Buteo lineatus*) and northern goshawk (*Accipiter gentilis*) territories have been documented nearby on Marinette County forestlands. State lands within the PWR project area provide similar habitat conditions at the stand level. The lack of large tracts with unfragmented forest cover may be limiting these species use within the project area (Krause 2011).

Golden-winged warblers (*Vermivora chrysoptera*) have experienced a significant decline range wide. Minnesota and Wisconsin have a unique responsibility to maintain the globally uncommon golden-winged warbler as an estimated 57% of its global range is found in these two states (USFWS In Prep.). Populations of golden-winged warblers have declined across their range; annual rates of decline average 2.3% throughout its breeding range and 2.6% in Wisconsin, for an overall decline of 69% in Wisconsin from 1966-2009 (Buehler et al. 2012). Range contraction at the southern edge of its Midwestern range, loss of early successional nesting habitat, and hybridization with blue-winged warbler (*Vermivora cyanoptera*) appear to be driving these declines (Buehler et al. 2007). There are important opportunities

for golden-winged warbler conservation and management in Northern Wisconsin because of high population densities and the relative absence of blue-winged warblers (Martin et al. 2007).

Portions of the PWR supports populations of golden-winged warbler, harbor large blocks of suitable habitat within a favorable landscape context (Athelstane Barrens and Amberg COA's), and are located within a US Fish and Wildlife Service focal area (Figure 7). Management efforts to benefit the golden-winged warbler should focus on maintaining a diverse landscape mosaic of community types of sedge meadow-lowland shrub, lowland forest, and upland forest communities, especially Alder Thicket, Shrub-carr, and young aspen stands, as well as adjacent areas of more mature forests (WDNR 2005, Martin et al. 2007, Streby et al. 2012). Recent research from Minnesota indicates that golden-winged warblers require more mature forests, particularly for fledgling and post-breeding adult survival, as well as for occasional nesting (Streby et al. 2012, Cutright et al. 2006). These studies reveal golden-winged warbler habitat associations are more complicated than initially thought and the species should be considered a diverse forest obligate rather than simply requiring early successional habitats. Providing for a matrix of open shrub wetlands, upland areas of overgrown fields or pastures, barrens or glades, and edge habitats (power-line right-of-way) adjacent to more mature forests could maximize benefits to golden-winged warblers as well as other rare or uncommon species (brown thrasher [*Toxostoma rufum*], field sparrow [*Spizella pusilla*], veery, and American woodcock [*Scolopax minor*]). When considering management focusing on enhancing habitat for golden-winged warblers, landscape-scale planning and conservation of bird species sensitive to forest fragmentation should be emphasized.

Figure 7: Predicted distribution of golden-winged and blue-winged warblers in Minnesota and Wisconsin Core— Locations inside focal areas and without blue-winged warblers should receive highest priority for conservation and management actions (USFWS In Prep.).



Rare Herptiles

A habitat assessment and turtle survey over the past four years have resulted in documenting rare reptiles along with other more common herptiles at the PWR. Turtle nesting along the North and South Branches of the Pike River currently appear limited to roadsides near bridge crossings. This predisposes adult female turtles to road mortality. Nests along roads tend to yield few, if any, hatchlings due to extremely high nest predation rates. Even if eggs escape predation, nest sites along north/south roads running through forested habitat are often unsuccessful because they are often too cool to allow for proper turtle embryo development (Hay and Thayer 2011). Maintaining and improving nest sites for turtles would involve creating sites away from roads both to reduce adult female mortality and help insure better nesting environments, and maintaining a buffer of at least 500 feet of adjacent upland habitat for foraging (PARC 2002). Turtle nest locations may be protected by limiting disturbance in their vicinity (especially from recreational activities), keeping the areas open by limiting forest succession, and controlling spotted knapweed (*Centaurea biebersteinii*) invasions. Several potential turtle nesting management sites were detailed by Hay and Thayer (2011). Placement of nest sites and management of gestating areas should take into consideration the forested landscape context to best minimize fragmentation of existing intact forested areas.

Upland barrens, Northern Dry Forest, and open Bedrock Glade communities present good opportunities for conserving rare reptiles at the PWR. Connecting these habitats within the property as well as between the PWR and adjacent suitably managed public land (county forest, state wildlife areas) would benefit common and rare herptiles. Through landscape scale projects, habitat needs for wildlife are maximized and their safe movement from one location to the next is ensured. Birds are extremely mobile, but other animals like small mammals and herptiles need to have suitable habitat connections to enable them to repopulate suitable areas or to continue to fulfill their life history requirements. These connections to open forest types represents a significant opportunity to attract numerous reptiles by providing critical areas for basking, overwintering den sites, staging areas for gravid females, and habitats for an abundant prey base.

High Conservation Value Forests

The Wisconsin DNR manages 1.5 million acres that are certified by the Forest Stewardship Council (FSC) and the Sustainable Forest Initiative (SFI). Forest certification requires forests to be managed using specified criteria for ecological, social, and economic sustainability. Principle 9 of the *Draft 7 FSC-US Forest Management Standard* concerns the maintenance of High Conservation Value Forests (HCVF). High Conservation Value Forests are defined as possessing one or more of the following:

- Contain globally, regionally, or nationally significant concentrations of biodiversity values, including rare, threatened, or endangered species and their habitats.
- Globally, regionally, or nationally significant large landscape level forests, contained within, or containing the management unit, where viable populations of most if not all naturally occurring species exist in natural patterns of distribution and abundance.
- Are in or contain rare, threatened, or endangered ecosystems.
- Provide basic services of nature in critical situations (e.g., watershed protection, erosion control).
- Are fundamental to meeting basic needs of local communities (e.g., subsistence, health).
- Are critical to local communities' traditional cultural identity (areas of cultural, ecological, economic, or religious significance identified in cooperation with such local communities).

Based on the current draft criteria for defining HCVPs (Forest Stewardship Council 2009) the best opportunities for HCVP on the PWR are the Primary Sites, as well as high quality natural communities and rare species habitat areas that are outside of the Primary Sites.

Priority Conservation Actions

The Wildlife Action Plan developed Priority Conservation Actions that make effective use of limited resources and address multiple species with each action. Implementing these actions and avoiding actions that may preclude successful implementation of these actions in the future would greatly benefit the SGCN on the PWR.

Priority Conservation Actions identified in the Wisconsin Wildlife Action Plan (WDNR 2006b) for the Northeast Sands Ecological Landscape that apply to the PWR include:

- Develop educational tools and demonstration/training areas that promote prescribed fire and other barrens/bracken grassland management practices.
- Manage the full range of barrens successional stages and diverse habitats in a landscape context. A comprehensive landscape plan will require identification and management of early succession cores. The barrens also need to have areas managed in a shifting mosaic of timber harvest with many clearcuts, some older than rotation-age stands, some thinning of stands for savanna structure and a few protected groves. Many small open patches are needed to conserve rare Lepidoptera. To enhance landscape attributes, red pine plantations can be applied to appropriate sites where the historical fire regime indicates that groves occurred.
- Restore oak/conifer barrens and shrub habitats on public lands in appropriate Conservation Opportunity Areas through fire, ground layer enhancement, and timber management.
- Develop conservation partnerships with county forests, private groups, and industrial forest landowners with the goal of planning landscape management.
- Integrate land-use planning efforts across federal, state, county, and local ownership boundaries.
- Eliminate off-trail operation of motor vehicles and off-road vehicles in barrens and bracken grassland restorations that leads to non-native invasive plant establishment, wind and storm erosion, or dominance of Pennsylvania sedge (*Carex pensylvanica*).
- Maintain lowland shrub communities like Alder Thicket and Shrub-carr, and manage the surrounding working forest to benefit golden-winged warblers by leaving scattered off-site aspen, ash and tamarack in shrub-dominated areas and managing the adjacent upland forest in a shifting mosaic of patch sizes and age classes to provide continuous habitat.
- Protect and restore large river habitat for pygmy snaketail (*Ophiogomphus howei*) and other aquatic invertebrate SGCN.

Wisconsin's Statewide Forest Strategy

Wisconsin's Statewide Forest Assessment (WDNR 2010b) was based on Wisconsin's Forest Sustainability Framework (Wisconsin Council on Forestry 2008) and was designed to assess the current state of Wisconsin's public and private forests and analyze the sustainability of our forested ecosystems. Wisconsin's Statewide Forest Strategy (WDNR 2010c) contains a collection of strategies and actions designed to address the management and landscape priorities identified in the Statewide Forest Assessment. The strategies are broad guides intended to focus the actions of the forestry community.

All three of these documents include topics related to biological diversity in Wisconsin’s forests, and provide information useful for department master planning and management activities. The following strategies, organized using their number in the Statewide Forest Strategy document, are particularly pertinent to the PWR planning efforts in regard to opportunities to maintain or enhance biological diversity (WDNR 2010c). These strategies may not be applicable to all areas of the PWR.

Strategy Number	Strategy
1	Encourage planting to enhance, protect, and connect larger tracts of forested land in appropriate locations consistent with ecological landscapes.
5	Pursue the conservation and protection of large, unfragmented blocks of forest lands
6	Strengthen collaborative and large scale planning at the town, county, state and federal levels
7	Increase the functional size of forest blocks by encouraging coordination of management of clusters of forest ownerships
11	Encourage the management of under-represented forest communities
12	Improve all forested communities with a landscape management approach that considers the representation of all successional stages
13	Increase forest structure and diversity
14	Encourage the use of disturbance mechanisms to maintain diverse forest communities
15	Maintain the appropriate forest types for the ecological landscape while protecting forest health and function
22	Strive to prevent infestations of non-native invasive species before they arrive
23	Work to detect new (non-native invasive species) infestations early and respond rapidly to minimize impacts to forests
24	Control and management of existing (non-native invasive species) infestations.
25	Rehabilitate, restore, or adapt native forest habitats and ecosystems
29	Attempt to improve the defenses of the forest and increase the resilience of natural systems to future climate change impacts

Ecological Priorities for Species of Greatest Conservation Need

The Wisconsin Wildlife Action Plan identifies ecological priorities in each Ecological Landscape. Ecological priorities are the natural communities in each Ecological Landscape that are most important to the Species of Greatest Conservation Need. Appendix D highlights the Ecological Priorities for vertebrate SGCN on the PWR. Note that these Ecological Priorities include all of the natural communities that we

have determined to provide the best opportunities for management on the PWR from an ecological/biodiversity perspective.

Natural Community Management Opportunities

The Wisconsin Wildlife Action Plan (WAP) (WDNR 2006b) identifies 21 natural communities for which there are “Major” or “Important” opportunities for protection, restoration, or management in the Northeast Sands Ecological Landscape. Twelve of these natural communities are present on the PWR:

Alder Thicket	Coolwater Streams	Northern Hardwood Swamp	Northern Wet-mesic Forest
Bedrock Glade	Northern Dry Forest	Northern Sedge Meadow	Open Bog
Coldwater Streams	Northern Dry-mesic Forest	Northern Wet Forest	Pine Barrens

Invasive Species

Many non-native invasive plants, animals and pathogens, both terrestrial and aquatic, are present at the Pike Wild River and in the surrounding landscape. Non-native invasive species thrive in disturbed areas, but also may invade and compromise high-quality natural areas. They establish quickly, tolerate a wide range of conditions, are easily dispersed, and are free of the diseases, predators, and competitors that kept their populations in check in their native range.

Non-native invasive plants can out-compete and even kill native plants by monopolizing light, water, and nutrients, and by altering soil chemistry and mycorrhizal relationships. In situations where non-native invasive plants become dominant, they may even alter ecological processes by limiting one’s ability to use prescribed fire, by modifying hydrology, and by limiting tree regeneration and ultimately forest composition (WDNR 2006c). In addition to the threats on native communities and native species diversity, non-native invasive species negatively impact forestry (by reducing tree regeneration, growth and longevity), recreation (by degrading fish and wildlife habitat and limiting access), agriculture, and human health (e.g., plants that cause skin rashes or blisters).

Similarly to terrestrial invasives, aquatic invasives are successful because they originate in other regions or continents, thus lacking natural checks and balances. Early and abundant growth of aquatic plants does not only overwhelm native plants; it may disrupt aquatic predator-prey relationships by fencing out larger fish, and may limit important aquatic food plants for waterfowl. The die-off of plants such as curly-leaf pondweed (*Potamogeton crispus*) in summer can cause oxygen depletion in waterbodies, and decaying plants can contribute to nutrient loading and algal blooms. Aquatic invasive animals similarly present overwhelming competition to their native counterparts (e.g., rusty crayfish [*Orconectes rusticus*] versus native crayfish). Another example is invasive mussels, which feed on plants, animals, and debris that are suspended in the water, and can lead to increased water clarity and light penetration (fostering overgrowth of rooted aquatic plants), as well as a depleted food supply for native aquatic organisms. Zebra mussels (*Dreissena polymorpha*) not only monopolize resources and alter the aquatic environment; they literally smother native mussels by attaching to their shells in great masses. Apart from environmental impacts, aquatic invasives diminish aquatic recreational resources by inhibiting boat and swimming access, and by negatively affecting game fish populations.

Invasive plant surveys were conducted in conjunction with natural community surveys of the PWR during 2011 biotic inventory efforts. Unlike many state properties, invasive nonnative plant species are currently of minor occurrence on the PWR. Recreational usage and anthropogenic disturbance on the PWR has contributed to the introduction and spread of the invasive species found at the property. Invasive species that are found at PWR and pose the greatest immediate threat to native species diversity, rare species habitats, or high-quality natural communities are listed in Table 6 below.

Table 5. Invasive Species Found at the Pike Wild River.

<i>Scientific Name</i>	Common Name	NR40 Classification	Habitats Found	PWR occurrence
<i>Berberis thunbergii</i>	Japanese barberry	NA	upland forests	one site
<i>Centaurea biebersteinii</i>	spotted knapweed	Restricted	grasslands	widespread
<i>Euphorbia esula</i>	leafy spurge	Restricted	grasslands	one site
<i>Hieracium aurantiacum</i>	orange hawkweed	NA	grasslands	widely scattered
<i>Hypericum perforatum</i>	common St. John's-wort	NA	grasslands	widespread
<i>Linaria vulgaris</i>	butter and eggs	NA	grasslands	widely scattered
<i>Lonicera tatarica</i>	tartarian honeysuckle	Restricted	upland forests	two sites
<i>Orconectes rusticus</i>	rusty crayfish	NA	aquatic systems	Pike River
<i>Phalaris arundinacea</i>	reed canary grass	NA	wetlands	widespread
<i>Verbascum thapsus</i>	Mullein	NA	grasslands	widely scattered

The nonnative invasive rusty crayfish is documented in the lower portion of the Pike River from the town of Amberg downriver to the Menominee River. Other aquatic invasive species that have been found within Marinette County include: banded mystery snail (*Viviparus georgianus*), Chinese mystery snail (*Cipangopaludina chinensis*), curly leaf pondweed, and zebra mussels. Species not known from within the Pike River watershed but with the potential for showing up in these aquatic habitats include New Zealand mud snails (*Potamopyrgus antipodarum*), which could potentially be found in the PWR as they are found in fast, rocky streams and can be transported by fisherman on waders. Early detection and rapid response for the non-native invasive common reed grass (*Phragmites australis*) and purple loosestrife (*Lythrum salicaria*) along slow water shores and in open wetlands and European marsh thistle (*Cirsium palustre*), known from nearby the property in forested coniferous wetlands, would be important.

When resources for complete control of widespread invasives are lacking, containment (i.e., limiting further spread) may be considered as an alternative action. Early detection and rapid control of new and/or small infestations, however, may be considered for higher prioritization in an invasive species management strategy (Boos et al. 2010).

For recommendations on controlling specific invasive species consult with DNR staff, refer to websites on invasive species, such as that maintained by the DNR (<http://dnr.wi.gov/invasives>) and by the Invasive Plants Association of Wisconsin (<http://www.ipaw.org>), and seek assistance from local invasive species groups:

- Wild Rivers Invasive Species Coalition (Forest/Florence/Marinette Co.) - contact: wildriverscwma@gmail.com - Jen Johnson (Coordinator) or Anna Jahns (Chair) <http://www.wrisc.org/>

Also refer to invasive species Best Management Practices (BMPs) for forestry, recreation, urban forestry, and rights-of-way, which were developed by the Wisconsin Council on Forestry (*Invasive Species Best Management Practices*).

