Landscape Stewardship Plan

The Fish Forests of Michigan's Eastern Upper Peninsula

Luce, Schoolcraft, Eastern Alger, and Western Mackinac Counties

The Two Hearted River, Luce County, MI © The Nature Conservancy

The Nature Conservancy
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1. Executive Summary

This landscape stewardship plan, covering a portion of Michigan's Eastern Upper Peninsula (UP) in Luce, Schoolcraft, Eastern Alger, and Western Mackinac Counties and over 1.9 million acres, is one of nine such plans that were developed through a larger grant project funded by U.S. Forest Service and administered by the Michigan Department of Natural Resources (DNR). The intent of developing this plan was to connect forest owners, both public and private, and organizations to each other and to forest stewardship information, resources and assistance programs, thereby increasing our collective capacity to protect and maintain the forests products, services and values on which this region depends. Only by working collaboratively at the landscape scale we can better address landscape-scale challenges that threaten the health and sustainability of our forests and other natural resources.

The focus of this plan, the central UP, is a region rich in natural resources—particularly water, containing both shorelines of Lake Superior and Lake Michigan, as well as several cold-water rivers and streams and protects many headwater lakes, wetlands, and peatlands. The landscape is predominately a rural landscape containing vast expanses of public and private forest land. The access for water and forest supports the region's tourism and outdoor recreation based economies. Pictured Rocks National Lakeshore is a national tourist attraction. Seney National Wildlife Refuge, is a large public owner in the center of this Landscape. Hardwood maple produced in this area provides basketball courts across the world. Each of the public owners including National Forest, National Parks, National Wildlife Refuge, land trusts, large timber owners, schools, and private landowners bring unique places and lessons to be shared with other landowners. This specific landscape was chosen because of the unique make up of ownership and the unique features and lessons that can be shared.

However, this region has already seen major changes and is not without threats. Factors such as climate change, invasive species, tree diseases and insect pests, habitat fragmentation, limited financial resources and lack of awareness or participation in active and sustainable land stewardship practices place our forests, and water resources at risk. Within the last six years this geography has seen the

almost complete loss of a dominate tree species – the American Beech (*Fagus grandifolia)* from beech bark disease and many more common species are modeled to shift under climate change. Many smaller landowners are unaware of the studies and research performed on larger public lands. A major goal of the landscape stewardship plan is to continue to share and grow the lessons learned from public owners while providing private owners a rich array of land stewardship opportunities tested and learned in this geography. Finally, this geography contains unique features and recreational opportunities found nowhere else in Michigan. Several of these unique recreational and biodiverse sites will also be highlighted in this plan.

A first step in this geography was to build on the foundation of an active group that has provided collaboration and projects since 1992. The Eastern Upper Peninsula Partnership in Ecosystem Management (EUPPEM) first formed in 1992 with members of the group representing organizations that manage two-thirds of this 1.9-million-acre landscape. The group includes US Forest Service, National Park Service, US Fish and Wildlife Service, large private timber owners, The Nature Conservancy, Lake States Fire Science Consortium, and MI DNR. The group's mission is to facilitate complementary management of public and private lands for all appropriate uses, using an ecological approach to sustain and enhance representative ecosystems, globally significant community and landscapes, and threatened and endangered species. At times the group has been very active and at times somewhat dormant. However, in the past two years the group has become active with staff from Seney National Wildlife Refuge providing leadership. The group has had several major grants and projects and many smaller collaborations. Several of the groups success and reports will be highlighted within this plan.

Each of the nine landscape stewardship plans characterizes the focal ecosystem's physical, biological and cultural resources, including a summary of existing resource assessments and forest ecology work. The process of developing this specific landscape stewardship plan has used groups like EUUPEM to summarize lessons learned that may be useful to smaller, private land owners in the geography. Using EUUPEM members, important areas within the plan were identified where private landowners may play important roles for resource connection between larger owners.

The most notable physical features of this landscape are the mosaic nature of the forests and the very large sets of wetlands, particularly in the central area of this plan's geography. These wetlands play a major role in collecting water and sending clean water from headwater sources to both Lake Superior and Lake Michigan. Several notable rivers; including both the Fox and Two Hearted – both famous for their cold-water fishery and undisturbed nature are found in this geography. This geography provides the water and shelter for fish both in the geography and within the big lakes as well.

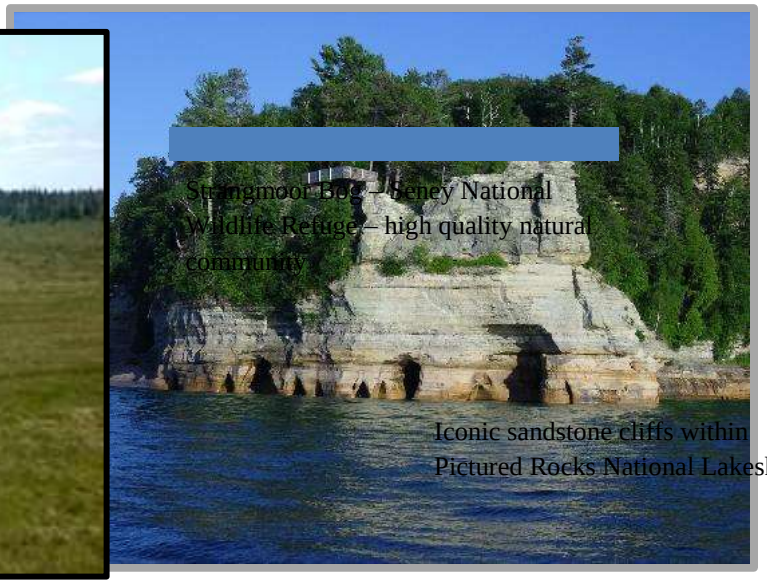
Another unique aspect to this plan is the larger role played by The Nature Conservancy. The Conservancy owns 30,000 acres in this geography, most of it managed as a working forest under the state's commercial forest act and certified by Forest Stewardship Council (FSC) certification. A major

goal of the Conservancy is to provide tools and lessons learned that any landowner could then use on their own forest land. Several findings from the Conservancy's management will be highlighted in this plan.

A key element of each landscape stewardship plan is the collection of inspirational stewardship stories told by the people living and working within the focal landscapes. Through these stories, local landowners and land managers share why and how they are active stewards of their own forests. Whether that means a small private property or a vast area of public land, these stories are told with the hope of inspiring other landowners and land managers to join in and become actively involved in the stewardship of our collective forest resources.

One of the unique features of this specific geography are the outstanding examples of both biodiversity and recreation that this particular area provides. Besides stories on management – this plan will also include stories on some of the unique and not well known recreational opportunities that are provided and some of the outstanding and state-unique biodiversity conserved and managed within this area.

Stumpmoor Bog – Seney National Wildlife Refuge – high quality natural community



Iconic sandstone cliffs within Pictured Rocks National Lakeshore.

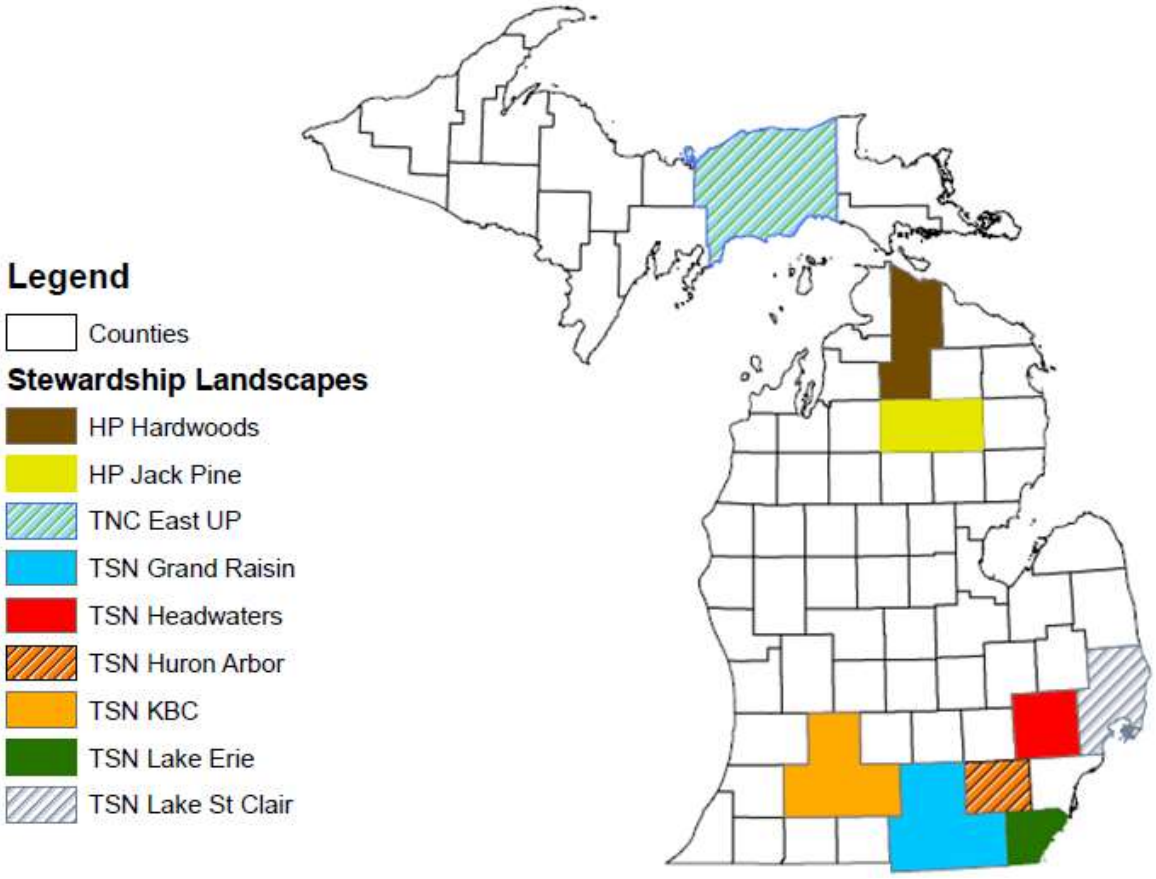
2. Project Introduction

This landscape stewardship plan focuses on Michigan's central Upper Peninsula (UP). This 1.9-million-acre landscape (~3,000 square miles) contains the largest contiguous set of wetlands in Michigan. The combination of forest and wetlands in this landscape provide important headwater procurement and water filtering that then flows into both Lake Superior and Lake Michigan. This geography also has every large public landowner found in Michigan within its boundaries

The overarching grant project began in 2015 when the Michigan Department of Natural Resources (DNR) received funding from the United State Forest Service (USFS) to partner with Huron Pines, The Nature Conservancy, and The Stewardship Network (all of which are 501(c)(3) nonprofit and non-governmental conservation organizations) to develop nine landscape stewardship plans, each covering unique Michigan ecosystems - see Map 2.1 and 2.2.