Emerald Ash Borer

The emerald ash borer (*Agrilus planipennis*), an invasive, wood-boring beetle that attacks ash trees, was positively identified for the first time in Wisconsin in 2008, and is now found in 12 counties. The beetle

attacks all species of ash (*Fraxinus* spp.) in Wisconsin, and the risk to forests is high: models predict that a healthy forest could lose 98% of its ash trees in six years (<http://www.emeraldashborer.wi.gov>).

The lowland forests of the PWR are vulnerable to the effects of emerald ash borer, as black ash, and to a lesser extent white and green ash, are important tree species within this ecosystem. Large-scale loss of ash in this area, whether through EAB-caused mortality or harvesting, could cause a cascade of negative impacts. Degradation of diverse, high-quality forests and loss of forest cover could further lead to diminishment of important habitat for rare plants and animals (especially forest interior birds), elevated water tables, and infestation of disturbance-loving invasives such as reed canary grass (WDNR 2010a). It is important to note that removal of all ash as a stopgap measure against EAB is not recommended; instead maintenance of a healthy forest and ash resource is suggested (WDNR 2010a).

Non-native Invasive Earthworms

The invasion of forests by European earthworms of the families *Acanthodrilidae*, *Lumbricidae*, and *Megascolecidae* is a concern throughout Wisconsin. While native earthworms were absent from this landscape after the last glaciation, non-native invasive earthworms have been introduced since Euro-American settlement, primarily as discarded fishing bait (Hendrix and Bohlen 2002, Hale et al. 2005). Non-native invasive earthworms can have dramatic impacts on forest floor properties by greatly reducing organic matter (Hale et al. 2005), microbial biomass (Groffman et al. 2004), nutrient availability (Bohlen et al. 2004, Suarez et al. 2004), and fine-root biomass (Groffman et al. 2004). These physical changes in the forest floor reduce densities of tree seedlings and rare herbs (Gundale 2002) and can favor invasive plants (Kourtev et al. 1999). In a study of 51 Northern Wisconsin forest stands, Wiegmann (2006) found that shifts in understory plant community composition due to non-native invasive earthworms were more severe in stands with high white-tailed deer densities. Many of the upland stands surveyed for this Biotic Inventory report in the PWR showed signs of infestation with earthworms. Earthworm presence appears highest in northern hardwood forests especially where maples are abundant.

Primary Sites: Site-specific Opportunities for Biodiversity Conservation

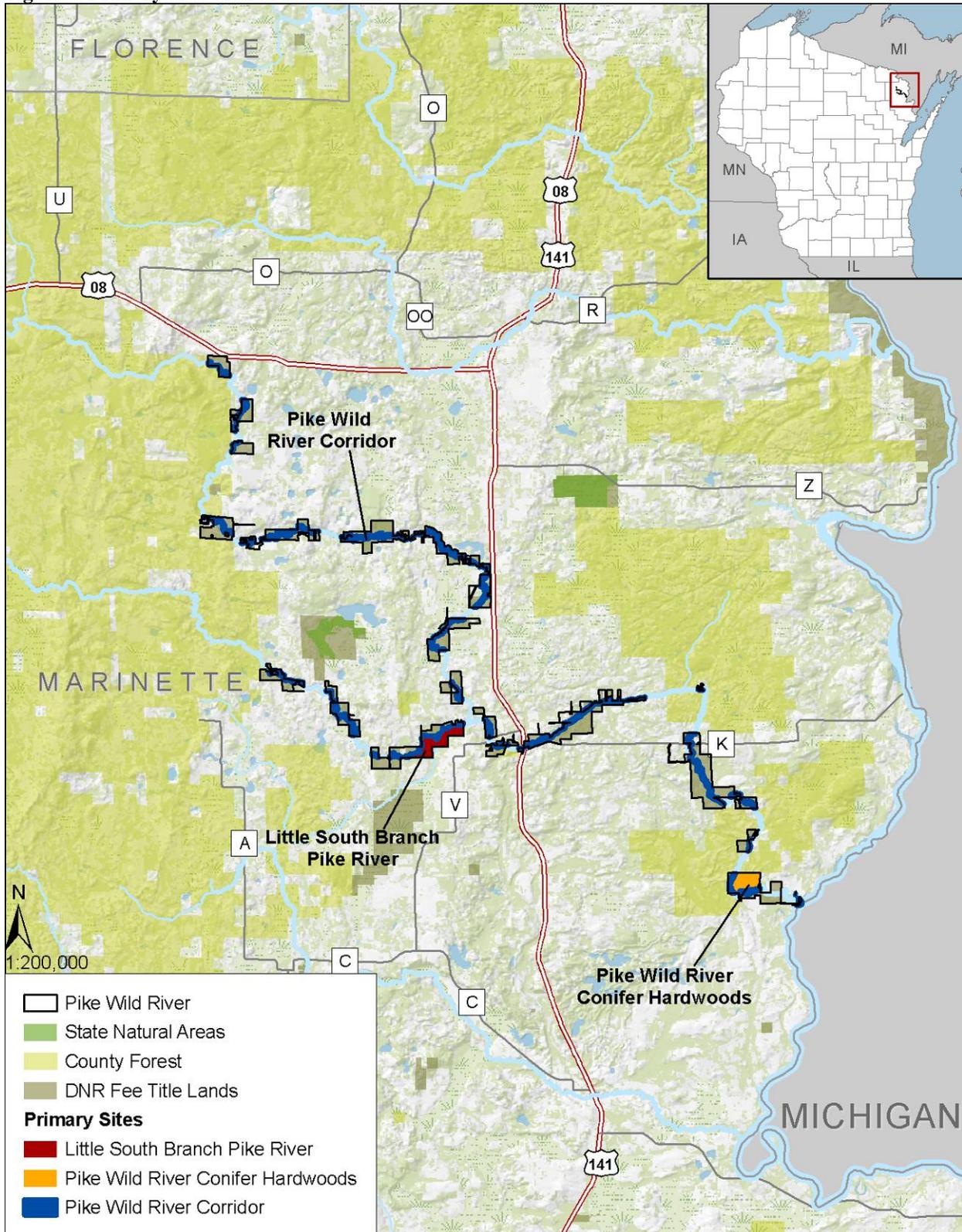
Three ecologically important sites were identified on the PWR (Figure 8). These “Primary Sites” were delineated because they generally encompass the best examples of 1) rare and representative natural communities, 2) documented occurrences of rare species populations, and/or 3) opportunities for ecological restoration or connections. These sites warrant high protection and/or restoration consideration during the development of the property master plan. This report is meant to be considered along with other information when identifying opportunities for various management designations during the master planning process.

Descriptions for each of the Primary Sites can be found in Appendix F. Information provided in the summary paragraphs includes location information, a site map, a brief summary of the natural features present, the site’s ecological significance, and management considerations.

Pike Wild River Primary Sites

- PWR01. Pike Wild River Corridor
- PWR02. Little South Branch Pike River
- PWR03. Pike Wild River Conifer Hardwoods

Figure 8. Primary Sites of the Pike Wild River



Future Needs

This project was designed to provide a rapid assessment of the biodiversity values for the PWR. Although the report should be considered adequate for master planning purposes, additional efforts could help to inform future adaptive management efforts, along with providing useful information regarding the natural communities and rare species contained in the PWR.

- Continued invasive species monitoring and control is needed. Public lands throughout Wisconsin are facing major management problems because of serious infestations of highly invasive species. Some of these species are easily dispersed by humans and vehicles; others are spread by birds, mammals, insects, water, or wind. In order to protect the important biodiversity values of the PWR, a comprehensive invasive species monitoring and control plan will be needed for detecting and rapidly responding to current and new invasive threats.
- Locations and habitats likely to support rare plants and animals should be identified for conducting additional surveys during appropriate seasons. This should include additional vertebrate and invertebrate animal taxon groups.
- Conduct focused plant and natural community surveys and inventory of Forested Seeps, Springs, and Spring Runs is needed, as these areas are known to harbor rare species.
- In Wisconsin, there has been a need to better understand the link between forest management and the management of Ephemeral Ponds. Collecting additional vegetative, herptile, and invertebrate data from Ephemeral Ponds within the PWR could add to the knowledge base of the physical and biotic parameters for Ephemeral Ponds and their surrounding habitats, and the wildlife species they support. This additional data could be used to inform adaptive management strategies for forests and other activities around ephemeral wetlands in Wisconsin.
- Additional inventory and monitoring is needed for reptiles and amphibians on the PWR. A frog and toad survey route could be established for lakes, streams, and wetland areas in or near the PWR and monitoring salamanders of Ephemeral Ponds through the Wisconsin Statewide Salamander Survey would be beneficial. Reptile surveys in open glades, barrens and Northern Dry Forests would be priorities as little herptile survey effort took place in these upland areas in 2011.
- Mammal inventories should be done within the PWR focusing on small mammals and bats.
- Research and baseline inventory data are lacking for Bedrock Glade communities. Information on suitable management activities to restore sites while protecting sensitive elements would be useful. Mapping location and extent of these communities within the PWR should be considered.

Glossary

adaptive management - a formal, structured approach to dealing with uncertainty in natural resource management, using the experience of management as an ongoing and continually improving process.

Ecological Landscape - landscape units developed by the WDNR to provide an ecological framework to support natural resource management decisions. The boundaries of Wisconsin's sixteen Ecological Landscapes correspond to eco-regional boundaries from the National Hierarchical Framework of Ecological Units, but sometimes combine subsections to produce a more manageable number of units.

element - the basic building blocks of the Natural Heritage Inventory. They include natural communities, rare plants, rare animals, and other selected features such as colonial bird rookeries, bat hibernacula, and mussel beds. In short, an element is any biological or ecological entity upon which we wish to gather information for conservation purposes.

element occurrence - an Element Occurrence (EO) is an area of land and/or water in which a rare species or natural community is, or was, present. An EO should have practical conservation value for the Element as evidenced by potential continued (or historical) presence and/or regular recurrence at a given location. For species, the EO often corresponds with the local population, but when appropriate may be a portion of a population (e.g., a single nest territory or long distance dispersers) or a group of nearby populations (e.g., metapopulation). For communities, the EO may represent a stand or patch of a natural community or a cluster of stands or patches of a natural community. Because they are defined on the basis of biological information, EOs may cross jurisdictional boundaries.

esker – a ridge, commonly sinuous, composed of sand and gravel deposited by a stream that flowed in an ice-walled channel beneath a glacier (Dott and Attig 2004).

Forest Certification – a market-based, non-regulatory forest conservation tool designed to recognize and promote environmentally-responsible forestry and sustainability of forest resources. The certification process involves an evaluation of management planning and forestry practices by a third-party according to an agreed-upon set of standards (from <http://www.pinchot.org/project/59>). See <http://dnr.wi.gov/forestry/certification/> regarding certification of WDNR managed lands.

Landtype Association (LTA) - a level in the National Hierarchical Framework of Ecological Units (see next entry) representing an area of 10,000 – 300,000 acres. Similarities of landform, soil, and vegetation are the key factors in delineating LTAs.

moraine – landforms composed of unsorted materials deposited by glaciers. They can cover broad geographic areas of millions of acres. Topography can vary from nearly level “till” plains to rough end moraine landscapes composed of steep dry ridges interspersed with deep kettle holes. These glacial “kettles” are frequent locations for lakes and wetlands.

National Hierarchical Framework of Ecological Units (NHFEU) – a land unit classification system developed by the U.S. Forest Service and many collaborators. As described by Avers et al (1994): “The NHFEU can provide a basis for assessing resource conditions at multiple scales. Broadly defined ecological units can be used for general planning assessments of resource capability. Intermediate scale units can be used to identify areas with similar disturbance regimes. Narrowly defined land units can be used to assess specific site conditions including: distributions of terrestrial and aquatic biota; forest growth, succession, and health; and various physical conditions.”

natural community – an assemblage of plants and animals, in a particular place at a particular time, interacting with one another, the abiotic environment around them, and subject to primarily natural disturbance regimes. Those assemblages that are repeated across a landscape in an observable pattern constitute a community type. No two assemblages, however, are exactly alike.

old-growth forest – Old-growth forests are relatively old and relatively undisturbed by humans. Old-growth stands are biologically old, containing some trees which are nearing or beyond their average expected lifespan. The original even-aged overstory, established following a catastrophic disturbance, is becoming senescent, is senescing, or has senesced. Typically, the development of old-growth conditions begins near the end of the stem exclusion stage; the most characteristic stages of stand development are demographic transition and multi-aged. Specific historical human disturbance events are relatively unimportant, as long as age and developmental criteria are met. The actual qualifying stand age will vary depending on dominant species (forest type) and site capability. Old-growth forests are dominated by native vegetation (WDNR 2006c).

old forest – Old forest stands are older than the typical managed forest, but are not biologically old. They are beyond economic maturity, but are not senescent. These stands are older than their traditional rotation age [usually near the age where mean annual increment (MAI) is at a maximum]. Typically, old forest stands are still in the stem exclusion stage of stand development, but, depending on forest type and disturbance history, they can be in the transition or multi-aged stages. Historical human disturbance is unimportant, as long as age and developmental criteria are met. The actual qualifying stand age will vary depending on dominant species (forest type) and site capability. Old forests are dominated by native vegetation (WDNR 2006c).

representative - native plant species that would be expected to occur in native plant communities influenced primarily by natural disturbance regimes in a given landscape - e.g., see Curtis (1959).

SGCN (or “Species of Greatest Conservation Need”) – native wildlife species with low or declining populations that are most at risk of no longer being a viable part of Wisconsin’s fauna (from the “Wisconsin Wildlife Action Plan,” WDNR 2006b).

Subsection – This is a level in the NHFEU that is intermediate in scale. Subsections are characterized by distinctive glacial landforms (e.g., outwash or moraine), soils, and broadly, by vegetation. The 16 Ecological Landscapes developed by the WDNR are largely based on NHFEU Subsections (see *Ecological Landscape*).

Species List

The following is a list of species referred to by common name in the report text.