NOTE: Throughout this report the area shown below will be referred to as the "report Landscape".

Map 2.1 – Geographic Location for the nine plans



Map 2.2 The Specific Report Landscape of the Eastern UP

Each of the nine landscape stewardship plans covers a two or three county area in Michigan, characterizes the physical and cultural context of the focal landscape, and connects landowners to assistance programs by summarizing available opportunities and providing program contact information. Each landscape stewardship plan also includes a collection of stewardship stories told by the local landowners and land managers working within each focal landscape. Rather than simply listing recommended land management practices, these stories demonstrate why and how real people, in their own words, choose to actively and sustainably manage their land.

The purpose of these landscape stewardship plans is to: 1. Highlight the unique characteristics and features of each geography; and 2. inspire people to become more active land stewards. Each purpose will be showcased through stories and by connecting people with the resources that can help them take the next steps in that process. By increasing the voluntary participation in land stewardship activities, we are ultimately working to protect and preserve Michigan's unique natural resources. This can only be achieved at the landscape scale – with private and public land managers all working in concert to maintain healthy forests, clean water and other natural resources for the use and enjoyment of current and future generations.

The Nature Conservancy developed the current landscape stewardship plan for the eastern Upper Peninsula, which covers Luce, Schoolcraft, Eastern Alger, and Western Mackinac Counties—an area dominated by large blocks of public and private forest land.

Huron Pines developed two of the nine landscape stewardship plans. The Huron Pine plans include a jack pines ecosystem plan, and a northern hardwoods plan. The Stewardship Network developed six landscape stewardship plans covering a large swathe of the southern Lower Peninsula. This region is a mosaic of urban areas, agricultural lands and small private forests. There is comparatively little forest land under public ownership in southern Michigan. Seventy-five percent of Michigan's 10 million residents live in this region, so land management activities across this region of the state have the potential to impact a large number of people.

While the lead organizations were responsible for developing their respective landscape stewardship plans, the content of each plan was generated with substantial input from other resource professionals, the landowners and land managers willing to tell their stories, and based upon existing resource assessments, stewardship plans and other available literature.

Project partners also worked with Dr. Stuart Gage, Michigan State University professor emeritus, to install at least one acoustic monitoring device in each landscape to capture the "soundscape" of each landscape. The sounds of the forest tell a story of their own. Eventually, a web site will be created to host an interactive "story map" that will allow people to view stories in their region, share their own stories, and listen to the stories of the forest.

Finally, a portion of the grant funding will be administered by the MDNR to provide cost-share to landowners within the nine landscape focus areas for developing and implementing unique Forest Stewardship Plans for their properties.

2.1 Project Goals and Objectives

Michigan's forests face many threats—invasive species, tree diseases, habitat fragmentation, financial challenges—that sometimes make it difficult to achieve forest stewardship goals. It is estimated that only 20% of Michigan's 11 million non-industrial private forest lands are being actively managed, yet active stewardship of private forest land is vital to the long-term health and productivity of the forest resources (including soil, water and wildlife) on which our local economies and communities depend. The overarching goal of this project is to highlight nine forested areas across Michigan and the unique biological diversity, lessons learned from management, and opportunities for forest work in those areas. A second goal is based on emphasizing highlights in these plans, includes increasing interest, awareness and participation in active forest stewardship opportunities for non-industrial forest owners through the collection of examples and scenarios covering unique forest ecosystems throughout the state of Michigan.

Specific objectives that the we seek to accomplish in order to achieve that goal include:

- Objective 1: Describe the physical, cultural, recreational, and resource management context of each of the nine landscapes to serve as a comprehensive reference for landowners and land managers.
- Objective 2: Facilitate collaborative management of multi-county areas by state, federal and local resource agencies, nonprofit conservation organizations, private sector professionals and individual landowners.
- Objective 3: Promote sustainable forest management practices and encourage people to be more active stewards of their land (e.g., develop and implement a Forest Stewardship Plan).
- Objective 4: Connect people with tools, resources and programs to help them take the next steps toward achieving their personal land management goals and increase our collective capacity to manage forest resources at the landscape scale.

These landscape stewardship plans also aim to support and inform strategies for addressing national priorities and state-level issues identified in "Michigan Forest Resource Assessment and Strategy," which was completed by the MDNR in 2010. These priorities and issues are:

- National Priority 1: Conserve Working Forest Landscapes
  - Issue 1.1: Promote Sustainable Active Management of Private Forests
  - Issue 1.2: Reduce Divestiture, Parcelization and Conversion of Private Forestlands
  - Issue 1.3: Reduce the High Cost of Owning Private Forestland

- National Priority 2: Protect Forests from Threats
  - Issue 2.1: Maintain and Restore Aquatic Ecosystems and Watersheds
  - Issue 2.2: Reduce Threats from Invasive Species, Pests and Disease

- Issue 2.4: Reduce Impact of Recreational Activities on Forest Resources

➢ National Priority 3: Enhance Public Benefits from Forests
- Issue 3.1: Maintain Markets for Utilization of Forest Products
- Issue 3.2: Maintain Ecosystem Services from Private Forestlands
- Issue 3.3: Provide Effective Conservation Outreach for Private Forestlands
- Issue 3.5: Maintain Community Quality of Life and Economic Resiliency
- Issue 3.6: Maintain and Enhance Scenic and Cultural Quality on Private Forestland
- Issue 3.7: Maintain Forested Ecosystems for Biodiversity and for Wildlife Habitat
- Issue 3.8: Maintain and Enhance Access to Recreational Activities on Private Forestlands

➢ This Report Landscape's Unique Goals: from the Eastern Upper Peninsula Partnership in Ecosystem Management (EUPPEM):
- Invest in Priority areas
- Build a collaborative network
- Appeal to self-interest – following existing federal and state plans
- Manage for results – align actions with neighbors
- Encourage flexibility.

2.2 The Need for Active Forest Stewardship

Forest land accounts for 55% of Michigan's total land area, and of Michigan's 20 million acres of forests, 12 million of those acres are privately owned. State and federal agencies are responsible for managing our public lands, but the overall health of Michigan's unique forest, water and wildlife resources ultimately depends on the collective management activities of all landowners. Unfortunately, a survey conducted by Michigan State University revealed that only about 20% of Michigan's non-industrial private forest lands are currently under active management.

The condition of a forest property is highly dependent on the condition of other forest lands throughout the landscape. Conversely, the management actions (or lack of active forest management) on a single property can impact forests, rivers, wildlife, property and people far beyond the boundary of that individual piece of land. Native wildlife, forest fires, harmful invasive species, tree diseases and insect pests all move freely among private and public land—they do not recognize property boundaries. Likewise, rivers and streams flowing from one property to the next carry the effects of poor land management activities downstream (or even upstream, as is the case with dams or poorly designed road crossings that block fish passage).

Maintenance of healthy forest landscapes are also important at the regional and global scale. We depend on our forests for timber and other forest products, to provide wildlife habitat, to help mitigate climate change, to protect the quality and quantity of our water resources and for the myriad aesthetic, recreational and spiritual values they provide. Protecting our forest products, services and values starts

with active stewardship of individual properties by landowners and land managers. Because widespread threats to forest health act at scales larger than single parcels, our approach to maintaining healthy, functional and sustainable forests must also incorporate landscape-scale considerations. The purpose of this project is encourage and inspire people to actively manage their forests to realize benefits for both individual landowners and the larger community. The next section describes our methodology for doing so.

2.3 Methodology: A Landscape Approach to Natural Resource Conservation

The Michigan DNR applied for and was awarded funding by the United States Forest Service (USFS) in 2015 to coordinate with Huron Pines, The Stewardship Network, and The Nature Conservancy to develop nine landscape stewardship plans. These partners strategically identified landscape types containing a set of unique physical and cultural features that help define each landscape area while also distinguishing them from other landscapes. Of course, ecological landscapes do not adhere to our political boundaries and tend to transition gradually and unevenly from one landscape type to another. However, for the purpose of managing landscape-scale issues and challenges while also keeping the project areas manageable and relevant to local landowners and land managers, we've defined each landscape area as ranging from two to four counties in geographic scope. One advantage of defining the project area based on county boundaries is that these align with jurisdictional areas of different resource agencies and nonprofit organizations. Therefore, the assistance programs, resources and opportunities offered within each landscape project area are generally consistent and the background information and stewardship stories are tailored to a particular local audience. Nevertheless, people in surrounding counties or other areas with similar characteristics will generally also find that these landscape stewardship plans are useful.

The central Upper Peninsula (UP) was identified as a good candidate landscape because of its unique combination of land owners (many large public) and the unique resources: state's largest wetlands, pine planes, and Great Lake shoreline forests. The resulting clean water, wetlands, large blocks of matrix forest, history of wildfire, and unique rocky and sandy shorelines, have in turn defined economic values, recreational pursuits and the land ownership picture of Luce, Schoolcraft, Eastern Alger, and Western Mackinac Counties.

The Nature Conservancy coordinated primarily with the members of EUUPEM group to develop the text in Section 2, including the project background and project goals, objectives and methodology. To complete Section 3: Landscape Context, The Nature Conservancy conducted a review of existing resource assessments and management plans/strategies. The Conservancy also met with government agencies, private resource providers and nonprofit organizations to collect information on the various assistance programs and opportunities that are available, with a focus on forest stewardship. Contacts for each program are included as a reference for property owners and land managers to learn more and produce better plans on their property.

A collection of 34 concise stewardship stories make up a stand-alone section of the plan. The stories fall into six categories:

1. Stories that describe a technique, forestry practice, or management tool used by landowners and land managers within this report Landscape.
2. Stories that describe a unique area, system, species, or feature of the report Landscape.
3. Stories that describe a unique or notable recreation opportunity or trail of the report Landscape.
4. Stories that describe tools that can be used for restoration or management.
5. Stories that describe unique challenges in the report Landscape.
6. Stories that describe unique opportunities in the report Landscape.

These stories make up Section 4. The purpose of these stories is to inspire others to learn more about this report Landscape, explore, and understand the unique features, and take advantage of the opportunities for applied management. The Nature Conservancy and partners identified people that are doing good stewardship on their land and who want to tell their stories. Interviews were conducted with individual, corporate, state and federal land owners and managers to document the wide range of land stewardship activities being performed. All landowner stories were provided voluntarily for inclusion in this plan and with permission to distribute in the hopes of encouraging other landowners to become active land stewards.

Forests also tell their own stories. This landscape had both trail cameras and acoustic monitoring performed for fall, winter, spring, and summer months of 2015 and 2016. An acoustic monitoring device was placed in three different times and locations within the report Landscape.

- Site 1 – McMahon Lake Preserve (Luce County) two months in fall 2015
- Site 2 – East Barfield Lakes area (Luce County) two months in mid-winter 2016.
- Site 3 – North Branch Two Hearted River (Luce County) six months April to September 2016.