Common Name	Scientific Name
Animals	
American woodcock	<i>Scolopax minor</i>
Blackburnian warbler	<i>Dendroica fusca</i>
Blanding's turtle	<i>Emydoidea blandingii</i>
Blue-winged warbler	<i>Vermivora cyanoptera</i>
Brook trout	<i>Salvelinus fontinalis</i>
Brown trout	<i>Salmo trutta</i>
Brown thrasher	<i>Toxostoma rufum</i>
Canada warbler	<i>Wilsonia canadensis</i>
Emerald ash borer	<i>Agrilus planipennis</i>
Fairy shrimp	<i>Eubbranchipus spp.</i>
Field sparrow	<i>Spizella pusilla</i>
Golden-crowned kinglet	<i>Regulus satrapa</i>
Golden-winged warbler	<i>Vermivora chrysoptera</i>
Nashville warbler	<i>Oreothlypis ruficapilla</i>
Northern goshawk	<i>Accipiter gentilis</i>
Northern parula	<i>Parula americana</i>
Northern pike	<i>Esox lucius</i>
Pine warbler	<i>Dendroica pinus</i>
Pygmy snaketail	<i>Ophiogomphus howei</i>
Red-shouldered hawk	<i>Puteo lineatus</i>
Rusty crayfish	<i>Orconectes rusticus</i>
Smallmouth bass	<i>Micropterus dolomieu</i>
Veery	<i>Catharus fuscescens</i>
Walleye	<i>Sander vitreus</i>
Winter wren	<i>Troglodytes hiemalis</i>
Wood frog	<i>Rana sylvatica</i>
Wood thrush	<i>Hylocichla mustelina</i>
Zebra mussels	<i>Dreissena polymorpha</i>
Plants	
American beech	<i>Fagus grandifolia</i>

American hazelnut	<i>Corylus americana</i>
American starflower	<i>Trientalis borealis</i>
American woolly-fruit sedge	<i>Carex lasiocarpa</i>
Annual bluegrass	<i>Poa annua</i>
Ash	<i>Fraxinus spp.</i>
Aspen	<i>Populus sp.</i>
Balsam fir	<i>Abies balsamea</i>
Bebb's willow	<i>Salix bebbiana</i>
Bird's-foot trefoil	<i>Lotus corniculata</i>
Black ash	<i>Fraxinus nigra</i>
Black cherry	<i>Prunus serotina</i>
Black spruce	<i>Picea mariana</i>
Blueberries	<i>Vaccinium spp.</i>
Blue-joint grass	<i>Calamagrostis canadensis</i>
Bogbean	<i>Menyanthes trifoliata</i>
Butter-and-eggs	<i>Linaria vulgaris</i>
Canada bluegrass	<i>Poa compressa</i>
Canadian goldenrod	<i>Solidago canadensis</i>
Canadian yew	<i>Taxus canadensis</i>
Cherries	<i>Prunus spp.</i>
Common boneset	<i>Eupatorium perfoliatum</i>
Common lake sedge	<i>Carex lacustris</i>
Common mullein	<i>Verbascum Thapsus</i>
Common tussock sedge	<i>Carex stricta</i>
Crested wood fern	<i>Dryopteris cristata</i>
Curly-leaf pondweed	<i>Potamogeton crispus</i>
Eastern hemlock	<i>Tsuga canadensis</i>
Eastern white pine	<i>Pinus strobus</i>
Grape woodbine	<i>Parthenocissus vitacea</i>
Jack pine	<i>Pinus banksiana</i>
Kentucky bluegrass	<i>Poa pratensis</i>
Leather-leaf	<i>Chamaedaphne calyculata</i>
Northern pin oak	<i>Quercus ellipsoidalis</i>
Northern white-cedar	<i>Thuja occidentalis</i>
Orange hawkweed	<i>Hieracium aurantiacum</i>

Pale corydalis	<i>Corydalis sempervirens</i>
Paper birch	<i>Betula papyrifera</i>
Pennsylvania sedge	<i>Carex pensylvanica</i>
Pines	<i>Pinus spp.</i>
Red maple	<i>Acer rubrum</i>
Red osier dogwood	<i>Cornus stolonifera</i>
Red pine	<i>Pinus resinosa</i>
Scrub oaks	<i>Quercus spp.</i>
Smooth brome	<i>Bromus inermis</i>
Speckled alder	<i>Alnus incana</i>
Sphagnum moss	<i>Sphagnum sp.</i>
Spotted Joe-Pye-weed	<i>Eupatorium maculatum</i>
Sugar maple	<i>Acer saccharum</i>
Sumacs	<i>Rhus spp.</i>
Swamp red currant	<i>Ribes triste</i>
Tall hawkweed	<i>Hieracium piloselloides</i>
Tamarack	<i>Larix laricina</i>
White meadowsweet	<i>Spiraea alba</i>
Willow	<i>Salix spp.</i>
Wool-grass	<i>Scirpus cyperinus</i>
Yellow birch	<i>Betula alleghaniensis</i>
Yellow clintonia	<i>Clintonia borealis</i>

Reference List

- Bohlen, P.J., D.M. Pelletier, P.M. Groffman, T.J. Fahey and M.C. Fisk. 2004. Influence of earthworm invasion on redistribution and retention of soil carbon and nitrogen in northern temperate forests. *Ecosystems* 7:13–27.
- Boos, T., K. Kearns, C. LeClair, B. Panke, B. Scriver, and B. Williams. 2010. *A Field Guide to Terrestrial Invasive Plants of Wisconsin*. Wisconsin DNR, Madison, WI. 124 pp.
- Buehler, D.A., J.L. Confer, R.A. Canterbury, T. Will, W.E. Thogmartin, W.C. Hunter, R. Chandler, A. Roth, and K. Kreitinger. 2012. Golden-winged Warbler status review. Chapter 1 in Roth, A.M., R.W. Rohrbaugh, T. Will, and D.A. Buehler, editors. 2012. Golden-winged Warbler (*Vermivora chrysoptera*) status review and conservation plan. <http://www.gwwa.org/>
- Buehler, D.A., A. Roth, R. Vallender, T. Will, J. Confer, R. Canterbury, S. Swarthout, K. Rosenberg, and L. Bulluck. 2007. Status and Conservation Priorities of Golden-winged Warbler in North America. *The Auk* 124:4, 1439-1445.
- Carlson, H., L.M. Andrews, and C.W. Threinen. 1975. *Surface Water Resources of Marinette County*. Department of Natural Resources, Madison, WI.
- Cleland, D.T.; Avers, P.E.; McNab, W.H.; Jensen, M.E.; Bailey, R.G., King, T.; Russell, W.E. 1997. National Hierarchical Framework of Ecological Units. Published in, Boyce, M. S.; Haney, A., ed. 1997. *Ecosystem Management Applications for Sustainable Forest and Wildlife Resources*. Yale University Press, New Haven, CT. pp. 181-200.
- Collins, B. M. 2011. Pike Wild River Breeding Bird Survey Final Report. A report submitted to the Natural Heritage Inventory, Bureau of Endangered Resources.
- Curtis, J. T. 1959. *The Vegetation of Wisconsin*. University of Wisconsin Press, Madison, WI. 657 pp.
- Cutright, N. J., B. Harriman, R. Howe. 2006. *Atlas of the Breeding Birds of Wisconsin*. Wisconsin Society of Ornithology.
- Dott, R.H. Jr. and J.W. Attig. 2004. *Roadside Geology of Wisconsin*. Mountain Press Publishing Company. Missoula, Montana.
- Ecosystem Management Planning Team [EMPT]. 2007. Table of Opportunities for Sustain Natural Communities by Ecological Landscape. Available online: <http://dnr.wi.gov/landscapes/ecoloppstable.pdf>
- Epstein, E.J., E.J. Judziewicz, and E.A. Spencer. 2002. Wisconsin Natural Community Abstracts. Department of Natural Resources, Bureau of Endangered Resources, Madison, WI. Available online: <http://dnr.wi.gov/org/land/er/communities/index.asp>
- Finley, R.W. 1976. *Original Vegetation Cover of Wisconsin*. Map compiled from General Land Office
- Forest Stewardship Council [FSC]. 2009. *Draft 7 FSC-US Forest Management Standard*. Minneapolis, MN.

- Groffman, P.M., P.J. Bohlen, M.C. Fisk, and T.J. Fahey. 2004. Exotic earthworm invasion and microbial biomass in temperate forest soils. *Ecosystems* 7:45-54.
- Gundale, M.J. 2002. Influence of exotic earthworms on soil organic horizon and the rare fern *Botrychium mormo*. *Conservation Biology* 16:1555–1561.
- Hale, C.M., L.E. Frelich and P.B. Reich. 2005. Exotic European earthworm invasion dynamics in northern hardwood forests of Minnesota, USA. *Ecological Applications* 15:848–860.
- Hawbaker, T.J., V.C. Radeloff, C.E. Gonzalez-Abraham, R.B. Hammer, and M.K. Clayton. 2006. Changes in the road network, relationships with housing development, and the effects on landscape pattern in northern Wisconsin: 1937 to 1999. *Ecological Applications* 16: 1222-1237.
- Hay, R.W. and T. Thayer. 2011. Pike Wild River Amphibians and Reptile Habitat Assessment and Species Observations, Marinette County, WI. A report conducted for the Natural Heritage Inventory, Bureau of Endangered Resources.
- Hendrix, P.F. and P.J. Bohlen. 2002. Exotic earthworm invasions in North America: ecological and policy implications. *Bioscience* 52:801–811.
- Invasive Species Best Management Practices*. Wisconsin Council on Forestry. Web. <<http://council.wisconsinforestry.org/invasives/>>.
- Krause, J.S. 2011. Pike Wild River Raptor Survey Final Report. A report submitted to the Natural Heritage Inventory, Bureau of Endangered Resources.
- Kreitinger, K. and A. Paulios, editors. 2007-2010. The Wisconsin All-Bird Conservation Plan, Version 1.0. Wisconsin Bird Conservation Initiative. Wisconsin Department of Natural Resources. Madison, WI.
- Kourtev, P.S., W.Z. Huang and J.G. Ehrenfeld. 1999 Differences in earthworm densities and nitrogen dynamics in soils under exotic and native plant species. *Biological Invasions* 1:237–245.
- Lorenz, H.E. 1991. Soil Survey of Marinette County, Wisconsin. US Department of Agriculture, Soil Conservation Service, in cooperation with the Research Division of the College of Agricultural and Life Sciences, University of Wisconsin.
- Martin, K.J., S. Lutz, M. Worland. 2007. Golden-winged Warbler Habitat Use and Abundance in Northern Wisconsin. *The Wilson Journal of Ornithology* 119:4, 523-532.
- Partners in Amphibian and Reptile Conservation (PARC). 2002. Habitat Management Guidelines for Amphibians and Reptiles of the Midwest.
- Radeloff, V.C., R.B. Hammer, and S.I. Stewart. 2005. Sprawl and forest fragmentation in the U.S. Midwest from 1940 to 2000. *Conservation Biology* 19: 793-805.
- Sauer, J. R., J. Hines, and J. Fallon. 2004. The North American Breeding Bird Survey, Results and Analysis 1966-2003. Version 2004.1. USGS, Patuxent Wildlife Research Center, Laurel, Maryland, USA.
- Streby, H. M., J. P. Loegering, and D. E. Andersen. 2012. Spot-mapping underestimates song-territory size and use of mature forest by breeding golden-winged warblers in Minnesota, USA. *Wildlife Society Bulletin* 36:40-46.

- Suarez, E.R., D.M. Pelletier, T.J. Fahey, P.M. Groffman, P.J. Bohlen, and M.C. Fisk. 2004. Effects of exotic earthworms on soil phosphorous cycling in two broadleaf temperate forests. *Ecosystems* 7:28-44.
- United States Fish and Wildlife Service [USFWS]. In Prep. DRAFT Golden-winged Warbler Status Assessment and Conservation Action Plan.
- Wiegmann, S.M. 2006. Fifty years of change in northern forest understory plant communities of the upper Great Lakes. Ph.D. Dissertation. University of Wisconsin, Madison. 206 pp.
- Wisconsin Bird Conservation Initiative [WBCI]. 2011. State of the Birds: Wisconsin
- Wisconsin Council on Forestry. 2008. *Wisconsin's Forest Sustainability Framework* (97 pp). Published by Wisconsin Department of Natural Resources, Madison, Wisconsin (WDNR PUB FR-423-2008). <http://council.wisconsinforestry.org/framework/pdf/SustainabilityFramework.pdf>
- Wisconsin Department of Natural Resources [WDNR]. 1993. Wisconsin DNR Wisland GIS coverage.
- Wisconsin Department of Natural Resources [WDNR]. In Prep. DRAFT Ecological Landscapes of Wisconsin. State of Wisconsin, Dept. of Nat. Resources, Handbook. 1805.1. Madison, WI
- Wisconsin Department of Natural Resources [WDNR]. 1995. Wisconsin's Biodiversity as a Management Issue: A Report to Department of Natural Resources Managers. Madison, WI.
- Wisconsin Department of Natural Resources [WDNR]. 2004. Wisconsin's Statewide Forest Plan: Ensuring a Sustainable Future. Available on the WDNR Web site: dnr.wi.gov/forestry/assessment/.
- Wisconsin Department of Natural Resources [WDNR]. 2005. Wisconsin's Strategy for Wildlife Species of Greatest Conservation Need. Madison, WI.
- Wisconsin Department of Natural Resources [WDNR]. 2006a. Wisconsin Land Legacy Report: an inventory of places critical in meeting Wisconsin's future conservation and recreation needs. Madison, WI.
- Wisconsin Department of Natural Resources [WDNR]. 2006b. Wisconsin Wildlife Action Plan. Available at <http://dnr.wi.gov/org/land/er/wwap/plan/>.
- Wisconsin Department of Natural Resources [WDNR]. 2006c. Old-growth and Old Forests Handbook. In preparation. Madison, WI.
- Wisconsin Department of Natural Resources [WDNR]. 2008. Wisconsin Wildlife Action Plan Implementation: Priority Conservation Actions and Conservation Opportunity Area. Available at: http://dnr.wi.gov/org/land/er/wwap/implementation/pdfs/WAP_Implementation_Report_2008.pdf
- Wisconsin Department of Natural Resources [WDNR]. 2009. DNR Land Certification. Available online: <http://dnr.wi.gov/forestry/certification/dnrland.html>
- Wisconsin Department of Natural Resources [WDNR]. 2010a. Emerald Ash Borer and Forest Management. Available online: <http://www.dnr.wi.gov/forestry/fh/PDF/EABWIManagementGuidelines.pdf>.
- Wisconsin Department of Natural Resources [WDNR]. 2010b. Wisconsin's Statewide Forest Assessment. Available online: <http://dnr.wi.gov/forestry/assessment/strategy/assess.htm>.

Wisconsin Department of Natural Resources [WDNR]. 2010c. Wisconsin's Statewide Forest Strategy. Available online: <http://dnr.wi.gov/forestry/assessment/strategy/overview.htm>.

Wisconsin Forest Inventory & Reporting System [WisFIRS]. Release 7. Accessed November 2011.

Wisconsin Natural Heritage Working List. Wisconsin Department of Natural Resources. Web. <<http://dnr.wi.gov/org/land/er/wlist/>>.

Additional Resources

Numerous online resources are available for learning more about the rare species, natural communities, and ecological concepts contained within this report. These are just a few of the resources that we recommend.

1. **Bureau of Endangered Resources' Animals, Plants, and Communities Web Pages**

Information for plants, animals, and natural communities on the Wisconsin Working List, as well as Species of Greatest Conservation Need from the Wisconsin Wildlife Action Plan. For reptiles and amphibians, information for more common species is also provided here. At this time, the level of detail available varies among species; some have detailed factsheets while others have only a short paragraph or a map. These pages will continue to evolve as more information becomes available and are the Bureau of Endangered Resources' main source of information for species and communities. dnr.wi.gov/org/land/er/biodiversity/

2. **Wisconsin Natural Heritage Inventory Working List**

The Wisconsin Natural Heritage Working List contains species known or suspected to be rare in the state and natural communities native to Wisconsin. It includes species legally designated as "Endangered" or "Threatened" as well as species in the advisory "Special Concern" category. This Web page offers a printable pdf file and a key to the Working List for use in conjunction with the information provided in #1 above. dnr.wi.gov/org/land/er/wlist/

3. **Ecological Landscapes of Wisconsin Handbook**

Wisconsin's 16 Ecological Landscapes have unique combinations of physical and biological characteristics such as climate, geology, soils, water, or vegetation. This handbook will contain a chapter for each of these landscapes with detailed information about their ecology, socioeconomics, and ecological management opportunities. An additional introductory chapter will compare the 16 landscapes in numerous ways, discuss Wisconsin's ecology on the statewide scale, and introduce important concepts related to ecosystem management in the state. The full handbook is in development as of this writing, and chapters will be made available online as they are published. Currently, a set of Web pages provide brief Ecological Landscape descriptions, numerous maps, and other useful information, including management opportunities for natural communities and Species of Greatest Conservation Need. dnr.wi.gov/landscapes/

4. **The Wisconsin Wildlife Action Plan**

This plan is the result of a statewide effort to identify native Wisconsin animal species of greatest conservation need. The plan also presents priority conservation actions to protect the species and their habitats. The plan itself is available online, and there are several online tools to explore the data within the plan. The Web pages are closely integrated with the pages provided in items #1 and #3 above. The Wildlife Action Plan Web pages are quite numerous, so we recommend the following links as good starting points for accessing the information.

- the plan itself: dnr.wi.gov/org/land/er/wwap/
- explore Wildlife Action Plan data: dnr.wi.gov/org/land/er/wwap/explore/
- Wildlife Action Plan Implementation: dnr.wi.gov/org/land/er/wwap/implementation/

5. **Wisconsin's Biodiversity as a Management Issue - A Report to Department of Natural Resources Managers**

This now out-of-print report presents a department strategy for conserving biological diversity. It provides department employees with an overview of the issues associated with biodiversity and

provides a common point of reference for incorporating the conservation of biodiversity into our management framework. The concepts presented in the report are closely related to the material provided in this report, as well as the other resources listed in this section.

dnr.wi.gov/org/es/science/publications/rs915_95.htm

6. Wisconsin's Statewide Forest Strategy

Wisconsin's Statewide Forest Strategy is a collection of many strategies and actions designed to address major issues and priority topics over the next five to ten years. It provides a long-term, comprehensive, coordinated approach for investing resources to address the management and landscape priorities identified in the Statewide Forest Assessment. Several of the strategies contain issues related to biodiversity and ecosystem management.

dnr.wi.gov/forestry/assessment/strategy/overview.htm

7. 2010 Wisconsin's Statewide Forest Assessment

The goal of this project was to assess the "state of affairs" of Wisconsin's public and private forests and analyze the sustainability of our forested ecosystems. The Statewide Forest Assessment helps to explain trends, identify issues, and present an updated view of the status of forests in Wisconsin. The first chapter deals with biological diversity in Wisconsin's forests, and the major conclusions from this assessment were used to develop the strategies in # 6 above.

dnr.wi.gov/forestry/assessment/strategy/assess.htm

Appendix A

Natural Heritage Inventory Overview and General Methodology

This biotic inventory and analysis was conducted by the Wisconsin Natural Heritage Inventory (NHI) program. The Wisconsin NHI program is part of the Wisconsin DNR's Bureau of Endangered Resources and a member of an international network of Natural Heritage programs representing all 50 states, as well as portions of Canada, Latin America, and the Caribbean. These programs share standardized methods for collecting, processing, and managing data for rare species, natural communities, and certain other natural features (e.g., bird rookeries). NatureServe, an international non-profit organization, coordinates the network. This appendix provides a general overview of the methodology we use for these projects. Please see the NatureServe Web site for more detailed information about standard methods used by the Heritage Network (www.NatureServe.org) for locating, documenting, and ranking rare species and natural community occurrences.

General Process Used when Conducting Biotic Inventories for Master Planning

The Wisconsin NHI Program typically uses a "coarse filter-fine filter" approach to conducting biotic inventory projects for master planning. This approach begins with a broad assessment of the natural communities and aquatic features present, along with their relative quality and condition. The area's landforms, soils, topography, hydrology, current land uses, and the surrounding matrix are also evaluated using Geographic Information Systems (GIS) and other electronic and hardcopy data sources. Data that describe conditions for the area prior to Euro-American settlement are often used during this step and at other times to further understand the ecological capabilities of the area. Often, we consult with local managers, biologists, or others familiar with the ecology of the area when preparing for an inventory project. The goals for this step are to identify the important ecological attributes and biological processes present, as well as to focus our inventory efforts.

The level of survey intensity varies based on the size and ecological complexity of the property or group of properties, as well as the resources available. For larger properties such as state forests, biotic inventory efforts typically take more than one year. Ideally, taxa surveys are conducted following a coarse-filter analysis that sometimes include extensive natural community surveys. There is often time for "mop-up work" during the year following the completion of the main survey effort, whereby additional surveys are conducted for areas that could not be reached the first year or for which new information has become available. For smaller properties, a "Rapid Ecological Assessment" often takes the place of a full-scale biotic inventory. The level of effort for these projects varies based on the needs of the study area, although surveys are almost always completed during one field season. Coarse filter work for rapid assessments is often done based on GIS data, aerial photos, data acquired from previous efforts, and information from property managers and others knowledgeable about the area.

Taxa-specific surveys can be costly and intensive and sometimes must be completed during a very narrow period of time. For example, bird surveys must be completed within an approximately one-month time window. For this and several other reasons, ***our surveys cannot locate every rare species occurrence within a given area.*** Therefore, it is important to use resources as efficiently as possible, making every effort to identify the major habitats present in the study area from the start. This approach concentrates inventory efforts on those sites most likely to contain target species to maximize efficient use of resources. Communication among biologists during the field season can help identify new areas of interest or additional priorities for surveys. The goal is to locate species populations with the highest conservation value whenever possible.

After all of the data are collected, occurrences of rare species, high-quality natural communities, and certain other features are documented, synthesized, and incorporated into the NHI Database. The NHI program refers to this process as “mapping” the data and uses a tabular and spatial database application designed specifically for the Heritage Network. Other secondary databases are also used by the Wisconsin NHI Program for storing additional species and community information such as species lists, GPS waypoints, photos, and other site documentation.

Once the data mapping and syntheses are completed, the NHI Program evaluates data from the various department biologists, contractors, and other surveyors. This information is examined along with many other sources of spatial and tabular information including topographic maps, various types of aerial photography, digital soil and wetland maps, hydrological data, forest reconnaissance data, and land cover data. Typically, GPS waypoints and other spatial information from the various surveys are superimposed onto these maps for evaluation by NHI biologists.

In addition to locating important rare species populations and high-quality natural community occurrences, the major products culminating from all of this work are the “Primary Sites.” These areas contain relatively undisturbed, high-quality, natural communities; provide important habitat for rare species; offer opportunities for restoration; could provide important ecological connections; or some combination of the above factors. The sites are meant to highlight, based on our evaluation, the best areas for conserving biological diversity for the study area. They often include important rare species populations, High Conservation Value Forests, or other ecologically important areas.

The final report describes the Primary Sites, as well as rare or otherwise notable species, and other ecological opportunities for conserving or enhancing the biological diversity of the study area. The report is intended for use by department master planning teams and others and strives to describe these opportunities at different scales, including a broad, landscape context that can be used to facilitate ecosystem management.

Select Tools Used for Conducting Inventory

The following are descriptions of standard tools used by the NHI Program for conducting biotic inventories. Some of these may be modified, dropped, or repeated as appropriate to the project.

File Compilation: Involves obtaining existing records of natural communities, rare plants and animals, and aquatic features for the study area and surrounding lands and waters from the NHI Database. Other databases with potentially useful information may also be queried, such as: forest reconnaissance data; the DNR Surface Water Resources series for summaries of the physical, chemical, and biological characteristics of lakes and streams (statewide, by county); the Milwaukee Public Museum's statewide Herp Atlas; the Wisconsin Breeding Bird Atlas; other NHI “atlas” and site databases; museum/herbarium collections for various target taxa; soil surveys; geological surveys; and the department's fish distribution database.

Additional data sources are sought out as warranted by the location and character of the site, and the purpose of the project. Manual files maintained within the Bureau of Endangered Resources, including the State Natural Area files, often contain information on a variety of subjects relevant to the inventory of natural features for an area.

Literature Review: Field biologists involved with a given project consult basic references on the natural history and ecology of the area, as well as any documented rare species. This sometimes broadens and/or sharpens the focus of the inventory efforts.

Target Elements: Lists of target elements including natural communities, rare plants and animals, and aquatic features are developed for the study area. Field inventory is then scheduled for the times when these elements are most identifiable or active. Inventory methods follow accepted scientific standards for each taxon.

Compilation of Maps and Other Spatial Data: USGS 7.5 minute topographic quadrangles, most often in digital form, serve along with aerial photos as the base maps for field survey and often yield useful clues regarding access, extent of area to be surveyed, developments, and the presence and location of special features. These are used in conjunction with numerous GIS layers, which are now a basic resource tool for the efficient and comprehensive planning of surveys and the analysis of their results.

WDNR wetland maps consist of aerial photographs upon which all wetlands down to a scale of 2 or 5 acres have been delineated. Each wetland polygon is classified based on characteristics of vegetation, soils, and water depth. These polygons have been digitized for most counties, and the resulting GIS layers can be superimposed onto other maps.

Ecoregion GIS layers are useful for comprehensive projects covering large geographic areas such as counties, national and state forests, and major watersheds. These maps integrate basic ecological information on climate, landforms, geology, soils, and vegetation. Ecological Landscapes provide the broad framework most often used in Wisconsin; however smaller units, including Landtype Associations, can be very helpful for evaluating ecoregions at finer scales.

Aerial photographs: These provide information on a study area not available from maps, paper files, or computer printouts. Examination of both current and historical photos, taken over a period of decades, can be especially useful in revealing changes in the environment over time. The Wisconsin NHI Program uses several different types of both color and black and white air photos. Typically, these are in digital format, although paired photos in print format can be valuable for stereoscopic viewing. High-resolution satellite imagery is often cost-prohibitive but is available for some portions of the state and is desirable for certain applications.

Original Land Survey Records: The surveyors who laid out the rectilinear Town-Range-Section grid across the state in the mid-nineteenth century recorded trees by species and size at all section corners and along section lines. Their notes also included general impressions of vegetation, soil fertility, and topography, and note aquatic features, wetlands, and recent disturbances such as windthrow and fire. As these surveys typically occurred prior to extensive settlement of the state by Europeans, they constitute a valuable record of conditions prior to extensive modification of the landscape by European technologies and settlement patterns. The tree data are available in GIS format as raw points or interpreted polygons, and the notes themselves can provide helpful clues regarding the study area's potential ecological capabilities.

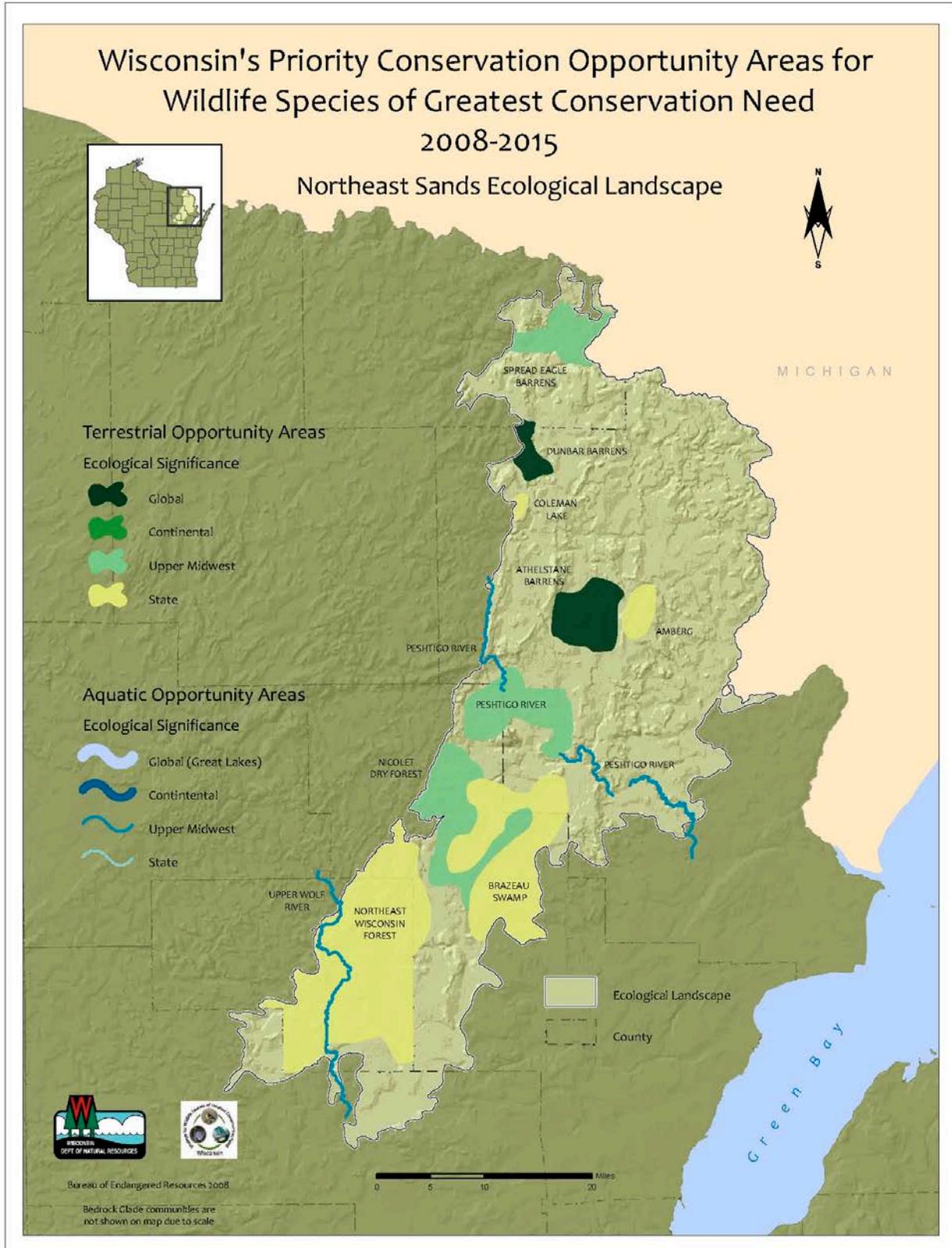
Interviews: Interviews with scientists, naturalists, land managers or others knowledgeable about the area to be surveyed often yield invaluable information.

Global Positioning Systems (GPS): Small, portable GPS units are now a routine piece of field equipment used for virtually all NHI survey work. Collecting coordinates (waypoints) facilitates mapping and makes it easy to quickly communicate specific locations among biologists. Often waypoints are paired with photos and/or other information and stored in a waypoint tracking database.

Aerial Reconnaissance: Fly-overs are desirable for large sites, and for small sites where contextual issues are especially important. When possible, this should be done both before and after ground level work. Flights are

scheduled for those times when significant features of the study area are most easily identified and differentiated. They are also useful for observing the general lay of the land, vegetation patterns and patch sizes, aquatic features, infrastructure, and disturbances within and around the site.

Appendix B



Appendix C

Summary Descriptions for Rare Species and High Quality Natural Communities Documented from Townships Adjacent to the Pike Wild River

The following paragraphs give brief summary descriptions for some of the rare species and high quality natural communities known from townships adjacent to the Pike Wild River and mapped in the NHI Database. More information can be found on the Endangered Resources Web site (www.dnr.wi.gov/org/land/er/) for several of these species and natural communities.

Rare Animals

A Tiger Beetle

A Tiger Beetle (*Cicindela patruela patruela*), a State Special Concern beetle, has been found in Semi open pine/oak barrens, jack and red pine stands with open areas on sandy soil, sandy firelanes or trails. Understory usually dominated by *Vaccinium*, bracken fern, and with a ground cover of moss patches. Optimal identification period is in the spring/fall with diminished numbers in mid summer.

Bald Eagle

Bald Eagle (*Haliaeetus leucocephalus*), a bird listed as Special Concern in Wisconsin and Federally protected by the Bald and Golden Eagle Protection Act, prefers large trees in isolated areas in proximity to large areas of surface water, large complexes of deciduous forest, coniferous forest, wetland, and shrub communities. Large lakes and rivers with nearby tall pine trees are preferred for nesting. The breeding season extends from February through August. Favored wintering and roosting habitat includes wooded valleys near open water and major rivers from December through March.

Banded Killifish

Banded killifish (*Fundulus diaphanus*), a State Special Concern fish, prefers clear water of the bays and quiet backwaters of large lakes and medium to large streams with and sparse to no vegetation over gravel, sand, silt, marl, clay detritus or cobble. Spawning occurs from June through mid-August.

Black-billed Cuckoo

Black-billed cuckoo (*Coccyzus erythrophthalmus*) is a Special Concern species in Wisconsin. They typically nest in deciduous and mixed deciduous-coniferous woodlands near lakes or streams, and less often in coniferous forests. Their breeding season occurs from mid May to late August.