The acoustic monitor recorded one minute every thirty minutes. Similar acoustic monitoring devices were deployed in several other landscapes throughout the state of Michigan. The acoustic maps for this project can be found at (http://www.real.msu.edu/projects/one_proj.php?proj=ls&page=overview). Trail camera photos were also taken Site 1 and Site 3 and a sampling are shown in Appendix 3.

Michigan DNR is hosting an online story map, where people can read the stewardship stories collected through this project, submit their own stories, view images and listen to sounds of our forests. A summary of the available assistance programs, additional resources and contacts are included at the end of the plan to provide guidance for active land stewardship.

2.4 Previous Landscape Stewardship Plans in the Area

There have been two previous planning efforts either within this specific report Landscape or just to the east in Chippewa County, Michigan. In the spring of 1999, a partnership was formed between Michigan DNR-Forest Stewardship Program, the Upper Peninsula Resource Conservation and Development Council (UP RC&D – now defunct), and the Luce-West Mackinac Conservation District. This

partnership was formed to initiate a project that would introduce Two Hearted River Watershed landowners to ecosystem management principles at the landscape level. The results of plan – included:

- Creating a resource guide for landowners in the watershed
- Completing the Land Type Associations (LTA's) for the Two Hearted Watershed to provide better data and resources to landowners and partners.
- Hosting several landowner field trips and meetings to show timber practices, best management guidelines, and hear and document landowner concerns.

The Two Hearted project lead to creation of a report that helped inform the science and management of a later large conservation acquisition within the watershed that included conservation ownership or conservation easements on the majority of the non-state owned forests.

The Two Hearted project followed a successful Clay Lake Plain Project in Chippewa and East Mackinac Counties (just east of this current report Landscape). The Clay Lake Plain Project provided information, resource materials, and technical assistance to develop landowner stewardship plans for over 130 landowners representing over 26,000 acres.

3. Landscape Context

This report Landscape contains some of the most scenic and most remote landscapes in Michigan. It includes the beauty of the sandstone cliffs and arches of Pictured Rocks National Lake Shore and the vast patterned peat lands of Seney National Wildlife Refuge and The Nature Conservancy's Two Hearted Reserve. The Fox and Two Hearted Rivers of this landscape both were made famous by Earnest Hemmingway's writing (one he visited, and one he borrowed the name of). The predictable heavy snows (160-200+ inches per season) bring winter sport enthusiastic including ice climbers, ice fisherman, snowmobilers, and cross country skiers. The communities within this report Landscape rely both on seasonal tourism winter and summer as well as a sustainable timber industry.

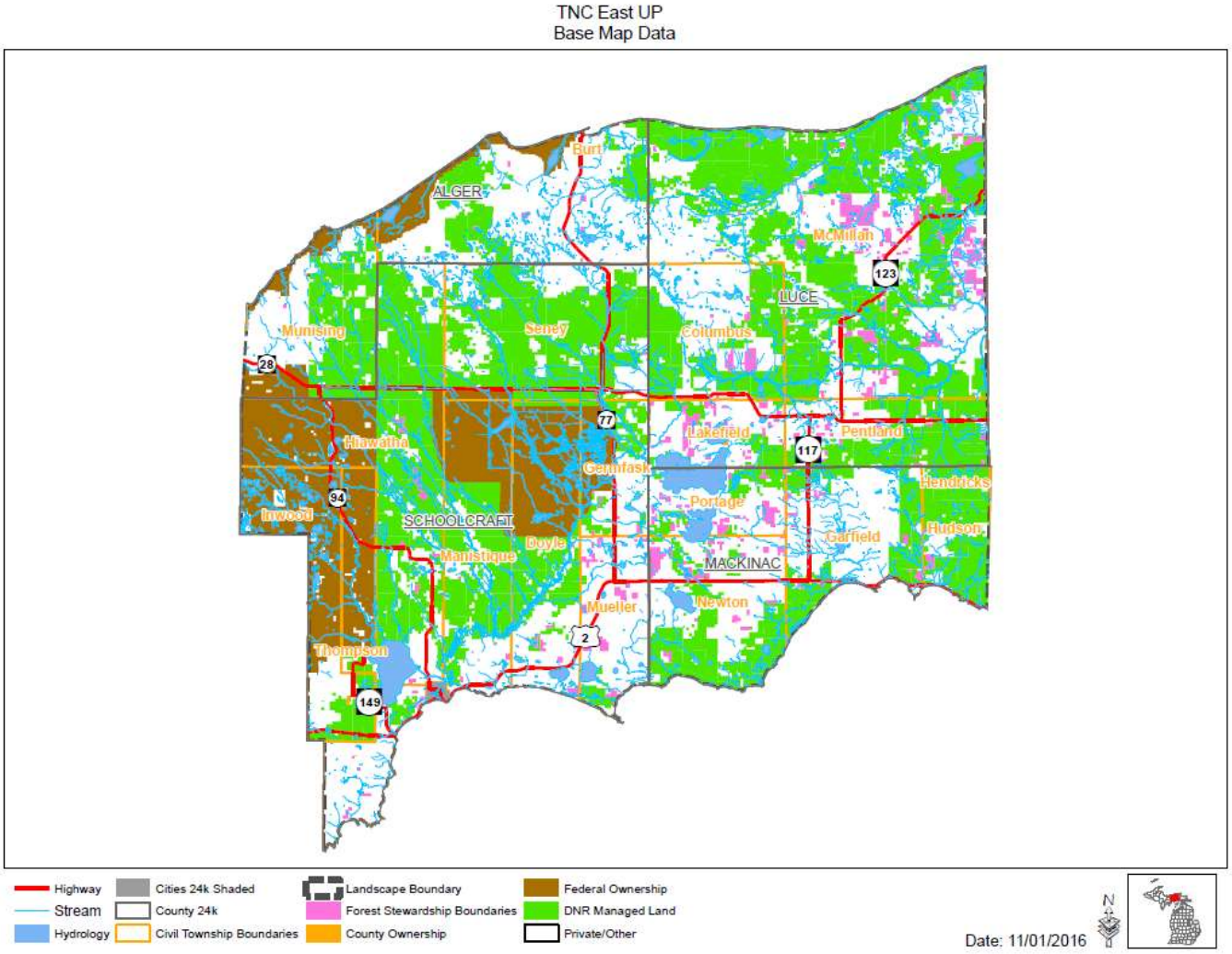
Active and collaborative stewardship of private and public lands have a unique history in this landscape and were discussed in Section 2. This partnership is important as the area has faced and continues to facts threats including invasive species, climate change, the threats facing forests, water resources and wildlife.

3.1 The Physical, Ecological and Cultural Landscape

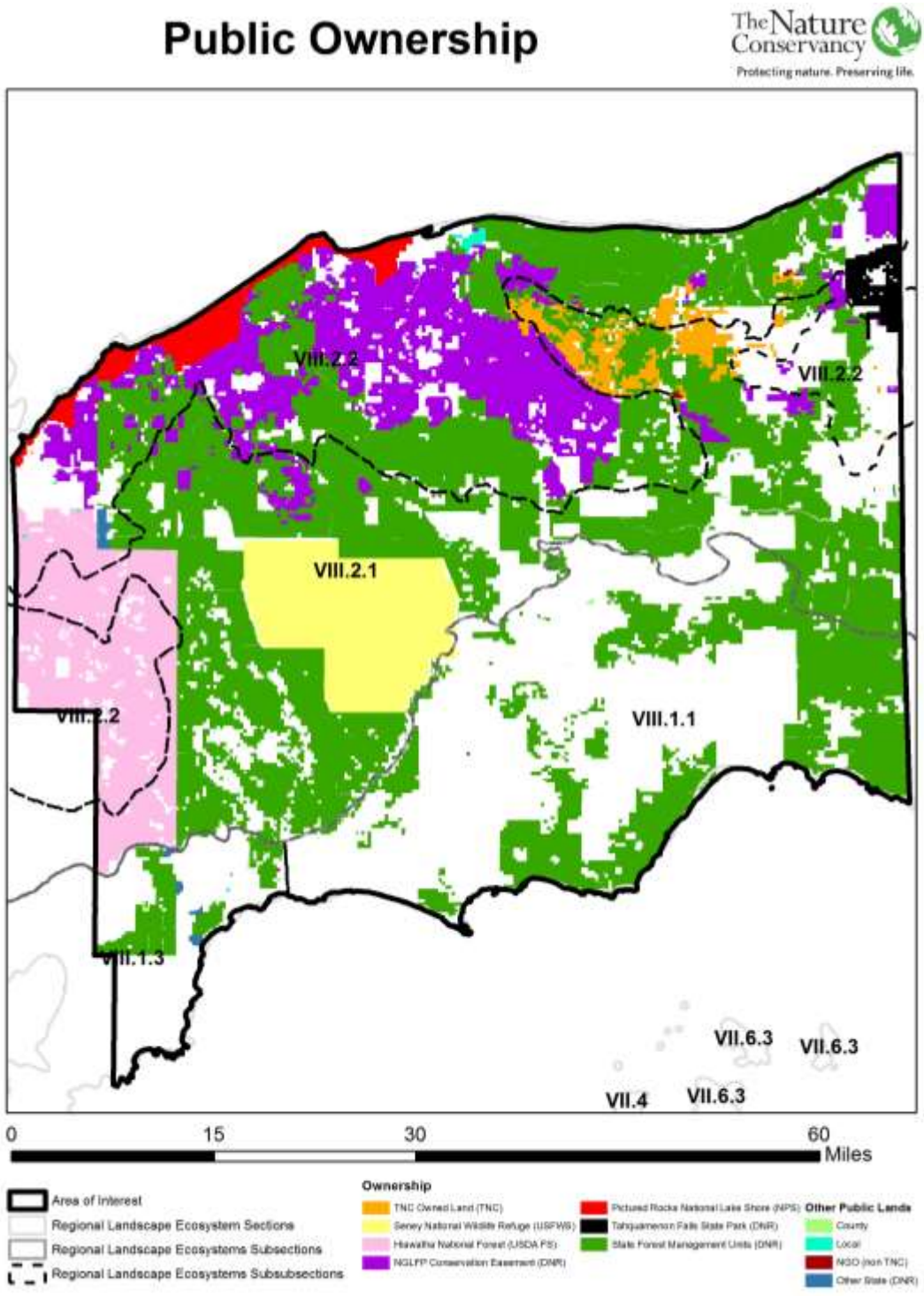
3.1.1 Geographic Scope

This landscape stewardship plan covers Luce, Schoolcraft, Eastern Alger, and Western Mackinac Counties in the Upper Peninsula of Michigan. This area contains the largest wetlands in the state and are important headwater areas for rivers and streams flowing both in the Lakes Michigan and Superior. Together, this central UP report Landscape contain a combined 1,134 square miles (or 1,905,740 acres) of land, most of which is sparsely populated and either heavily forested or in large wetlands. The other unique aspect of this landscape is that there is no place else in the state with the diversity of large public and large private owners. Map 3.1 displays the Base Geography for this Landscape,
Map 3.2 displays the public ownership and biodiversity subsections, Map 3.3 displays the public ownership with private stewardship plans, and Map 3.4 displays the land use types. Table 3.1 displays land manager and acreage information.