Blanding's Turtle

Blanding's turtles (*Emydoidea blandingii*) are listed as a Threatened species in Wisconsin. They utilize a wide variety of aquatic habitats including deep and shallow marshes, shallow bays of lakes and impoundments where areas of dense emergent and submergent vegetation exists, sluggish streams, oxbows and other backwaters of rivers, drainage ditches (usually where wetlands have been drained), and sedge meadows and wet meadows adjacent to these habitats. This species is semi-terrestrial and individuals may spend a good deal of time on land. They often move between a variety of wetland types during the active season, which can extend from early March to mid-October. They overwinter in standing water that is typically more than 3 feet in deep and with a deep organic substrate but will also use both warm and cold-water streams and rivers where they can avoid freezing. Blanding's generally breed in spring, late summer or fall. Nesting occurs from about mid-May through June depending on spring temperatures. They strongly prefer to nest in sandy soils and may travel well over a mile to find

suitable soils. This species appear to display nest site fidelity, returning to its natal site and then nesting in a similar location annually. Hatching occurs from early August through early September but hatchlings can successfully overwinter in the nest, emerging the following late April or May. This species takes 17 to 20 years or more to reach maturity.

Brown Thrasher

Brown Thrasher (*Toxostoma rufum*) is a bird of Special Concern in Wisconsin. This species nests in hedgerows and in brushy edges of fields and forests. Breeding occurs from early May to mid July.

Canada Warbler

Canada Warblers (*Wilsonia canadensis*) are typically most abundant in moist, mixed coniferous-deciduous forests with a well-developed understory. In Wisconsin they occur in spruce, hemlock, and balsam fir forest types in the northern counties. Important components of breeding habitat include conifers and often creeks and streams. The Canada Warbler nests in dense vegetation, often in areas with mosses, ferns, and decaying stumps or logs. The breeding season occurs from early June to early July.

Delicate Emerald

Delicate emerald (*Somatochlora franklini*), a State Special Concern dragonfly, has been found in spring-fed sphagnum bogs. The flight period extends from early to late June.

Dorcas Copper

Dorcas copper (*Lycaena dorcas*), a State Special Concern butterfly, has been found in boreal rich fens, wet meadows, lake margins, bogs and poor fens, tamarack and black spruce swamps. Shrubby cinquefoil (*Pentaphylloides floribunda*) is commonly used as the host plant in the Great Lakes area and appears to be the foodplant of Door County populations. However, most *L. dorcas* sites in Wisconsin contain no shrubby cinquefoil and the butterfly is closely associated with marsh cinquefoil (*Comarum palustris*). Adults fly from about July 1 into early August in Wisconsin or as early as mid June during years with an early spring.

Eastern Hog-nosed Snake

Eastern Hog-nosed snakes (*Heterodon platirhinos*), listed as Special Concern in Wisconsin, are harmless to humans despite their intimidating behavior of puffing up with air, flattening their necks like cobras, and hissing loudly when threatened, garnering the nickname “puff adder”. Hog-nosed snakes almost never bite, but rather will feign death if provoked enough. These snakes are often found in open, sandy woodlands and their upturned, hog-like snout is used to burrow after toads, a favorite food. Hog-nosed snakes mate in the Spring and females lay up to 60 eggs in June or July, usually in an underground burrow. The young snakes hatch out about 60 days later, and are usually grayish with black blotches. Adult coloration appears as they mature.

Field Sparrow

Field Sparrow (*Spizella pusilla*) is a Special Concern species in Wisconsin. This species prefers dry, moderately brushy or early successional upland habitats such as dry prairies and old fields, idle grasslands, pastures, areas that have recently been cut and burned, pine barrens, young plantations, and oak savannas. Their breeding season occurs from late April to late August.

Forcinate Emerald

Forcinate emerald (*Somatochlora forcipata*), a State Special Concern dragonfly, has been found in small spring-fed woodland streams and pools. The flight period extends from mid June through early August.

Gray Wolf

Gray wolf (*Canis lupus*), also referred to as timber wolf, is currently listed as State Special Concern fully protected wild animal. Wolves are also on the State list of Protected Wild Animals. Gray wolves are social animals, living in a family group, or pack. Pack sizes in Wisconsin average 2-6 individuals, with a few packs as large as 10-12 animals. A territory represents the geographic extent that a particular wolf pack will utilize in search of food and shelter. A wolf pack's territory may cover 20-80 square miles.

Hooded Warbler

Hooded Warbler (*Wilsonia citrina*), a bird listed as Threatened in Wisconsin. This species is found in large upland forest tracts in Wisconsin, where they occur in pockets of dense understory near small or partial canopy openings. Breeding occurs from late May through mid July.

Lake Sturgeon

Lake Sturgeon (*Acipenser fulvescens*), a fish listed as Special Concern, prefers large rivers and lakes. It also lives in the shoal waters of the Great Lakes. Inland it shows a preference for the deepest mid-river areas and pools. Spawning occurs from late April through early June in cold, shallow fast water.

Merlin

Merlin (*Falco columbarius*), a bird listed as Special Concern, prefers coniferous forests especially stands of spruce, along lakeshores, but may be observed in agricultural areas. The recommended avoidance period is from early June through mid-August.

Osprey

Osprey (*Pandion haliaetus*) prefer large trees in isolated areas in proximity to large areas of surface water, large complexes of deciduous forest, coniferous forest, wetland, and shrub communities. Large lakes and rivers with nearby tall pine trees are preferred for nesting. The breeding season extends from late April through August.

Pronghorned Clubtail

Pronghorned clubtail (*Gomphus graslinellus*), a State Special Concern dragonfly has been found in slow moving streams, ponds or lakes. The flight period is early June through late July.

Pygmy Snaketail

Pygmy snaketail (*Ophiogomphus howei*), a dragonfly presently listed as a Federal Species of Concern and Threatened in Wisconsin has been found in small to large, clean, fast-flowing warm streams with gravel-sand substrates. Adults apparently forage and perch on the stream-side forest canopy. The flight period extends from late May through late June.

Red-shouldered Hawk

Red-shouldered Hawk (*Buteo lineatus*), a bird listed as Threatened in Wisconsin. This species prefers larger stands of medium-aged to mature lowland deciduous forests, dry-mesic and mesic forest with small wetland pockets. Breeding occurs from mid-March through early August.

Round Pigtoe

Round pigtoe (*Pleurobema sintoxia*), a State Special Concern mussel. In Wisconsin, this species prefers various habitat types. It occurs only in clean water of small streams to large rivers on stable substrate. The known host fish include a number of cyprinid species.

Ski-tailed Emerald

Ski-tailed emerald (*Somatochlora elongata*), a State Special Concern dragonfly has been found in forest streams with rapids, outlets of lakes and ponds. The flight period extends from early June through late July.

Slaty Skimmer

Slaty skimmer (*Libellula incesta*), a State Special Concern dragonfly, has been found in marshy ponds near floodplain forests. The flight period extends from early June through mid July.

Tawny Crescent Spot

Tawny crescent spot (*Phyciodes batesii*), a state Special Concern butterfly and Federal Species of Concern. This species is typically found in areas with sandy soil. Dry clearings in the north and roadsides through dry forest and barrens. Its host plants are Asters including wavy-leaved aster (*Aster undulatus*), which is found in the eastern United States, and possibly panicled aster (*A. lanceolatus*) in Wisconsin. One flight in Wisconsin generally from early June to the end of the month. The flight has been recorded a couple times in May in abnormally advanced seasons.

Wood Turtle

Wood turtles (*Clemmys insculpta*), a Threatened species in Wisconsin, prefer clean rivers and streams with moderate to fast flows and adjacent riparian wetlands and upland deciduous forests. This species often forages in open wet meadows or in shrub-carr habitats dominated by speckled alder. They overwinter in streams and rivers in deep holes or undercut banks where there is enough water flow to prevent freezing. This semi-terrestrial species tends to stay within about 300 meters of rivers and streams but exceptions certainly occur, especially within the driftless area of southwestern and western Wisconsin. This species becomes active in spring as soon as the ice is gone and air temperatures reach around 50 degrees in March or April. They can remain active into mid-October but have been seen breeding under the ice. Wood turtles can breed at any time of year, but primarily during the spring or fall. Nesting usually begins in late May in northern WI and early June in southern WI and continues through June. This species nests in sand or gravel, usually very close to the water, although it is known to nest along sand and gravel roads or in abandoned gravel pits some distance from water. Hatching occurs in 55-75 days (August) depending on air temperatures. This species does not overwinter in nests, unlike other WI turtles.

Rare Plants

Dwarf Milkweed

Dwarf Milkweed (*Asclepias ovalifolia*), a State Threatened plant, is found in periodically brushed areas, rights-of-way. Blooming occurs early June through early July; fruiting occurs late June through late August. The optimal identification period for this species is throughout June.

Large-flowered Ground-cherry

Large-flowered Ground-cherry (*Leucophysalis grandiflora*), a State Special Concern plant, is found mostly in recently burned moist to dry forests, as well as gravel bars of large rivers. Blooming occurs throughout July; fruiting occurs throughout August. The optimal identification period for this species is throughout July.

Limestone Oak Fern

Limestone Oak Fern (*Gymnocarpium robertianum*), a State Special Concern plant, is found on moist shaded dolomite or, less commonly, sandstone cliffs. The optimal identification period for this species is late May through late September.

Missouri Rock-cress

Missouri Rock-cress (*Arabis missouriensis*), a State Special Concern plant, is found in soil pockets on acidic cliffs, as well as in pine forests in sterile sand and gravel outwash plains. Blooming occurs late

May through late June; fruiting occurs late June through late July. The optimal identification period for this species is late May through late June.

Ram's-head Lady's-slipper

Ram's-head Lady's-slipper (*Cypripedium arietinum*), a State Threatened plant, is found on basic substrates in various habitats, but it is most characteristic of conifer swamps. Blooming occurs late May through early June; fruiting occurs late June through late July. The optimal identification period for this species is late May through early June.

Showy Lady's-slipper

Showy Lady's-slipper (*Cypripedium reginae*), a State Special Concern plant, is found in neutral to alkaline forested wetlands; it is also found in rich upland forests in seeps and moist to dry clay bluffs. Blooming occurs late June through late July; fruiting occurs late July through late August. The optimal identification period for this species is late June through late July.

Natural Communities

Bedrock Glade

Bedrock glades are xeric, sparsely vegetated, non-vertical bedrock exposures, with thin, often discontinuous soils. The rock types vary from quartzite (Baraboo Hills, McCaslin Mountain), to basalt (lower St. Croix River valley), to granite (northeastern Wisconsin). The flora can include prairie, savanna, or barrens components, some of them reaching their northern range limits in this community type, as well as bare rock specialists. Tree and shrub cover is usually sparse, and often has structural similarities to a thinly timbered savanna or woodland habitat. Important woody species may include pines (*Pinus* spp.), oaks (*Quercus* spp.), hickories (*Carya* spp.), and cherries (*Prunus* spp.), along with dogwood (*Cornus* spp.), hazelnuts (*Corylus* spp.), prairie willow (*Salix humilis*), and ericads such as huckleberry (*Vaccinium* sp.). Xerophytic pteridophytes such as rusty woodsia (*Woodsia ilvensis*), northern fragile fern (*Cystopteris fragilis*), and rock spike-moss (*Selaginella rupestris*) are characteristic plants, as are lichens and mosses. Glades have apparently served as refugia for light-demanding species that are adapted to the more open savanna and prairie conditions that were formerly much more abundant and widespread in parts of Wisconsin. Many uncommon plant species usually associated with these habitats were documented in the glades of the Baraboo Hills.

Black Spruce Swamp

An acidic conifer swamp forest characterized by a relatively closed canopy of black spruce (*Picea mariana*) and an open understory in which Labrador-tea (*Ledum groenlandicum*) and sphagnum mosses (*Sphagnum* spp.) are often prominent, along with three-leaved false Solomon's-seal (*Smilacina trifolia*), creeping snowberry (*Gaultheria hispidula*), and three-seeded sedge (*Carex trisperma*). The herbaceous understory is otherwise relatively depauperate. This community is closely related to Open Bogs and Muskegs, and sometimes referred to as Forested Bogs outside of Wisconsin.

Ephemeral Pond

These ponds are depressions with impeded drainage (usually in forest landscapes), that hold water for a period of time following snowmelt but typically dry out by mid-summer. Common aquatic plants of these habitats include yellow water crowfoot (*Ranunculus flabellaris*), mermaid weed (*Proserpinaca palustris*), Canada bluejoint grass, floating manna grass (*Glyceria septentrionalis*), spotted cowbane (*Cicuta maculata*), smartweeds (*Polygonum* spp.), orange jewelweed (*Impatiens capensis*), and sedges. Ephemeral ponds provide critical breeding habitat for certain invertebrates, as well as for many amphibians such as frogs and salamanders.

Northern Hardwood Swamp

The northern hardwood swamp is a deciduous forested wetland that occurs along lakes or streams, or in insular basins in poorly drained morainal landscapes. This community occurs across the state, but is most common in the northern Ecological Landscapes. The dominant tree species is black ash (*Fraxinus nigra*), but in some stands red maple (*Acer rubrum*), yellow birch (*Betula allegheniensis*), and (formerly) American elm (*Ulmus americana*) are also important. The tall shrub speckled alder (*Alnus incana*) may be locally common. The herbaceous flora is often diverse and may include many of the same species found in Alder Thickets. Typical species are marsh-marigold (*Caltha palustris*), swamp raspberry (*Rubus pubescens*), skullcap (*Scutellaria galericulata*), orange jewelweed (*Impatiens capensis*), and many sedges (*Carex* spp.). Soils may be mucks or mucky sands

Northern Mesic Forest

Prior to Euro-American settlement, the northern mesic forest covered the largest acreage of any Wisconsin vegetation type. It is still very extensive, but made up of second-growth forests that developed following the Cutover. It forms the matrix for most of the other community types found in northern Wisconsin, and provides habitat for at least some portion of the life cycle of many species. It is found primarily north of the Tension Zone (Figure 2-2), on loamy soils of glacial till plains and moraines deposited by the Wisconsin glaciation. Sugar maple (*Acer saccharum*) is dominant or co-dominant in most stands. Historically, eastern hemlock (*Tsuga canadensis*) was the second most important species, sometimes occurring in nearly pure stands with eastern white pine (*Pinus strobus*); both of these conifer species are greatly reduced in today's forests. American beech (*Fagus grandifolia*) can be a co-dominant with sugar maple in the counties near Lake Michigan. Other important tree species were yellow birch (*Betula allegheniensis*), American basswood (*Tilia americana*), and white ash (*Fraxinus americana*). The groundlayer varies from sparse and species poor (especially in hemlock stands) with wood ferns (*Dryopteris* spp.), blue-bead-lily (*Clintonia borealis*), club-mosses (*Lycopodium* spp.), and Canada mayflower (*Maianthemum canadense*), to lush and species-rich with fine spring ephemeral displays. Historically, Canadian yew (*Taxus canadensis*) was an important shrub, but it is now absent from nearly all locations. Historic disturbance regimes were dominantly gap-phase windthrow; large windstorms occurred with long return periods. After old-growth stands were cut, trees such as quaking (*Populus tremuloides*) and big-toothed aspens (*Populus grandidentata*), paper birch (*Betula papyrifera*), and red maple (*Acer rubrum*) became abundant and still are important in many second-growth northern mesic forests. Several distinct associations within this complex warrant recognition as communities, and draft abstracts of these are currently undergoing review.

Northern Sedge Meadow

This open wetland community is dominated by sedges and grasses and occurs primarily in northern Wisconsin. There are several common, fairly distinctive, subtypes: Tussock meadow, dominated by tussock sedge (*Carex stricta*) and blue-joint grass (*Calamagrostis canadensis*); Broad-leaved sedge meadow, dominated by the robust sedges (*Carex lacustris* and/or *Carex utriculata*); and Wire-leaved sedge meadow, dominated by woolly sedge and/or few-seeded sedge. Frequent associates include blue flag (*Iris versicolor*), marsh fern (*Thelypteris palustris*), marsh bellwort (*Uvularia* sp.), manna grasses (*Glyceria* spp.), panicled aster (*Aster lanceolatus*), spotted Joe-Pye-weed (*Eupatorium maculatum*), and the bulrushes (*Schoenoplectus tabernaemontani* and *Scirpus cyperinus*). Sphagnum mosses (*Sphagnum* spp.) are either absent or they occur in scattered, discontinuous patches. Sedge meadows occur on a variety of landforms and in several ecological settings that include depressions in outwash or ground moraine landforms in which there is groundwater movement and internal drainage, on the shores of some drainage lakes, and on the margins of streams and large rivers.