Map 3.1 Base Geography of Landscape.



Map 3.2 Public Ownership with Biodiversity Subsections



Note biodiversity Sub-Subsections are described and mapped beginning on pages 55-56.

Map 3.3 Ownership map with private forest stewardship plans

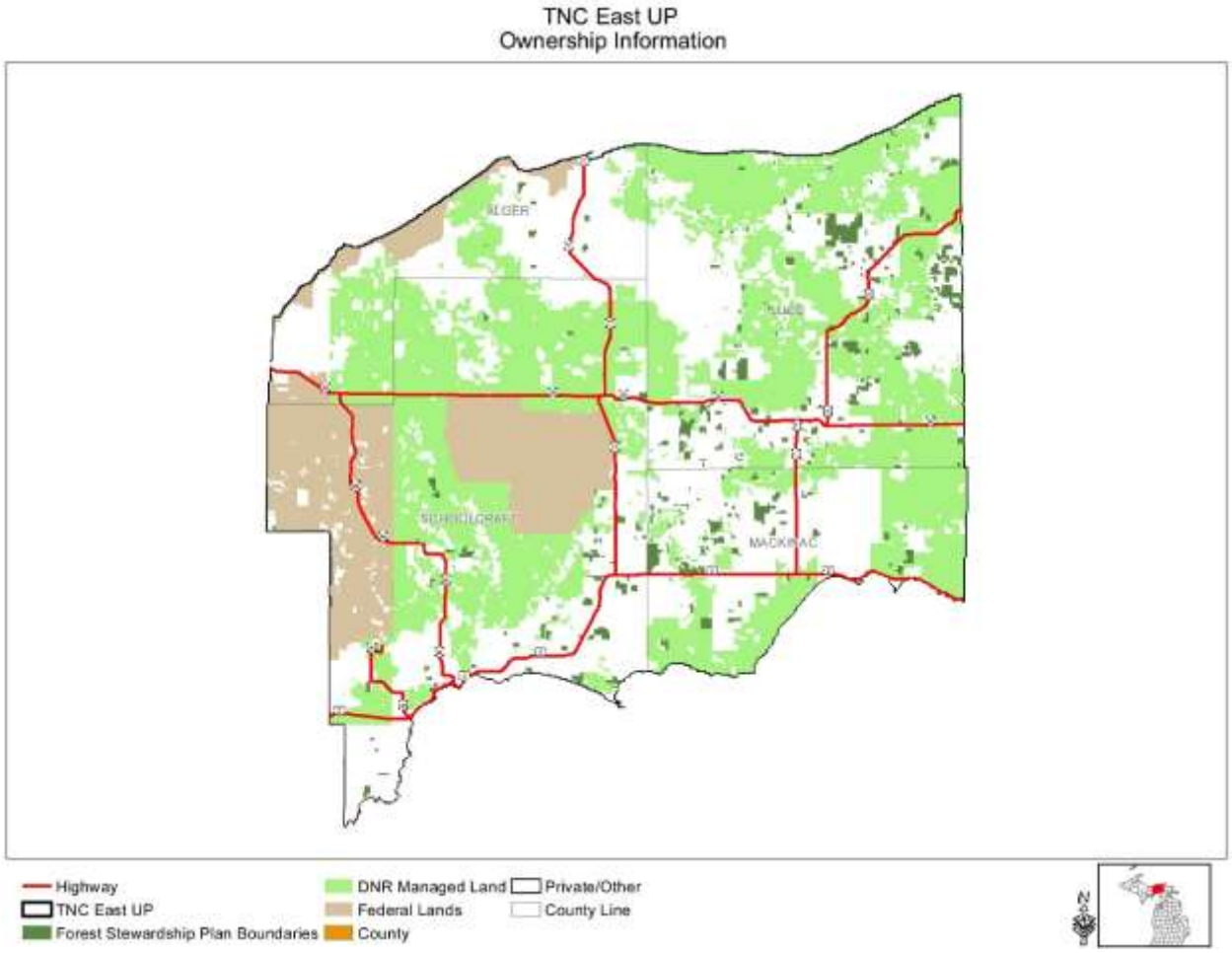
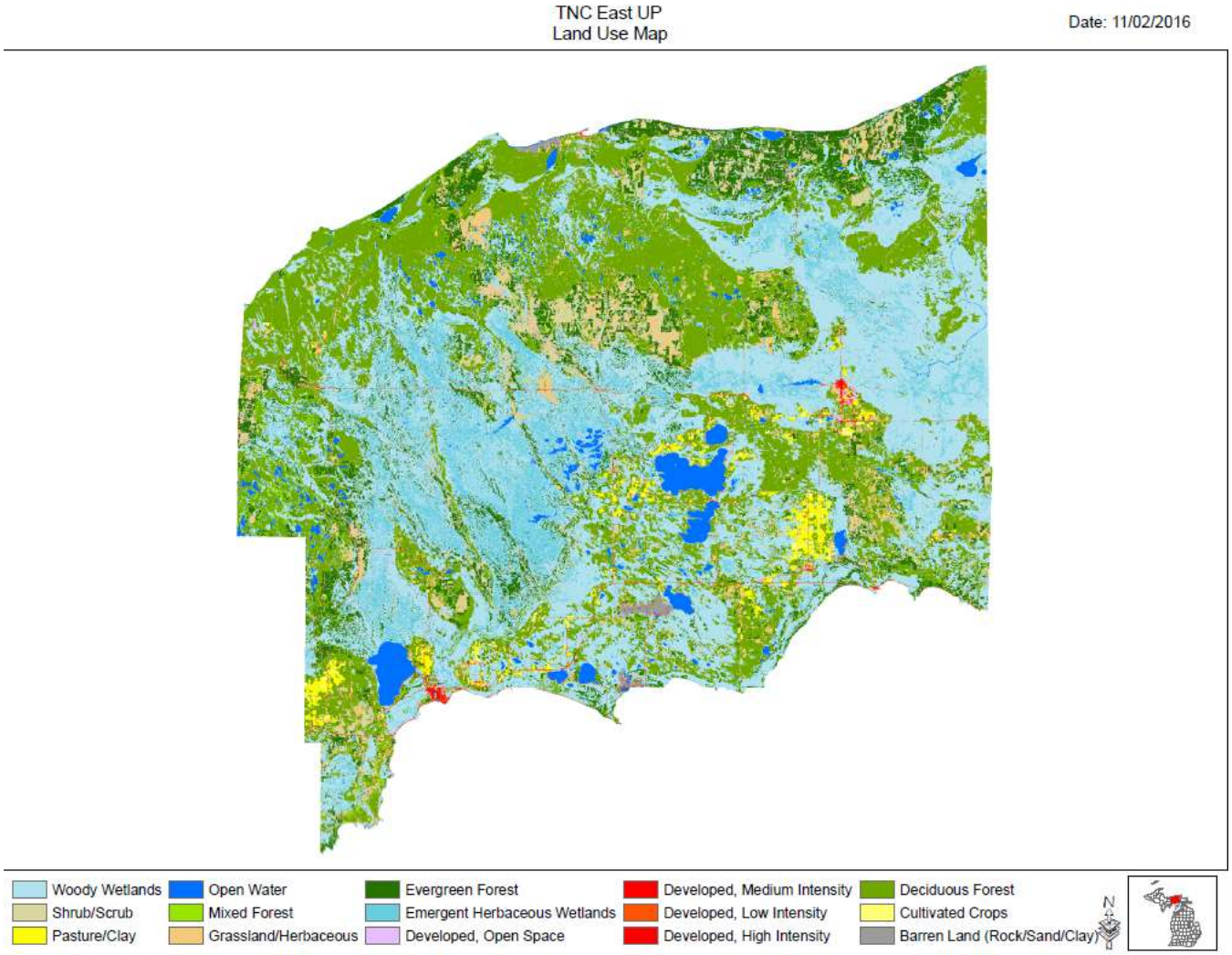


Table 3.1 Manager and Acreage

MANAGER	ACRES
COUNTY	300
LOCAL	1,778
NGO (NON TNC)	527
STATE PARKS (NON TAHQ)	3,195
TNC	29,959
SENEY NWR	92,623.65
HIAWATHA NF	132,752
HANCOCK FOREST (EASEMENT)	186,929
PICTURED ROCKS	30,132
TAHQUAMENON FALLS ST PARK	11,080
STATE FOREST	754,926
PRIVATE LANDWONERS WITH STEWARDSHIP PLAN	61518

Map 3.4 Land use map



3.1.2 Cultural Landscape

Native American:

Pre-settlement time runs from the end of the glaciers, about 10,000 years ago, to the time when Europeans and Americans started to settle in what is now Michigan. During this time, there were many American Indians living along the shores of the Great Lakes and the major rivers. Ojibwa (Chippewas-Anishinabek), Menominees, Ottawas, Potawatomes, Miamis, and Hurons were important peoples living in Michigan. And before them, there were the Woodland Cultures. These people came to Michigan for many reasons, including copper mining (MSU – GEO 333).

In the 1836 Treaty (the Washington Treaty), the Anishinabek ceded over 3.8 million acres (21,621 square miles) of land in what is now northern Michigan. Roughly speaking, the 1836 ceded territory boundaries are the Eastern Upper Peninsula up to the Escanaba River and two-thirds of the northern

lower peninsula down to Thunder Bay River on the east side and the Grand River on the west side with a boundary line drawn between the two rivers, as Map 3.5 details: The treaty was concluded and signed on March 28, 1836 in Washington, D.C. by Henry Schoolcraft, Indian Commissioner for the United States and several representatives of the Native American nations. The treaty was proclaimed on May 27, 1836. In Article Thirteenth of the 1836 Treaty, the Anishinabek reserved the right to hunt and fish. After several court cases and settlements, the rights have been upheld and the tribes have gathering, hunting, and fishing rights over the lands in this landscape.

Map 3.5 Tribes and the Treaty lands

MSU - EDU http://geo.msu.edu/extra/geogmich/images/indianreservation.jpg

Early European Explorers:

Fur trader Pierre Esprit Radisson, in 1658 first saw the central UP coast and especially remembered the "Pictured Rocks" and the Grand Sable Banks. These features are two of the most striking scenic features in the eastern United States, yet 300 years after Radisson the area was still little known. The very accurate 1670 Jesuit map of Lake Superior was followed by a series of increasingly distorted depictions of the region (Karamanski, 1995).

In the mid-1800's Henry Rowe Schoolcraft an explorer with the Lewis Cass expedition to extend peaceful relations with the native peoples, wrote the first description of the area in English. While Henry Wadsworth Longfellow used the writing and descriptions of Schoolcraft to write his 1855 *The Song of Hiawatha,* Wadsworth himself never visited nor showed much interest in the region itself (MSU Native America Research Guide). Artist. A. L. Rawson spent 2 summers in the area, exploring and drawing, in the 1860's. *Harper's New Monthly Magazine*, in May of 1867 featured his extended narration and art from the area. While beautiful he did admit in the article that the area was very remote with little services (Karamanski, 1995).

From the 1800's, fishing camps were based at various locations along the Lake Michigan shoreline from Epoufette west to Seul Choix Point. Limestone had been quarried at several locations within the area including, Millecoquins Lake, and Seul Choix Bay. Upland areas dominated by pines and northern hardwoods were cut, and often burned, by the early 20th century. Along the Lake Superior shoreline, surveyors noted several Native American trails, fields, and sugar camps west of Tahquamenon Bay and near Munising.

By the late 1880's several large lodge-style camps or hotels where on the Lake Superior Shoreline, mainly west of this report Landscape. Cruises to tour the cliffs began in the early 1900's to view the rocks from the water. Even into the 1930's, however, it was an intrepid visitor traveling poor roads and unmarked routes that found the beauty in the landscape.

The Log Camps and Railroad:

The Center of Michigan History Studies has outlined the history of camps (http://www.michigan-history.org/lumbering/LumberingBriefHistory.html). The earliest lumbering was done by the French in order to build forts, fur-trading, posts and missions. The British, and later the Americans, used Michigan's hardwoods to build merchant and war ships.

Beginning north of the Muskegon and Saginaw area (in the northern lower), pines were found in abundance including white, jack and red, as well as other conifers. White pine allowed the heyday of the lumber industry. Many white pines were over 200 years old, two hundred feet in height, and five feet in diameter.

Michigan's pine became dominant, as the supply of trees in the northeast US were cut over. By 1880, Michigan was producing as much lumber as the three neighboring states combined. The first group of people to set up lumbering operations were from New England, especially Maine and New York. The forests there were almost entirely cut, so the owners and experienced crews followed the work. Many felt that the huge forests of Michigan would last for many, many years, yet within a 20-year period, 1870 to 1890, most of the trees were cut. Timber cruisers worked for lumbermen and would select the best land available and reserve it at the land office for their employers. Much of this land sold for as little as $1.25 an acre; and later, under the Homestead Act (1862), men were hired to claim a plot of 160 acres and stay until the timber on it was cut.

After the timber cruisers found the best stands of pine, the crew would come in and build a camp, which consisted of a bunkhouse, cook shanty which had a dining room and kitchen, the most important part of camp. There was a blacksmith and a carpenter as well as a granary and barn for the animals. The camp store would have the basic supplies need by the men, such as clothes and tobacco. These buildings were not very well built, as they were often meant to be temporary, to be moved when the trees were gone. Today forest hikers will often find old metal garage from these camps. Each camp typically had two foremen, about seventy men, twenty teams of horses and seven yoke of oxen. The men came to the

camp in late fall or early winter, as logging was a cold weather job. The crews worked from about 4 a.m. until dusk, even eating the noon meal in the woods.

The logs were far too big and heavy to take from the woods by dragging, so the loggers made ice-covered roads, where the logs could be pulled on sleds. The loads were often extremely big and contests were held between rival camps to see which could stack a load the highest. The logs were taken to the banks of rivers, where they were piled twenty to thirty feet high, awaiting the spring thaw. When rivers melted, the logs were pushed into the swollen rivers and floated to the mills. Much folklore arose from the camps and mills. The men were in the woods many months with only Sundays off. They often sang and made up stories, many of which are known today(A Brief History of Logging in Michigan - http://www.michigan-history.org/lumbering/LumberingBriefHistory.html). Map 3.6 shows the log camps of the central UP and Table 3.2 shows the names of these camps.

Map 3.6 The Location of Camps in the Central UP 1920-1930 (Parlin, et al. 2011)

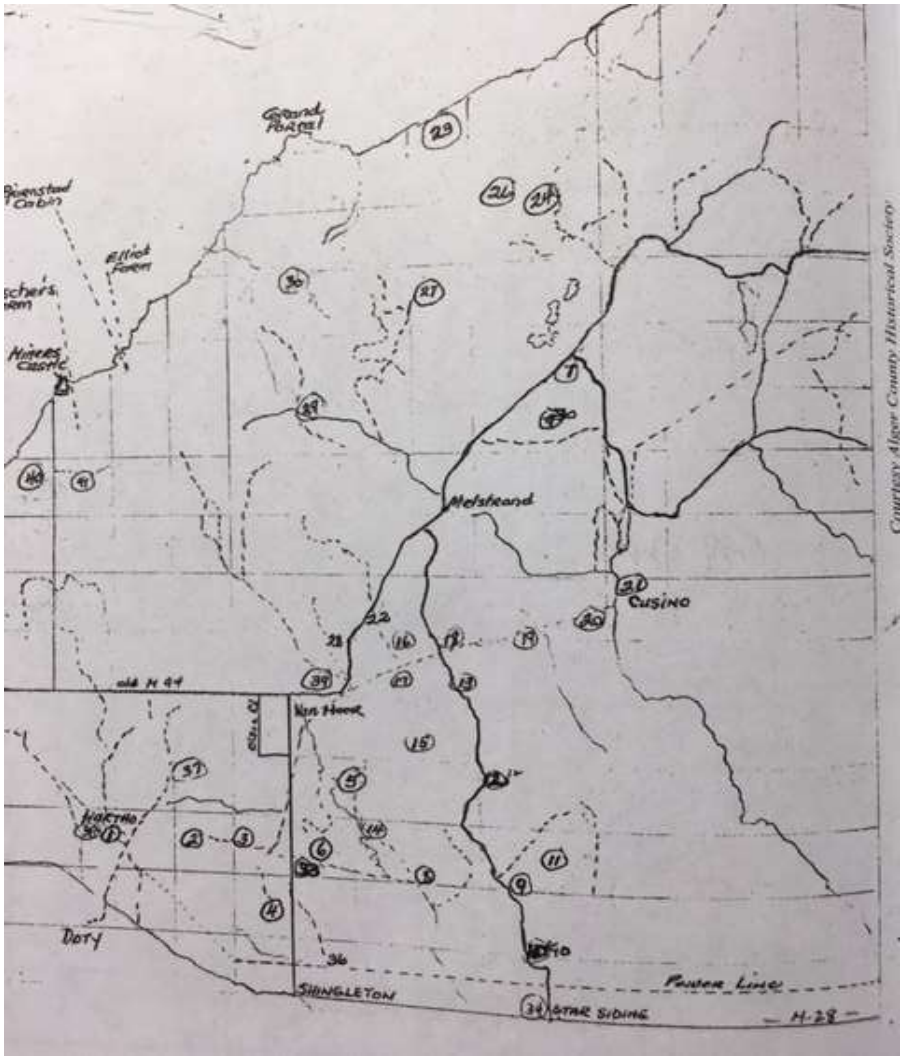
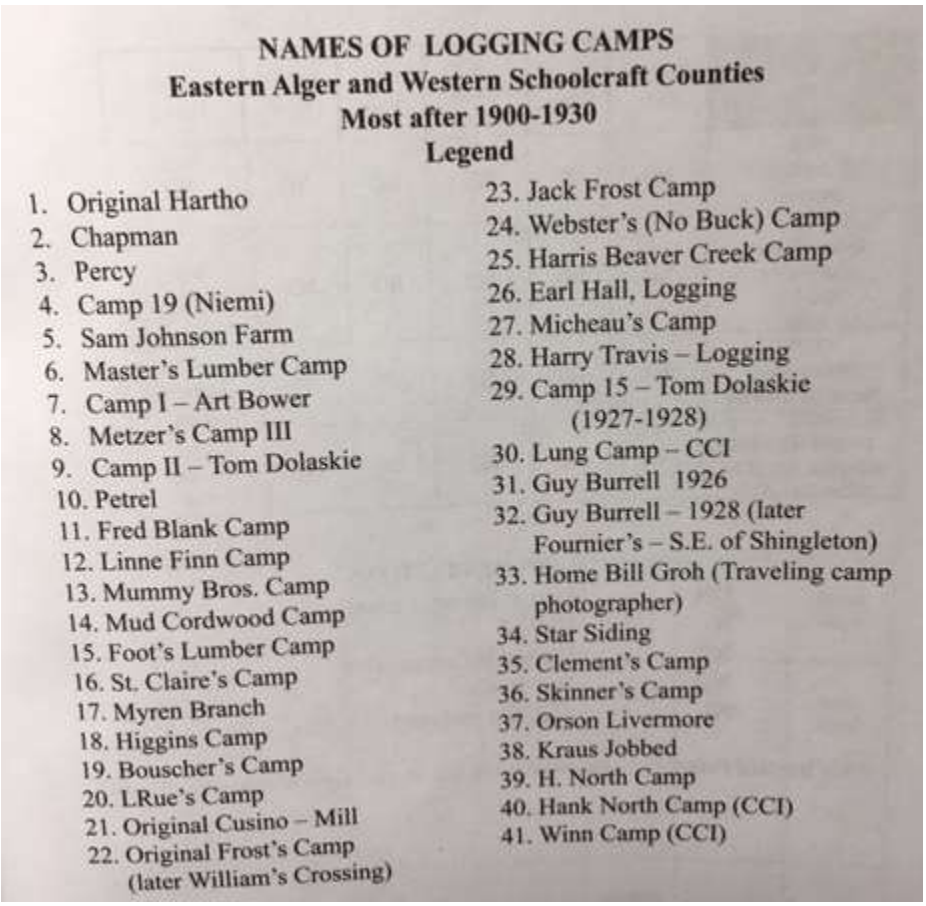


Table 3.2 The Location of Camps in the Central UP 1920-1930 (Parlin, et al. 2011)