Northern Dry-mesic Forest

In this forest community, mature stands are dominated by eastern white (*Pinus strobus*) and red pines (*Pinus resinosa*), sometimes mixed with northern red oak (*Quercus rubra*) and red maple (*Acer rubrum*). Common understory shrubs are hazelnuts (*Corylus* spp.), blueberries (*Vaccinium* spp.), wintergreen

(*Gaultheria procumbens*), and partridgeberry (*Mitchella repens*). Among the dominant herbs are wild sarsaparilla (*Aralia nudicaulis*), Canada mayflower (*Maianthemum canadense*), and cow-wheat (*Melampyrum* sp.).

Northern dry-mesic forests are typically found on irregular glacial topography (e.g., heads-of-outwash, tunnel channel deposits), or in areas with mixed glacial features (e.g., pitted outwash interspersed with remnant moraines). Soils are loamy sands or sands, and less commonly, sandy loams. Some occurrences are in areas where bedrock is close to the surface. Areas of northern dry-mesic forest that were historically dominated by red and eastern white pines were considered the great "pineries" before the Cutover. Today, the extent of red and eastern white pine stands is greatly decreased, while red maple, sugar maple (*Acer saccharum*), aspen (*Populus* spp.), and oaks (*Quercus* spp.) have increased. Historically, fire disturbance of low to moderate intensity and frequency was key to maintaining the northern dry-mesic forest type.

Northern Wet-mesic Forest

This forested minerotrophic wetland is dominated by northern white-cedar (*Thuja occidentalis*), and occurs on rich, neutral to alkaline peats and mucks throughout much of northern Wisconsin. Balsam fir, black ash (*Fraxinus nigra*), and spruces (*Picea* spp.) are among the many potential canopy associates. The understory is rich in mosses, lichens, liverworts, ferns, sedges, orchids, and wildflowers such as three-leaved gold-thread (*Coptis trifolia*), fringed polygala (*Polygala paucifolia*), and naked miterwort (*Mitella nuda*), and trailing sub-shrubs such as twinflower (*Linnaea borealis* subsp. *americana*) and creeping-snowberry (*Gaultheria hispidula*). A number of rare plants occur more frequently in the cedar swamps than in any other habitat. Older cedar swamps are often structurally complex, as the easily wind-thrown cedars are able to root from their branch tips. Some of the canopy associates have the potential to reach heights considerably beyond those usually attained by cedar, producing a multi-layered canopy. The tall shrub layer is often well-developed and may include speckled alder (*Alnus incana*), alder-leaf buckthorn (*Rhamnus alnifolia*), wild currants (*Ribes* spp.), and mountain maple (*Acer spicatum*). Canadian yew (*Taxus canadensis*) was formerly an important tall shrub in cedar swamps but is now rare or local.

Seepages, springs, and spring runs contribute to stand complexity and provide critical habitat for additional plants and animals. Cedar swamps are relatively common in depressions that receive mineral-enriched groundwater, and can be associated with both ground moraine and outwash landforms.

Northern Wet Forest

These weakly minerotrophic conifer swamps, located in the North, are dominated by black spruce (*Picea mariana*) and tamarack (*Larix laricina*). Jack pine (*Pinus banksiana*) may be a significant canopy component in certain parts of the range of this community complex. Understories are composed mostly of sphagnum (*Sphagnum* spp.) mosses and ericaceous shrubs such as leatherleaf (*Chamaedaphne calyculata*), Labrador-tea (*Ledum groenlandicum*), and small cranberry (*Vaccinium oxycoccos*) and sedges such as (*Carex trisperma* and *C paupercula*). The Natural Heritage Inventory has split out two entities, identified (but not strictly defined) by the two dominant species (see Black Spruce Swamp and Tamarack Swamp).

Open Bog

Bogs are acidic, low nutrient, northern Wisconsin peatlands dominated by sphagnum mosses (*Sphagnum* spp.) that occur in deep layers and accumulate over time as peat. The bog surface is often uneven, with pronounced hummock and hollow microtopography. In northern Wisconsin, bogs are frequently found in the kettle depressions of pitted outwash and morainal landforms. They also frequently occur on the borders of lakes that have low nutrient inputs. Vascular plant diversity is very low in the most acidic sites, but includes characteristic and distinctive specialists such as the narrow-leaved sedge species, cotton-

grasses (*Eriophorum* spp.), and ericaceous shrubs, especially leather-leaf (*Chamaedaphne calyculata* var. *angustifolia*), bog-laurel (*Kalmia polifolia*), bog-rosemary (*Andromeda glaucophylla*), and small cranberry (*Vaccinium oxycoccos*). Trees are absent or stunted and achieve very low cover values.

In the strictest sense, bogs receive nutrients only from precipitation and limited internal runoff. The thick layers of sphagnum isolate the bog from the influence of nutrient enriched groundwater, and create an environment characterized by high acidity, low oxygen and nutrient levels, and inhabited by a limited number of highly specialized plants that are able to tolerate or thrive in the extreme conditions. Poor fen, open bog, and muskeg often occupy different parts of the same wetland basin, which may include one or more types of lowland coniferous forest as well. Each of these communities responds to slight differences in local site conditions.

Pine Barrens

This savanna community is characterized by scattered jack pines (*Pinus banksiana*), or less commonly red pines (*P. resinosa*), sometimes mixed with scrubby Hill's and bur oaks (*Quercus ellipsoidalis* and *Q. macrocarpa*), interspersed with openings in which shrubs such as hazelnuts, (*Corylus* spp.) and prairie willow (*Salix humilis*) and herbs dominate. The flora often contains species characteristic of "heaths" such as blueberries (*Vaccinium angustifolium* and *V. myrtilloides*), bearberry (*Arctostaphylos uva-ursi*), American hazelnut (*Corylus americana*), sweet fern (*Comptonia peregrina*), and sand cherry (*Prunus pensylvanica*). Also present are dry sand prairie species such as june grass (*Koeleria macrantha*), little bluestem (*Schizachyrium scoparium*), silky and sky-blue asters (*Aster sericeus* and *A. azureus*), lupine (*Lupinus perennis*), blazing-stars (*Liatris aspera* and *L. cylindracea*), and western sunflower (*Helianthus occidentalis*). Pines may be infrequent, even absent, in some stands in northern Wisconsin and elsewhere because of past logging, altered fire regimes, and an absence of seed source.

Poor Fen

This acidic, weakly minerotrophic peatland type is similar to the Open Bog, but can be differentiated by higher pH, nutrient availability, and floristics. Sphagnum (*Sphagnum* spp.) mosses are common but don't typically occur in deep layers with pronounced hummocks. Floristic diversity is higher than in the Open Bog and may include white beak-rush (*Rhynchospora alba*), pitcher-plant (*Sarracenia purpurea*), sundews (*Drosera* spp.), pod grass (*Scheuchzeria palustris*), and the pink-flowered orchids (*Calopogon tuberosus*, *Pogonia ophioglossoides* and *Arethusa bulbosa*). Common sedges are (*Carex oligosperma*, *C. limosa*, *C. lasiocarpa*, *C. chordorrhiza*), and cotton-grasses (*Eriophorum* spp.).

Shrub-carr

This wetland community is dominated by tall shrubs such as red-osier dogwood (*Cornus stolonifera*), meadow-sweet (*Spiraea alba*), and various willows (*Salix discolor*, *S. bebbiana*, and *S. gracilis*). Canada bluejoint grass (*Calamagrostis canadensis*) is often very common. Associates are similar to those found in Alder Thickets and tussock-type Sedge Meadows. This type is common and widespread in southern Wisconsin but also occurs in the north.

Tamarack (poor) Swamp

These weakly to moderately minerotrophic conifer swamps are dominated by a broken to closed canopy of tamarack (*Larix laricina*) and a frequently dense understory of speckled alder (*Alnus incana*). The understory is more diverse than in Black Spruce Swamps and may include more nutrient-demanding species such as winterberry holly (*Ilex verticillata*) and black ash (*Fraxinus nigra*). The bryophytes include many genera other than Sphagnum. Stands with spring seepage sometimes have marsh-marigold (*Caltha palustris*) and skunk-cabbage (*Symplocarpus foetidus*) as common understory inhabitants. These seepage stands have been separated out as a distinct type or subtype in some nearby states and provinces.

Appendix D

Species of Greatest Conservation Need

The following are vertebrate Species of Greatest Conservation Need (SGCN) associated with natural community types that are present in townships adjacent to the Pike Wild River (PWR) in the Northeast Sands Ecological Landscapes. Only SGCN with a high or moderate probability of occurring in the Northeast Sands Ecological Landscapes are shown. Communities shown here are identified as management opportunities for the Northeast Sands Ecological Landscape in the Wisconsin Wildlife Action Plan (WDNR 2006b). Letters indicate the degree to which each species is associated with a particular habitat type (S=significant association, M=moderate association, and L=low association). Animal-community combinations shown here that are assigned as either “S” or “M” are also Ecological Priorities, as defined by the Wisconsin Wildlife Action Plan (see dnr.wi.gov/org/land/er/WWAP/ for more information about these data). Shaded species have been documented for the PWR.

	Major						Important						Present	
	Coldwater streams	Coolwater streams	Northern Dry Forest	Northern Dry-mesic Forest	Northern Wet-mesic Forest	Pine Barrens	Alder Thicket	Northern Hardwood Swamp	Northern Mesic Forest	Northern Sedge Meadow	Northern Wet Forest	Open Bog	Ephemeral Pond	Shrub Carr
Species that are Significantly Associated with the Northeast Sands Landscape														
American Woodcock			L	L	L	L	S	M	M	L	L	L	L	S
Black-billed Cuckoo			L	L		M	S	L	M	L	L			S
Bobolink										S		M		
Brown Thrasher			L			S								
Field Sparrow						M								
Golden-winged Warbler			M	M	L	L	S	M	M		M	M		S
Grasshopper Sparrow						L								
Lake Sturgeon														
Least Flycatcher			M	M	L			M	S					L
Mink Frog	M	S			L		M	L	L	S	L	S	M	M
Mudpuppy	M	L												
Northern Flying Squirrel			M	S	S	L		M	S		S			
Red Crossbill			S	S		M			L		L			
Red-headed Woodpecker			L	L		L								
Veery			L	M	L		S	S	M		M			S
Vesper Sparrow						S								
Water Shrew	S	S			S		M	S	M	L	S	L		L
Whip-poor-will			M	M		M			L					
Wood Thrush				L	L			L	M		L			
Wood Turtle	S	S			M	S	S	M	S	M	M		M	S
Species that are Moderately Associated with the Northeast Sands Landscape														
American Bittern							L			S		S		L

Blanding's Turtle	M	M				S	M			M			S	M
Canada Warbler			L	M	S		M	S	M		M			L
Four-toed Salamander	M	M			S		S	M	S	M	M	S	S	S
Gray Wolf			M	S	S	M	S	M	S	L	S	M		M
Lark Sparrow						M								
Northern Goshawk			L	M	L			L	S					
Northern Harrier						M	L			S		M		L
Pickereel Frog	S	S			M		M		M	S	M	M	S	M
Red-shouldered Hawk			L	M	L			L	M				S	
Rusty Blackbird							M					M	M	M
Sharp-tailed Grouse						S				M		L		L
Solitary Sandpiper	M	M					L			L		M	S	L
Upland Sandpiper						M				L				
Woodland Jumping Mouse			L	L	M	L	L	M	S	L	M	L	M	L

Appendix E

Wisconsin Natural Heritage Working List Explanation

The Wisconsin Natural Heritage Working List contains species known or suspected to be rare in the state and natural communities native to Wisconsin. It includes species legally designated as "Endangered" or "Threatened" as well as species in the advisory "Special Concern" category. Most of the species and natural communities on the list are actively tracked and we encourage data submissions on these species. This list is meant to be dynamic - it is updated as often as new information regarding the biological status of species becomes available. See the Endangered Resources Program web site for the most recent Natural Heritage Inventory Working List (<http://dnr.wi.gov/org/land/er/wlist/>).

Key

Scientific Name: Scientific name used by the Wisconsin Natural Heritage Inventory Program.

Common Name: Standard, contrived, or agreed upon common names.

Global Rank: Global element rank. See the rank definitions below.

State Rank: State element rank. See the rank definitions below.

US Status: Federal protection status in Wisconsin, designated by the Office of Endangered Species, U.S. Fish and Wildlife Service through the U.S. Endangered Species Act. LE = listed endangered; LT = listed threatened; XN = non-essential experimental population(s); LT,PD = listed threatened, proposed for de-listing; C = candidate for future listing.

WI Status: Protection category designated by the Wisconsin DNR. END = endangered; THR = threatened; SC = Special Concern.

WDNR and federal regulations regarding Special Concern species range from full protection to no protection. The current categories and their respective level of protection are SC/P = fully protected; SC/N = no laws regulating use, possession, or harvesting; SC/H = take regulated by establishment of open closed seasons; SC/FL = federally protected as endangered or threatened, but not so designated by WDNR; SC/M = fully protected by federal and state laws under the Migratory Bird Act.

Special Concern species are those species about which some problem of abundance or distribution is suspected but not yet proved. The main purpose of this category is to focus attention on certain species before they become threatened or endangered.

Global & State Element Rank Definitions

Global Element Ranks:

G1 = Critically imperiled globally because of extreme rarity (5 or fewer occurrences or very few remaining individuals or acres) or because of some factor(s) making it especially vulnerable to extinction.

G2 = Imperiled globally because of rarity (6 to 20 occurrences or few remaining individuals or acres) or because of some factor(s) making it very vulnerable to extinction throughout its range.

G3 = Either very rare and local throughout its range or found locally (even abundantly at some of its locations) in a restricted range (e.g., a single state or physiographic region) or because of other factors making it vulnerable to extinction throughout its range; in terms of occurrences, in the range of 21 to 100.

G4 = Apparently globally secure, though it may be quite rare in parts of its range, especially at the periphery.

G5 = Demonstrably secure globally, though it may be quite rare in parts of its range, especially at the periphery.

GH = Of historical occurrence throughout its range, i.e., formerly part of the established biota, with the expectation that it may be rediscovered.

GU = Possibly in peril range-wide, but their status is uncertain. More information is needed.

GX = Believed to be extinct throughout its range (e.g. Passenger pigeon) with virtually no likelihood that it will be rediscovered.

G? = Not ranked.

Species with a questionable taxonomic assignment are given a "Q" after the global rank.

Subspecies and varieties are given subranks composed of the letter "T" plus a number or letter. The definition of the second character of the subrank parallels that of the full global rank. (Examples: a rare subspecies of a rare species is ranked G1T1; a rare subspecies of a common species is ranked G5T1.)

State Element Ranks

S1 = Critically imperiled in Wisconsin because of extreme rarity (5 or fewer occurrences or very few remaining individuals or acres) or because of some factor(s) making it especially vulnerable to extirpation from the state.

S2 = Imperiled in Wisconsin because of rarity (6 to 20 occurrences or few remaining individuals or acres) or because of some factor(s) making it very vulnerable to extirpation from the state.

S3 = Rare or uncommon in Wisconsin (21 to 100 occurrences).

S4 = Apparently secure in Wisconsin, with many occurrences.

S5 = Demonstrably secure in Wisconsin and essentially ineradicable under present conditions.

SA = Accidental (occurring only once or a few times) or casual (occurring more regularly although not every year); a few of these species (typically long-distance migrants such as some birds and butterflies) may have even bred on one or more of the occasions when they were recorded.

SE = An exotic established in the state; may be native elsewhere in North America.

SH = Of historical occurrence in Wisconsin, perhaps having not been verified in the past 20 years, and suspected to be still extant. Naturally, an element would become SH without such a 20-year delay if the only known occurrence were destroyed or if it had been extensively and unsuccessfully looked for.