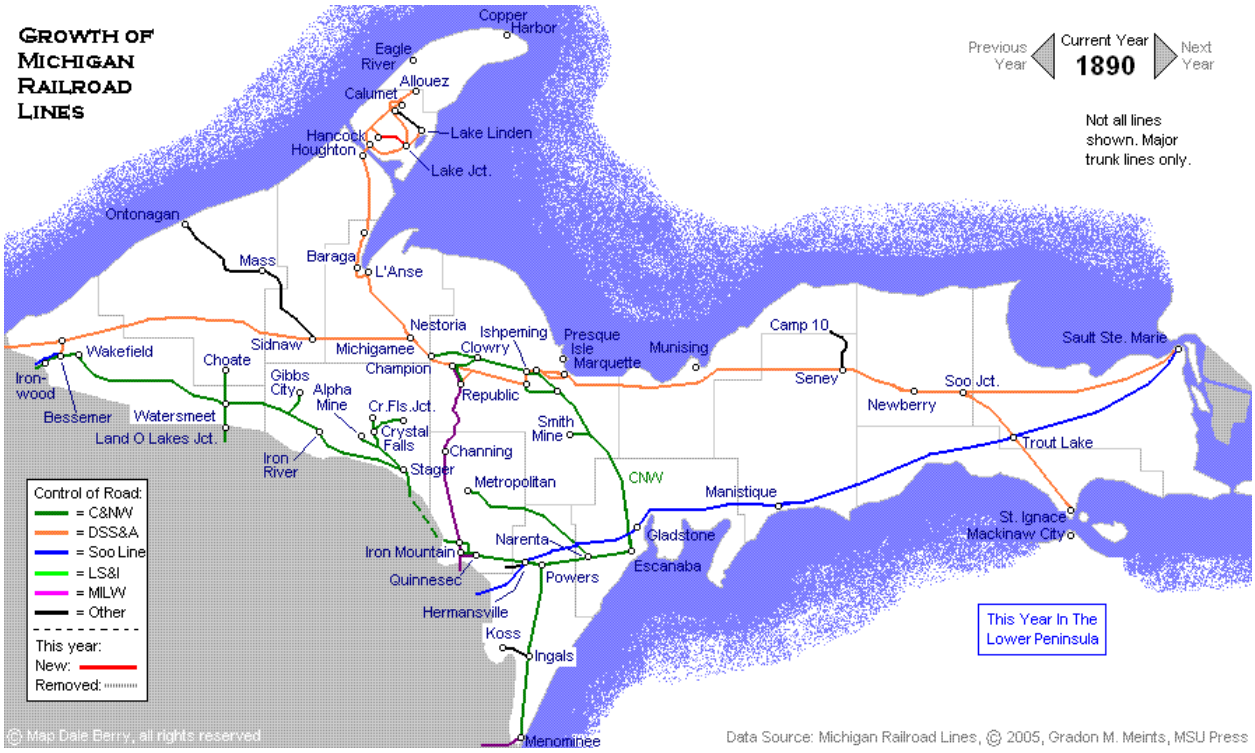


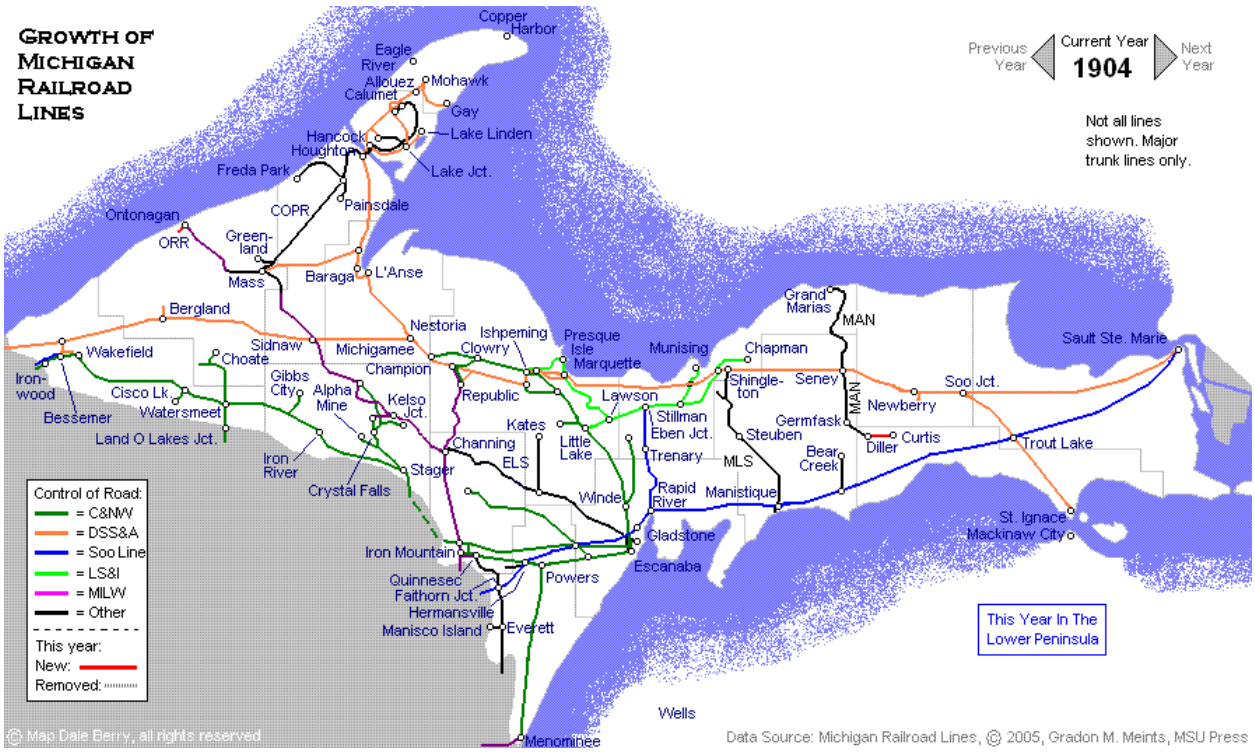
NAMES OF LOGGING CAMPS
Eastern Alger and Western Schoolcraft Counties
Most after 1900-1930
Legend

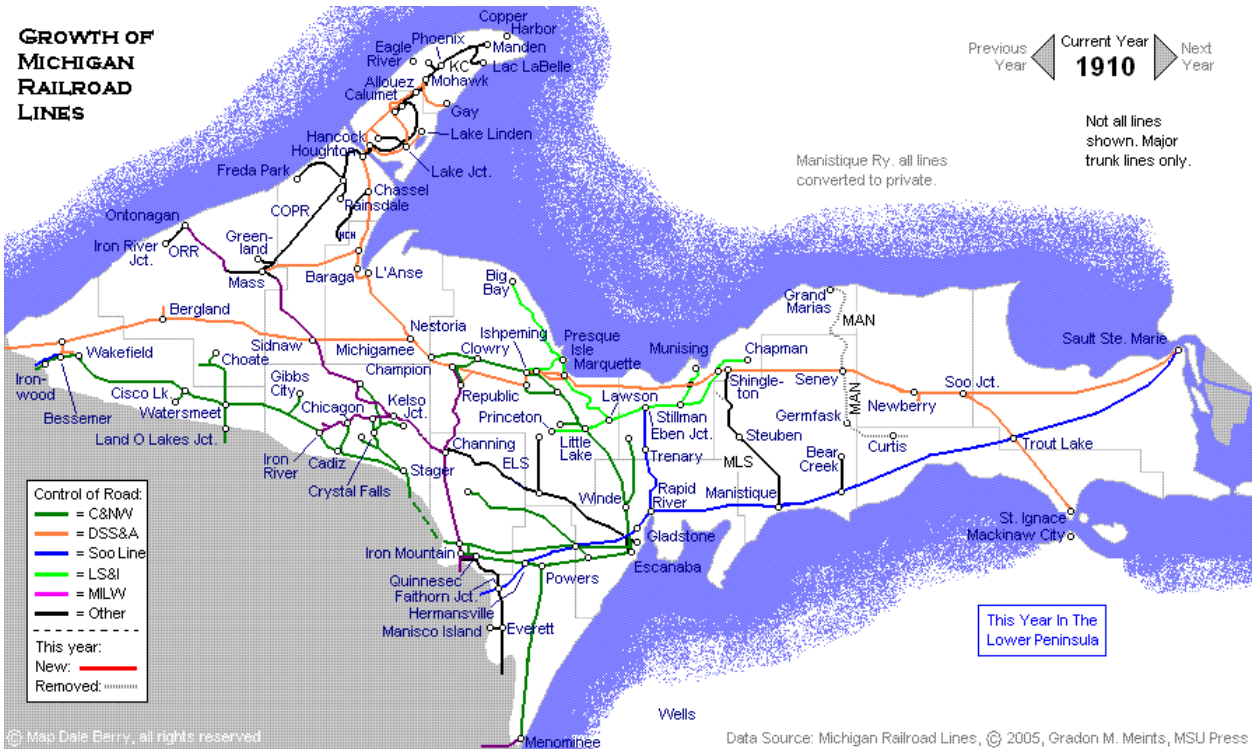
1. Original Hartho
2. Chapman
3. Percy
4. Camp 19 (Niemi)
5. Sam Johnson Farm
6. Master's Lumber Camp
7. Camp I – Art Bower
8. Metzer's Camp III
9. Camp II – Tom Dolaskie
10. Petrel
11. Fred Blank Camp
12. Linne Finn Camp
13. Mummy Bros. Camp
14. Mud Cordwood Camp
15. Foot's Lumber Camp
16. St. Claire's Camp
17. Myren Branch
18. Higgins Camp
19. Bouscher's Camp
20. LRue's Camp
21. Original Cusino – Mill
22. Original Frost's Camp (later William's Crossing)
23. Jack Frost Camp
24. Webster's (No Buck) Camp
25. Harris Beaver Creek Camp
26. Earl Hall, Logging
27. Micheau's Camp
28. Harry Travis – Logging
29. Camp 15 – Tom Dolaskie (1927-1928)
30. Lung Camp – CCI
31. Guy Burrell 1926
32. Guy Burrell – 1928 (later Fournier's – S.E. of Shingleton)
33. Home Bill Groh (Traveling camp photographer)
34. Star Siding
35. Clement's Camp
36. Skinner's Camp
37. Orson Livermore
38. Kraus Jobbed
39. H. North Camp
40. Hank North Camp (CCI)
41. Winn Camp (CCI)

As technology improved, the wood in Michigan was more quickly taken, especially with the introduction of the logging railroad in the 1850's. These small engines and their portable narrow gauge track made it possible to log farther away from the rivers. These railroads could haul loads of logs no matter the weather. Other improvements included the use of the crosscut saw to fell the trees much more quickly than the axe, the circular saw in the mills and the "big wheel" for logging in the summer months. Map 3.7 displays the growth of small line rails across the report Landscape. However, most of these lines have been now long abandoned.

Map 3.7 – Growth of long and shore line rails in Central UP (Meints 2005)







Last Century:

When the great depression struck in the early thirties, thousands of young men were enrolled in the Civilian Conservation Corps (CCC), one of President Franklin D. Roosevelt's recovery programs. Michigan was among the first of the states to receive its full quota of CCC camps. At the end of 1935 there were over 100 camps operating in the state, Camp Cusino in this report Landscape was one such camp. The camp was originally near the small town of Melstrand and a sign today commemorates what now is an old field with apple trees.

At the Cusino Wildlife Research Station near Shingleton, an extensive moose research project, the only one of its kind in the nation, took place. The CCC crews assisted by moving moose from Isle Royale to the Cusino Station where studies determined the animals' food requirements, mating habits and disease resistance. An experimental deer-feeding project was also conducted at Cusino and again the CCC crew assisted in building a huge enclosure (1-mile square) for deer research.

Not far from Cusino, the men of Company 3626 established the Seney National Wildlife Refuge in 1935. These members of Camp Germfask, the only U.S. Bureau of Biological Survey camp in Michigan, transformed 95,000 acres of marshland into a domicile for migratory wildfowl. A system of dams, spillways, ditches, dikes and pools was built, and hundreds of acres of millet, celery and wild rice were planted as food for birds. More heavy machinery was operated at Camp Germfask than at any other Michigan CCC camp. Most Michigan CCC camps were in either national or state own lands.

Current Human Settlement:

The cultural landscape of the four-county area, which has a combined population of less than 20,000 (2010 census), is primarily rural in character.

County Population:

Schoolcraft – 8,247
Luce – 6,502
Eastern Alger – 3,000
West Mackinac – 900

The report Landscape's largest communities are Newberry, in Luce County (1,519 people) and Manistique in Schoolcraft County (3,097people). This mostly undeveloped landscape is dominated by two interrelated physical features that define the region's sense of place and support its tourism and outdoor recreation based economy—the coastal ecosystem of Lake Superior and Lake Michigan and the vast wetlands in the central part of the landscape that feed the undeveloped rivers of the Two Hearted and Fox.

The people of this landscape counties continue to have a close relationship with the forests, waters and wildlife of the central Upper Peninsula. The economy continues to be driven by forest products and tourism. Tourism includes canoe livery and miles of snowmobile and ATV trails. Hosting snowmobilers is the major winter revenue source along with timbering.

3.1.3 Climate

This landscape in the Upper Peninsula has a cool lacustrine climate, owing to northern latitude and proximity to Lakes Huron, Michigan, and Superior. The Great Lakes, and in this instance, Lake Superior temper the climate of the area.

Extending approximately 20 miles inland from Lake Superior, this "lake effect" retards warming in the spring, reduces maximum temperatures in the summer, retards fall cooling, and lessens extreme minimum temperatures in the winter. The proximity of Lake Superior also reduces the severity of thunderstorms \ and provides for considerable lake-effect snowfall (Albert et al. 1986).

Based on records for the period 1940 -1969 at the Grand Marais Weather Station, the average growing season is about 107 days, with average annual minimum and maximum temperatures of 32° F (D° C) and 50° F (28° C), respectively. The recorded minimum and maximum temperatures are -32° F below zero (-18° C) and 99° F (55° C). Precipitation annually averages approximately 31 in. (79 cm.), of which about 50 percent falls in winter, as a seasonal snowfall of about 126 in (320 cm.) (Michigan Dept. of Agriculture Weather Service, 1974). The weather for the southern half of this landscape would be less snow – since it is removed from the Lake Superior Lake Effect and slightly warmer.

While the climate is dominated by lacustrine influences near its margins, the center of this report Landscape is an extreme frost pocket near the center of the broad central wetlands. Growing season

ranges from less than 100 days in the center of the frost pocket to approximately 130 days at the northern and southern edges (Albert et al. 1986, Eichenlaub 1990). The growing-season heat sum (1,800-degree C-days) is one of the lowest in the State (Albert et al. 1986, Denton 1985). Extreme minimum temperature is -46½F near the center and -36½F at the north and south edges. Average annual precipitation is 32 to 34 inches.

The presence of the Great Lakes not only influences the local climate, but also greatly affects the physical and biological features of the terrestrial environment. The most important among these factors is the fluctuation of lake levels and the greater occurrence of storms.

Lake Superior water levels are partially regulated by compensating gates on the Saint Mary 's River, the outlet of Lake Superior to Lake Huron, located at Sault Ste. Marie, Michigan. Lake Superior serves as the main mechanism for controlling levels of all the other Great Lakes, but particularly Lakes Huron and Michigan. Human-imposed lake level changes are made mainly for the purposes of shipping navigation, and reducing beach erosion (R. Kivetsky, pers. comm.). However, Lake Superior levels are primarily controlled by lake-wide natural forces such as precipitation, evaporation, and run-off. Lake level fluctuations have seasonal, annual, and long-term variations. Lake Superior levels have ranged from a minimum m of 599.5 feet to a maxi m u m of 603.5 feet above sea level over the period of record, 1918 to 1993 (U.S. Army Corps of Engineers, 1994).

Lake level changes and storms determine the movement of dunes, influence the deposition of sediments in the nearshore areas, and alter the flow of rivers near their mouths. Further inland, the lake influences natural disturbance regimes causing wind throw of trees and winter storm damage to trees. Also, lake level changes may be responsible for fluctuations of ground water tables several miles inland thus influencing vegetative composition of intermittent wetlands (Price,1994).

3.1.4 Climate Change

In spring of 2007 the Intergovernmental Panel on Climate Change (IPCC) released a large report on climate change. The report was the end product of 600 authors from 40 countries and reviewed by more than 620 experts and governments. The IPCC found that global climate change is almost certainly driven by manmade greenhouse gas emissions.

In a Michigan conference that followed the release – the report was focused down to impacts within Michigan. Upper Peninsula and Great Lakes effects of climate change may include – as noted at the conference were the following:

Higher temperatures: Temperatures in Michigan have risen by a little less than 2 degrees Fahrenheit since the 1980s and are projected to increase 2 to 7 degrees by the end of the century. Most warming occurs in winters, in the Upper Peninsula and at nighttime.

Lower lake levels: Higher temperatures produce less ice cover on the Great Lakes, which means more water evaporates off the lakes. As a result, lake levels are projected to decrease by one to five feet by the end of the century.

Changes in precipitation: Michigan will have more frequent heavy rain storms, occurring mostly at the beginning of the spring, followed by less rainfall during the summer months. Heavier snow falls in winter (from non-ice covered Great Lakes) may melt off faster in spring causing flashy and flooding conditions.

Changing forestry conditions: Most of the timber industry depends on cold, deeply snow covered ground which provides a lot of buffer when logging. Deep snow and cold temperatures insure that the soil and vegetation at ground level is never disturbed during winter logging operations. However, with larger swings in temperature and more periods of above freezing temperature the logging industry may be challenged to log using the timing and methods they have been accustomed to.

3.1.5. Forest Adaptation Resources

To assist forest owners to better understand climate adaptation and management, the Northern Institute of Applied Climate Science (NICAS) was created at a USDA Forest Service Research Station in Houghton Michigan. NIACS is a collaborative effort among the Forest Service, universities, and forest industry to provide information on managing forests for climate change adaptation, enhanced carbon sequestration, and sustainable production of bioenergy and materials. As a regional, multi-institutional entity, NIACS builds partnerships, facilitates research, and synthesizes information to bridge the gap between carbon and climate science research and the information and management needs of land owners and managers, policymakers, and members of the public.

One of the major products from NIACS are regional Climate Change Response Frameworks. In 2009 a frame work was created to provide information and resources for land managers in northern Wisconsin. The project was expanded to the Northwoods Climate Change Response Framework in 2011 to cover 64 million acres across the Laurentian Mixed Forest Province within northern Minnesota, Michigan and Wisconsin. The project's overall goals are to help land management needs of land owners and managers, policymakers, and members of the public. NIACS has assisted forest managers adapt ecosystems to changing climate, learn from partners across ownership boundaries, and rapidly incorporate science and monitoring information into management activities. For Links to this project – click Here or go to http://www.forestadaptation.org/

A valuable resource for this specific report Landscape is the publication produced by NIACS entitled *Michigan forest ecosystem vulnerability assessment and synthesis: a report from the Northwoods Climate Change Response Framework project* which was published in 2014. The report specifically focuses on forests in the eastern UP and northern lower peninsula. Many northern trees such as balsam fir, white cedar, jack and red pine are predicted to lose climate-based habitat while species such as cherry, oaks, red maple, and white pine may perform better under Michigan climate scenarios. Landowners in this specific report Landscape may

benefit from cooler winds off Lake Superior that may dampen some of the warming trends but likely the UP will observe many major shifts in trees species, arguably not all bad. If the UP gains oak species, cherry is improved, and possibly walnut or hickory added these will be value-added trees to the forest economy. However, if climate change hastens an exotic insect that may prey on maple then great harm could come to the UP forests and economy. To download, the MI Climate Vulnerability Assessment, click Here or go to https://www.nrs.fs.fed.us/pubs/45688.

3.1.6 Geology

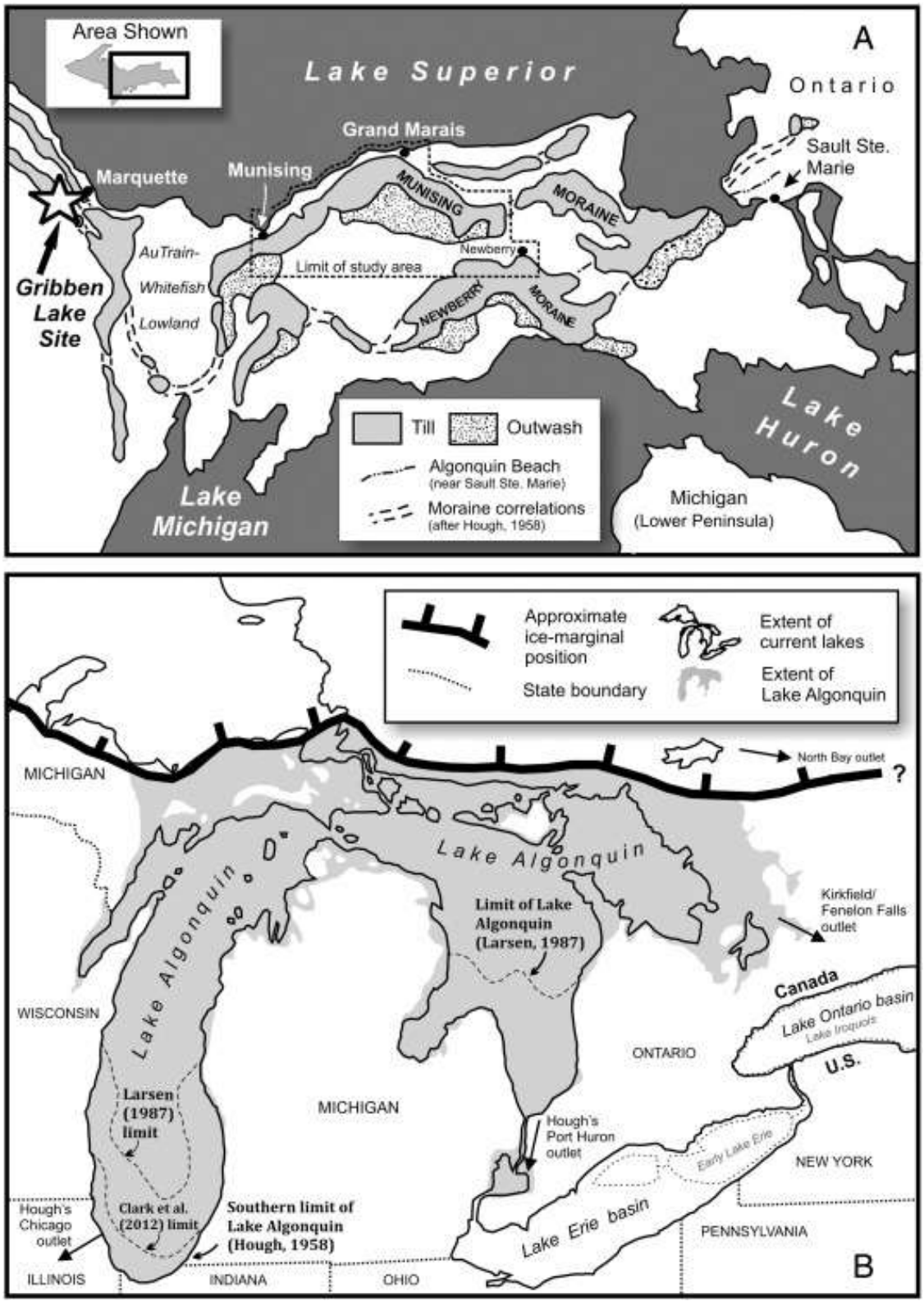
The geologic features, landforms, and soils of this landscape are geologically young, forming during the last period of continental glaciation, known as the Wisconsinan stage, from 50,000 to 9,500 years ago (Dorr and Eschman, 1970; Farrand, 1992).