SN = Regularly occurring, usually migratory and typically non-breeding species for which no significant or effective habitat conservation measures can be taken in Wisconsin. This category includes migratory birds and bats that pass through twice a year or, may remain in the winter (or, in a few cases, the summer) along with certain lepidoptera which regularly migrate to Wisconsin where they reproduce, but then completely die out every year with no return migration. Species in this category are so widely and unreliably distributed during migration or in winter that no small set of sites could be set aside with the hope of significantly furthering their conservation.

SZ = Not of significant conservation concern in Wisconsin, invariably because there are no definable occurrences in the state, although the taxon is native and appears regularly in the state. An SZ rank will generally be used for long-distance migrants whose occurrence during their migrations are too irregular (in terms of repeated visitation to the same locations), transitory, and dispersed to be reliably identified, mapped, and protected. Typically, the SZ rank applies to a non-breeding population.

SR = Reported from Wisconsin, but without persuasive documentation which would provide a basis for either accepting or rejecting the report. Some of these are very recent discoveries for which the program hasn't yet received first-hand information; others are old, obscure reports that are hard to dismiss because the habitat is now destroyed.

SRF = Reported falsely (in error) from Wisconsin but this error is persisting in the literature.

SU = Possibly in peril in the state, but their status is uncertain. More information is needed.

SX = Apparently extirpated from the state.

State Ranking of Long-Distance Migrant Animals:

Ranking long distance aerial migrant animals presents special problems relating to the fact that their non-breeding status (rank) may be quite different from their breeding status, if any, in Wisconsin. In other words, the conservation needs of these taxa may vary between seasons. In order to present a less ambiguous picture of a migrant's status, it is necessary to specify whether the rank refers to the breeding (B) or non-breeding (N) status of the taxon in question. (e.g. S2B,S5N).

APPENDIX F

Primary Sites within the Pike Wild River¹

Three ecologically important sites were identified on the Pike Wild River (PWR). These Primary Sites were delineated because they generally encompass the best examples of 1) rare and representative natural communities, 2) documented occurrences of rare species populations, and/or 3) opportunities for ecological restoration or connections. These sites warrant high protection and/or restoration consideration during the development of the property master plan. This report is meant to be considered along with other information when identifying opportunities for various management designations during the master planning process.

Information provided in the summary paragraphs includes location information, a site map, a brief summary of the natural features present, the site’s ecological significance, and management considerations.

Primary Sites	page
PWR01. Pike Wild River Corridor	2
PWR02. Little South Branch Pike River	5
PWR03. Pike Wild River Conifer Hardwoods	8

¹ A list of species referred to by common name is found at the end of this appendix.

PWR01. PIKE WILD RIVER CORRIDOR

Location

Property:	Pike Wild River
County:	Marinette
Landtype Association:	212Tc06 Athelstane Moraines; 212Tc11 Amberg Moraines; 212Tc05 Aurora Moraines; 212Tc10 Wausaukee Outwash Plains; 212Tc03 Butler Plains
Approximate Size (acres):	1,080

Description of Site

The site is delineated based upon the boundaries of high-quality natural communities contained within the Wild Rivers segment of the property. The corridor is managed to protect the natural resources associated with the Pike River and preserve the river in a free-flowing natural state by preventing development adjacent to the river and restoring sections of the river to an undeveloped condition. This site provides significant opportunities to protect and enhance old-growth forests. There are large bedrock outcrops and magnificent waterfalls scattered throughout the river corridor adding to the scenic beauty and ecological significance.

The primary cover types of the primary site are Northern Hardwood Swamp (swamp hardwoods), Northern Mesic and Northern Wet-mesic Forest. Northern Hardwood Swamps dominate the narrow river corridor and comprise the second largest percentage cover type (by acreage) of the PWR, behind aspen (WisFIRS 2011). These hardwood swamps have a canopy dominated by black ash (*Fraxinus nigra*) with common canopy associates being red maple (*Acer rubrum*), green ash (*Fraxinus pennsylvanica*), silver maple (*Acer saccharinum*), American elm (*Ulmus americana*), basswood (*Tilia americana*), and bur oak (*Quercus macrocarpa*). There are relic stands of Northern Wet-mesic Forest occurring along the corridor and include northern white-cedar (*Thuja occidentalis*), tamarack (*Larix laricina*), eastern hemlock (*Tsuga canadensis*), and occasionally yellow birch (*Betula allegheniensis*). Standing pools of water and small, linear wet swales are common. Natural hydrological variations of the Pike River appear to be part of the natural disturbance regime within this natural community.

Northern Mesic Forest and Northern Wet-mesic Forest are also prevalent in the river corridor, often times associated with bedrock outcrops. These forests appeared to be best developed on north facing slopes in areas where the river runs west to east (Krause 2011). The canopy in these areas is dominated by eastern hemlock, northern white-cedar, and eastern white pine (*Pinus strobus*) and red pine (*Pinus resinosa*). Areas of seepage slopes are present draining down into the Pike River. Small stands of cedar swamp are interspersed in these areas with northern white-cedar, tamarack, white spruce (*Picea glauca*), balsam fir (*Abies balsamea*) common in the canopy, and eastern white pine and eastern hemlock as associates.

Significance of Site

In addition to preserving the aesthetics of this important recreational river the wild river corridor has protected mature conifer and conifer-hardwood forests providing habitat for uncommon plant and animal species and protecting water quality of this Outstanding Resource Waterway. In addition, there are numerous bedrock outcrops and seepage slopes within the primary site that have the potential to support rare or uncommon plant species. The primary site presents an opportunity to create a complex of old growth conifer forest within an expansive forested corridor. Connecting the lowland forests along the river with unfragmented upland forests on state and county lands could provide a substantial block of interior forest, meeting the needs of many rare plants and animals requiring these habitats.

Red-shouldered hawks (*Buteo lineatus*) and northern goshawks (*Accipiter gentilis*) are known from the adjacent Marinette County Forest. While no active territories were discovered during this survey effort, the lower river terraces and areas with well-developed hardwood swamps and bottomlands in the Pike River floodplain present the best potential red-shouldered hawk habitats on the PWR (Krause 2011). Such areas are locally remote with little human disturbance, dominated by mature forest cover, and contain an abundance of Ephemeral Ponds, wet swales, and backwater sloughs which should support an abundant and diverse prey base. Many of these lowland forests are bordered by small but good quality stands of natural origin pine, oak, and/or eastern hemlock which provide additional potential habitat. This forest corridor is important for many bird species, including forest interior birds and conifer-associated species. Bird diversity and abundance were exceptionally high with 71 of 79 species of birds detected in the PWR being found in these lowland forests (Collins 2011).

The riparian zone is an important travel corridor for many mammal species including bats. The intact forest buffer of the primary site provides ideal forested cover for foraging and tree roosting bats and helps to maintain the water quality of the Pike River, which helps provide a diverse prey base of insects, the sole food source for bats. Rare aquatic vertebrate species and numerous aquatic invertebrates benefit from the pristine river within this primary site.

Management Considerations

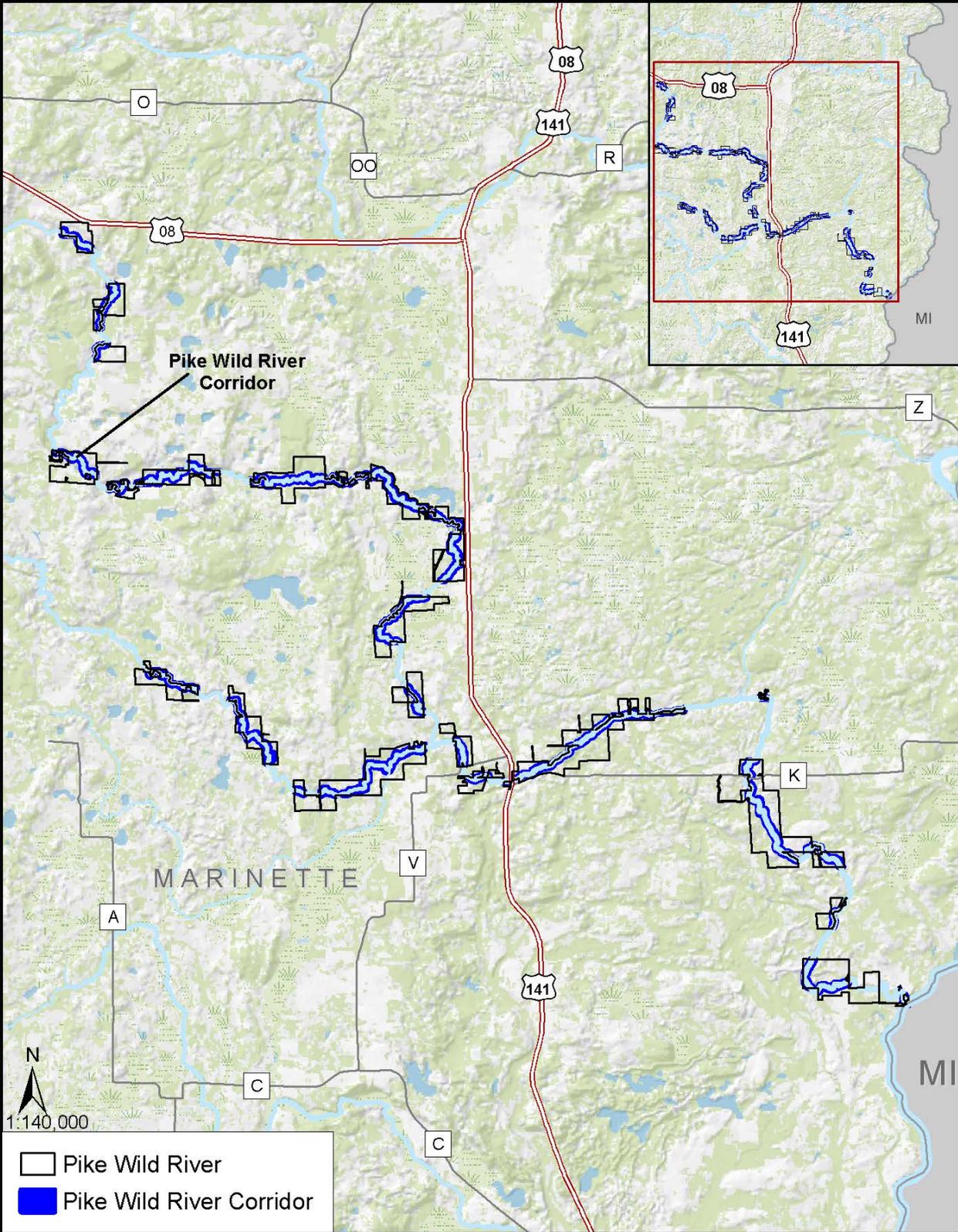
This primary site, along with other older forests identified during this inventory, and largely represented as other primary sites, offers a significant opportunity to manage for old-growth forests within a landscape of other older forests (Marinette County Forest) and should be considered for special management designation. In addition, adjacent older forests exist in the 150 - 400 foot zone along the river, where some management is allowed (Halfmann pers. comm.). These areas could be managed with longer rotations and combined with this primary site to encourage a more significant corridor benefitting biodiversity of the property.

Important management considerations for this site are:

- reducing fragmentation from forest roads and timber management
- encouraging regeneration or reestablishment of eastern hemlock, Canadian yew (*Taxus canadensis*), northern white-cedar, and other conifers where appropriate through adaptive management techniques
- restoring complexity to the forest by retaining biological legacies such as large and cavity trees, snags, boles, large woody debris on the forest floor, diverse herbaceous and understory plants, and forest floor organic matter
- maintaining, enhancing, and restoring under-represented successional stages that would have naturally occurred in this area, including old-growth
- preventing the spread of invasive species during timber management and other activities by using invasive species Best Management Practices

Invasive species are rare at this site, with reed canary grass (*Phalaris arundinacea*), Japanese barberry (*Berberis thunbergii*) and tartarian honeysuckle (*Lonicera togarica*) the most significant threats. Given the current limited extent of these invasive species, control of these manageable populations and monitoring for new invasions represents an important activity on this site. Rusty crayfish (*Orconectes rusticus*) have been documented in the lower portion of the Pike River ranging from below Amberg to its confluence with the Menominee River. Other aquatic invasive species to look out for that have been found within Marinette County include: banded mystery snail (*Viviparus georgianus*), Chinese mystery snail (*Cipangopaludina chinensis*), New Zealand mud snails (*Potamopyrgus antipodarum*), curly leaf pondweed (*Potamogeton crispus*), and zebra mussels (*Dreissena polymorpha*).

PWR01. Pike Wild River Corridor Primary Site



PWR02. LITTLE SOUTH BRANCH PIKE RIVER

Location

Property:	Pike Wild River
County:	Marinette
Landtype Association:	212Tc06 Athelstane Barrens; 212Tc03 Butler Plains
Approximate Size (acres):	163

Description of Site

This site is located along the South Branch of the Pike River and connects to the Pike Wild River Corridor primary site to the north with private lands bordering the site to the south. The Little South Branch Pike River primary site includes a matrix of Northern Mesic Forest on slopes and terraces of the Pike River grading into drier, second growth mixed conifer-deciduous forest of red pine, eastern white pine, oaks (*Quercus* spp.), red maple, and trembling aspen (*Populus tremuloides*). There is a Bedrock Glade on a large, sloped outcrop between the river and a narrow Northern Sedge Meadow along a small tributary of the South Branch.

A good-quality, closed canopy Northern Mesic Forest (approximately 60 acres in size) occurs in the southwestern portion of the site and is dominated by eastern hemlock with most canopy trees in the 80-year-old range (WisFIRS 2011). Associated canopy species are northern white-cedar, balsam fir, paper birch (*Betula papyrifera*), yellow birch, and American beech (*Fagus grandifolia*). There is some eastern hemlock regeneration present. Characteristic groundlayer species present include American starflower (*Trientalis borealis*), Canada mayflower (*Maianthemum canadense*), twisted stalk (*Streptopus lanceolatus*), and bracken fern (*Pteridium aquilinum*), and polypody fern (*Polypodium virginianum*). Some seepage slopes draining down into the riparian zone are present.

A high-quality, but relatively small and linear Northern Sedge Meadow is found along an unnamed tributary to the South Branch Pike River within the eastern portion of the site. Characteristic forbs, sedges, and rushes include woolgrass (*Scirpus cyperinus*), Canada goldenrod (*Solidago canadensis*), spotted Joe-Pye-weed (*Eupatorium maculatum*), and lake sedge (*Carex lacustris*). There are scattered shrubby thickets of speckled alder (*Alnus incana*), willow (*Salix* spp.), white meadowsweet (*Spiraea alba*) and red-osier dogwood (*Cornus sericea*).

The Bedrock Glade at the site is of good-quality and occurs on a large, sloped rock outcrop with characteristic lichens and drought tolerant plants such as northern pin oak (*Quercus ellipsoidalis*), jack pine (*Pinus banksiana*), eastern white pine, juneberry (*Amelanchier* sp.), blueberry (*Vaccinium* sp.), northern bush honeysuckle (*Diervilla lonicera*), sweet-fern (*Comptonia peregrina*), polypody fern, and rusty cliff fern (*Woodsia ilvensis*).

Significance of Site

The entire site falls within the Amberg Conservation Opportunity Area and enlarges the adjacent Pike Wild River Corridor Primary Site by enhancing the scenic solitude of the area with the highest quality block of Northern Mesic Forest found on the property. The mesic forest stand is still relatively young by older growth standards and currently lacks old growth characteristics, but is fairly large in size when combined with the river corridor site, has regenerating eastern hemlock, and presents future opportunities for management as an old growth forest. The wet meadow is fairly pristine, contiguous and has a high diversity of forbs. The Bedrock Glade community at the site is recognized as an important ecological feature and a major management opportunity found in the Northeast Sands Ecological Landscape

(WDNR in Prep). Bedrock Glades are a globally imperiled community (G2; see Appendix E), supporting rare plant assemblages and important habitat for herptiles.

The primary site and surrounding area provides habitat for one of the best assemblages of Species of Greatest Conservation Need (SGCN) birds on the property.

Management Considerations

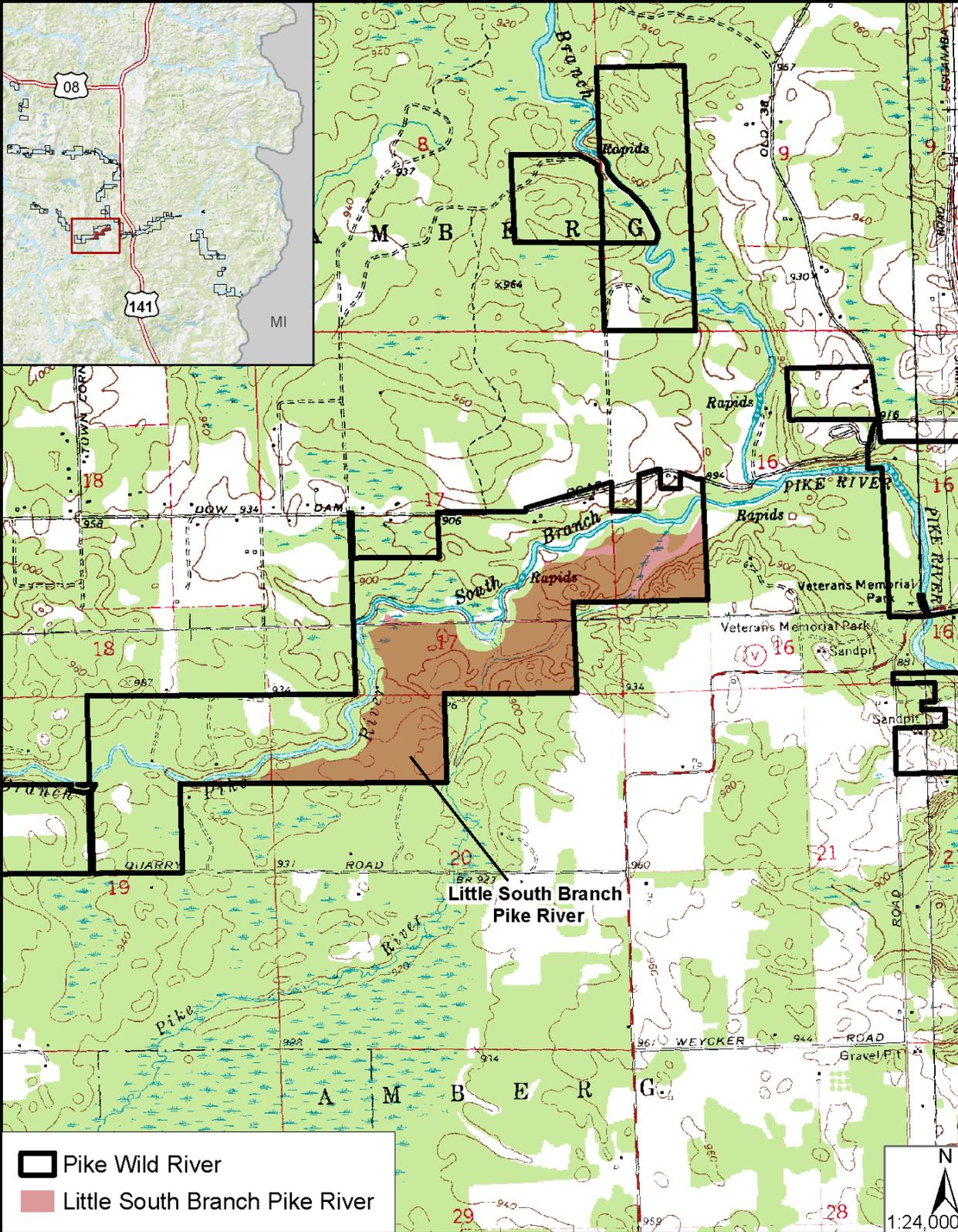
Managing the stand of Northern Mesic Forest as a contiguous block with the high-quality lowland forests comprising the Pike Wild River Corridor Primary Site would constitute a large block of mature forest, benefitting older forest and forest interior species like red-shouldered hawk, northern goshawk, black-throated blue warbler (*Dendroica caerulescens*), bats, and other mammals. Managing this stand through extended rotations could allow for old growth characteristics to develop in this stand and represents an age class uncommonly encountered on the property.

Opportunities exist in the uplands of the site to explore landscape-scale management of barrens, glades and dry forests. Public lands nearby include Marinette County Forest and Amberg State Wildlife Area and are in some instances being managed with similar goals to promote these state and globally rare ecosystems. Managing large tracts of land for barrens and Northern Dry Forest using a variety of methods can help to mimic diverse natural disturbance patterns that are important to many barrens dependent species (Radeloff et al. 2000). For example, Niemuth and Boyce (1998) concluded that there are differences in resulting vegetation structure on sites that have experienced clear-cutting, short-cycle prescribed burning, and crown fires. The resulting differences in vegetation structure can benefit numerous uncommon characteristic barrens plants and animals.

Bedrock Glades have thin soils and support slow-growing lichen and moss cover that are sensitive to anthropogenic disturbance. Conservation efforts should focus on preserving the ecological integrity of existing high-quality Bedrock Glades (MNFI 2007). Prescribed burns may provide a useful management tool to maintain open conditions and increase herbaceous plant diversity, although little research on the response of this plant community to fire has been documented (MNFI 2007). Additionally, there are questions as to whether these areas will burn due to typically sparse, fine fuels.

Currently there are little to no populations of invasive plants present at the site but private lands to the south may present a means for their introduction. There is moderate regeneration of eastern hemlock occurring at the site. Regeneration of browse sensitive species (cedar, hemlock, yew) often times occurs in areas of fractured bedrock, which are inaccessible to white-tailed deer (*Odocoileus virginianus*). These features are present at the site, enhancing the quality of mesic and wet-mesic forests here.

PWR02. Little South Branch Pike River Primary Site



PWR03. PIKE WILD RIVER CONIFER HARDWOODS

Location

Property:	Pike Wild River
County:	Marinette
Landtype Association:	212Tc10 Wausaukee Outwash Plains
Approximate Size (acres):	158

Description of Site

The Pike Wild River Conifer Hardwoods site is connected to the Pike Wild River Corridor primary site on the north side of the river just before its confluence with the Menominee River. This primary site is very diverse as several forest types are represented, varying degrees of age classes are present, and variable topographical relief and geological formations are found here. The main feature of the site is a large stand of Northern Dry-mesic Forest featuring some large-diameter red pine and super canopy eastern white pine on elevated glacial formations (eskers). There are large diameter oaks also present within and adjacent to this pine forest. These areas grade into mesic slopes and lowlands with bottomland hardwoods of red maple, paper birch, and black ash common in the canopy. Found within this hardwood stand is a good quality Ephemeral Pond. The small pond has blackwater edges with winterberry (*Ilex verticillata*) and speckled alder are common. Herbaceous plants found in the pond are wild iris (*Iris* sp.), lake sedge, stinging nettle (*Urtica dioica*), and mint (*Mentha* sp.). Adding to the diversity of the primary site is a good quality white spruce and northern white-cedar swamp found at the site below the apex of the esker formation. Additionally, older-aged Northern Wet-mesic Forests associated with the Pike River terraces connect to the uplands creating a good-sized block of intact forest habitat.

Site Significance

The large tract of old pine forest has old growth characteristics and was noted for having exceptionally high diversity and abundance of birds compared to similar habitats across the region (Collins 2011). Fairly common bird species like Blackburnian warbler (*Dendroica fusca*), pine warbler (*Dendroica pinus*), ovenbird (*Seiurus aurocapilla*), and Nashville warbler (*Oreothlypis ruficapilla*) make up the majority of the species found in these pine forests. Bird species of Special Concern were also noted from within the primary site, making this an important site for bird conservation on the PWR.



Singing Nashville warbler in jack pine (photo by Brian Collins)

Ephemeral Ponds are present at the site and are important breeding areas for many invertebrates and amphibians. Blue-spotted and spotted salamanders (*Ambystoma laterale* and *A. maculatum*) are commonly found in the Ephemeral Ponds and are indicator species of good-quality forests. Some of these ponds have high potential for supporting four-toed salamander (*Hemidactylium scutatum*), a Species of Greatest Conservation Need. Wisconsin's fairy shrimp occur sporadically on the Wisconsin landscape and are Ephemeral Pond obligates with all three species known from Wisconsin being SGCN (WDNR 2006).

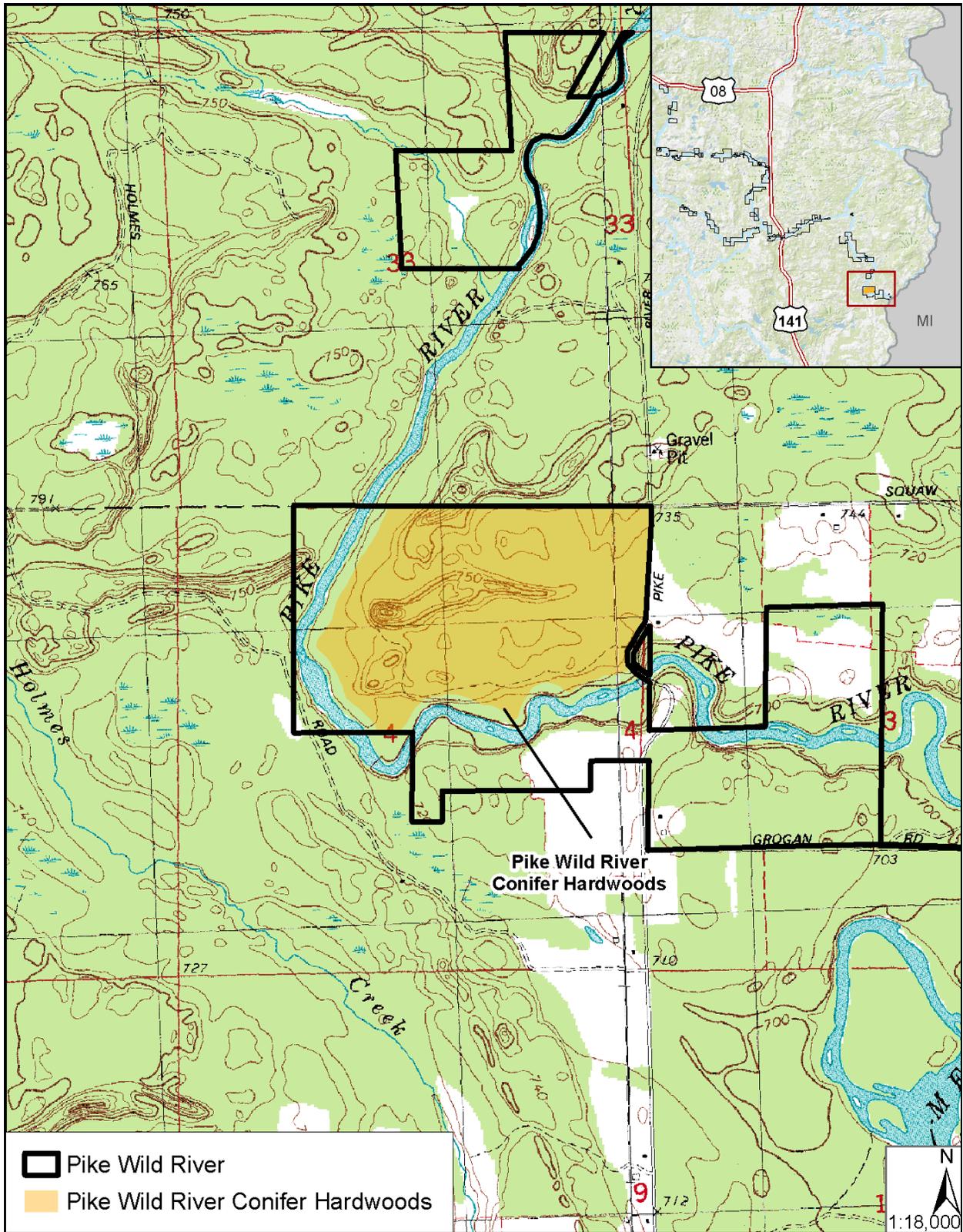
Management Considerations

The site is connected to the extensive high-quality Pike Wild River Corridor Primary Site, providing benefits to species associated with large blocks of intact forest. Limiting fragmentation of this landscape and connecting these sites to the nearby Marinette County Forest lands could add to the biodiversity of the property. The forest has areas that are developing old-growth characteristics, a feature not well represented on the property. Promoting and enhancing these forests with uneven-aged structure and many different size classes of canopy trees and some large diameter, standing, and downed coarse woody debris through extended rotation management could be adaptively applied to benefit many rare, older forest dependant species (WDNR 2006).

Ephemeral Ponds within minimally fragmented, closed canopy forest are important habitat components for pond-breeding amphibians that require adjacent, older, humid forests for carrying out their terrestrial life-cycle. Early identification of Ephemeral Ponds and their associated species distributions throughout the forest would enable adaptive management to protect pond amphibians and invertebrates.

Invasives present at the site in forest openings are spotted knapweed (*Centaurea biebersteinii*) and common St John's-wort (*Hypericum perforatum*).

PWR03. Pike Wild River Conifer Hardwoods



Species List

List of species referred to by common name in Appendix F.

Common Name	Scientific Name
Animals	
golden-winged warbler	<i>Vermivora chrysoptera</i>
least flycatcher	<i>Empidonax minimus</i>
northern goshawk	<i>Accipiter gentilis</i>
red-shouldered hawk	<i>Buteo lineatus</i>
veery	<i>Catharus fuscescens</i>
Plants	
American beech	<i>Fagus grandifolia</i>
balsam fir	<i>Abies balsamea</i>
black ash	<i>Fraxinus nigra</i>
eastern hemlock	<i>Tsuga canadensis</i>
eastern white pine	<i>Pinus strobus</i>
jack pine	<i>Pinus banksiana</i>
lake sedge	<i>Carex lacustris</i>
northern white-cedar	<i>Thuja occidentalis</i>
oaks	<i>Quercus</i> spp.
paper birch	<i>Betula papyrifera</i>
polypody fern	<i>Polypodium virginianum</i>
red maple	<i>Acer rubrum</i>
red pine	<i>Pinus resinosa</i>
speckled alder	<i>Alnus incana</i>
sweet-fern	<i>Comptonia peregrina</i>
tamarack	<i>Larix laricina</i>
white spruce	<i>Picea glauca</i>
yellow birch	<i>Betula allegheniensis</i>

Reference List

- Collins, B. M. 2011. Pike Wild River Breeding Bird Survey Final Report. A report submitted to the Natural Heritage Inventory, Bureau of Endangered Resources.
- Krause, J.S. 2011. Pike Wild River Raptor Survey Final Report. A report submitted to the Natural Heritage Inventory, Bureau of Endangered Resources.
- Michigan Natural Features Inventory [MNFI]. 2007. Natural Communities of Michigan: Classification and Description. Report for: Michigan Department of Natural Resources Wildlife Division and Forest, Mineral and Fire Management Division. Sept. 30, 2007. Report No. 2007-21. Version 1.2. Last Updated: July 9, 2010.
- Niemuth, N.D. and M.S. Boyce. 1998. Disturbance in Wisconsin Pine Barrens: Implications for Management. Transactions of the Wisconsin Academy of Sciences, Arts, and Letters.
- Radeloff, V.C, D.J. Mladenoff, and M.S. Boyce. 2000. A historical perspective and future outlook on landscape scale restoration in the northwest Wisconsin Pine Barrens. Restoration Ecology. 7:119-126.
- Wisconsin Department of Natural Resources [WDNR]. In Prep. a. DRAFT Ecological Landscapes of Wisconsin. State of Wisconsin, Dept. of Nat. Resources, Handbook. 1805.1. Madison, WI
- Wisconsin Department of Natural Resources [WDNR]. 2006. Wisconsin Wildlife Action Plan. Available at <http://dnr.wi.gov/org/land/er/wwap/plan/>.
- Wisconsin Forest Inventory & Reporting System [WisFIRS]. Release 7. Accessed November 2011.