In the northern portion of this landscape, an east-west-trending sandstone escarpment of Cambrian age is exposed in several waterfalls, including Tahquamenon Falls, Spray Falls, and Miner's Falls, and along the Lake Superior shoreline at Pictured Rocks National Lakeshore (Dorr and Eschman 1984, Reed and Daniels, 1987). Farther inland, Ordovician sandstone and dolomite are the underlying bedrock (Reed and Daniels, 1987). Bedrock is locally exposed, but drift can be at least 200 feet thick, both on the outwash plains and on the moraine ridges (Vanlier, 1963a).

The Crisp Point Moraine and Munising Moraine bisect the lake plain in the east end of this landscape (Vanlier 1958; Drexler et al. 1983). A large lobe of the Munising Moraine also occurs in the west and southwest portions of the watershed creating the drainage divides between the Two Hearted River system and the Sucker and Tahquamenon Rivers. These moraines are composed of variable amounts of unsorted clay, silt, cobbles, and boulders within a matrix of predominantly sand, sandy loam, and sandy clay loam (Farrand and Bell, 1982; Vanlier, 1958). These well-drained ridges support a wide array of community types from northern hard woods, aspen-birch, and upland conifers to moister lowland conifer and hard woods where finer-grained materials slow water movement. Since the higher elevations of the moraines often define the location of stream courses, typically materials at the base of the moraines are fine-grained, poorly-d rained alluvium. Here lowland conifer and mixed conifer-hard wood forests predominate.

The Crisp Point Moraine and Munising Moraine make a major contribution to groundwater recharge in several rivers including the Two Hearted, Sucker, and Fox systems.The moraines contribute water not only to these lakes, but also to adjacent t peatlands. High infiltration rates coupled with the more calcareous material found in moraines make these glacial features important to the peatlands they adjoin by supplying large volume of mineral-rich water.
See Map 3.8 for display of the moraines.

Map 3.8 – Areas of Moraines

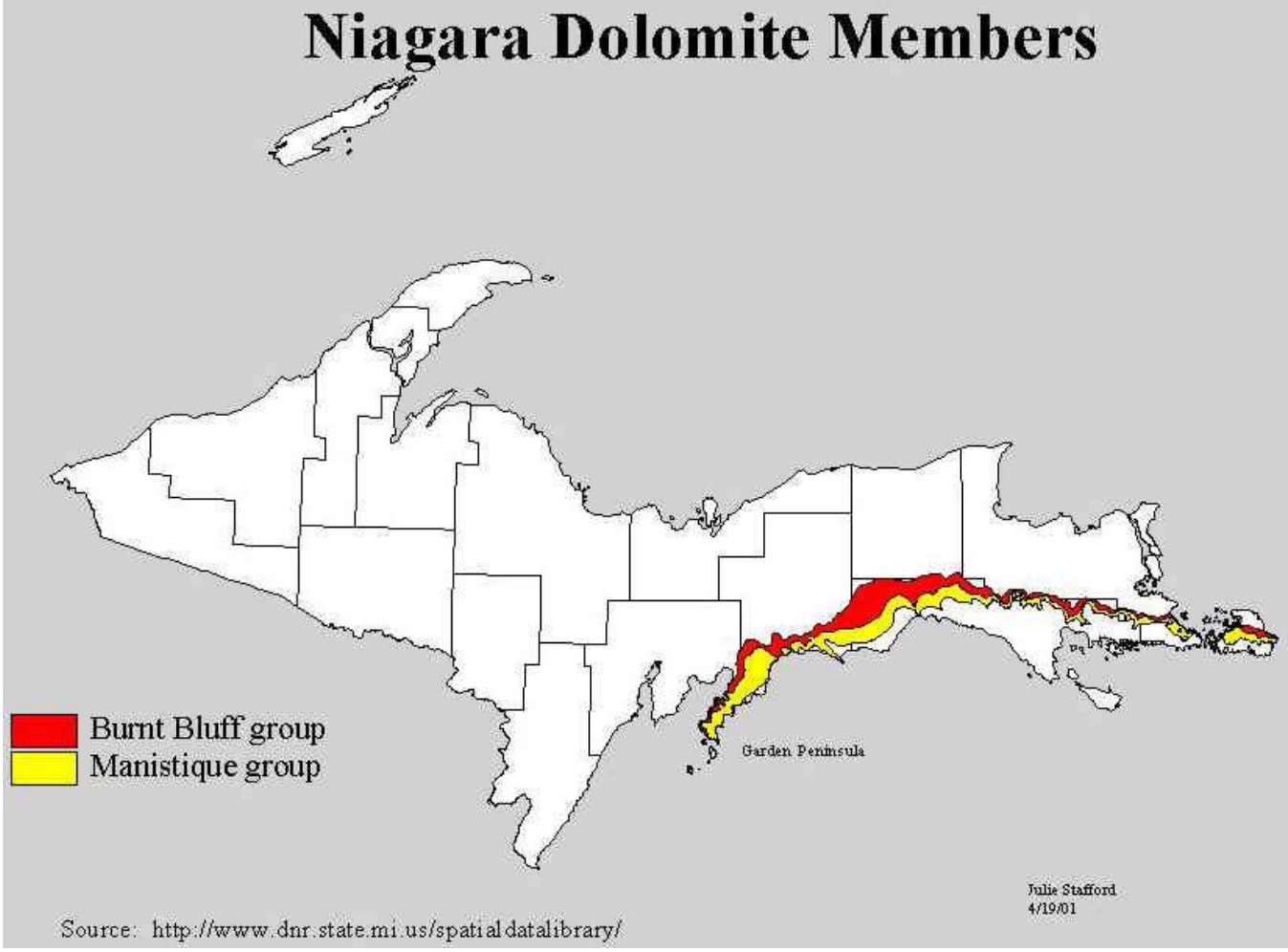


(From Blewett, 2014)

The southern part of the report Landscape is underlain by Silurian and Ordovician-age sedimentary bedrocks, principally limestone and dolomite, but also includs less resistant shale and gypsum (Dorr and Eschman 1984). The resistant Niagaran series dolomite and limestone of Silurian age form the Niagaran Escarpment, which is locally exposed as cliffs and limestone pavement along the Lake Michigan shoreline for the length of this report Landscape. The underlying bedrock is typically less than 50 feet below the surface of the glacial drift (Vanlier and Deutsch 1958; Sinclair 1959, 1960). Limestone is mined in several places within this report Landscape along lake Michigan. The limestone, in places tends to form a prominent topographic feature (the Niagara cuesta) and it outcrops in many places as high, rocky cliffs. See Map 3.9 and 3.10.

Map 3.9. The Niagara Escarpment – From the Giant Rib Escarpment Education Network

Map 3.10 Niagara Dolomite



3.1.7 Land Cover Type

The land cover for this landscape is dominated by undeveloped natural lands – with few towns. While there are paved highways; notably US Route 28/41 and US Route 2 at the southern boundary, many hundreds of miles of lesser dirt, two-tracks exist.

Much of the landscape lies exclusively on sandy soils and sandy lake plain deposits. This area supports the pine plains ecosystem which extends many miles especially in the Lake Superior watershed. Today the sand plain supports mostly jack pine (*Pinus banksiana*) with a scattering of red pine (*Pinus resinosa*), red oak (*Quercus rubra*), aspen (Populus spp.), and white birch (*Betula papyrifera*) and a sparse ground cover chiefly of blueberry (*Vaccinium* spp.), reindeer moss (*Cladina* spp.), sweet fem (*Comptonia* spp.), and bracken fem (*Pteridium aquilinwn*). The strong winds and dune movement have created a depauperate ground flora along the nearshore dunes. The nearshore vegetation includes dune grasses, bearberry (*Arctostaphylos uva-ursi*), wormwood (*Anemisia* spp.) and a few scattered trees representative of those found on the more inland sand plain. The land forms are lacustrine in origin. On

both Great Lake shores parabolic dune fields, and shallow embayment's containing transverse dunes are found.

Broad, poorly drained embayment's contain beach ridges and depressions (swales), sand spits, transverse sand dunes, and sand bars. Deltaic deposits occur along the northern margins of the embayment's, where glacial meltwater streams carried massive amounts of sand into the shallow waters.

Along the northern portions of the landscape are sandy ridges of end moraine and pitted outwash. Lacustrine deposits of glacial and postglacial origin are also located along the northeastern edge. The recent geomorphological interpretation is that many of the end moraines (as originally interpreted by Leverett 1929) are actually heads of outwash and related stagnation landforms (Blewett and Rieck 1987).

Lacustrine deposits within the sub-subsection can be broken into two major types: the droughty sand dunes and beach ridge deposits and the poorly and very poorly drained glacial lacustrine deposits. Along the Lake Superior shoreline, sand dunes, sand spits, and beach ridges form a broad zone characterized by vast expanses of excessively drained sand soils, unlike most shorelines of the Great Lakes.
The Grand Sable Dunes, west of the town of Grand Marais within Pictured Rocks, are large, steep dunes perched upon till. The dunes are active, supporting only local areas of forest. At their protected east end, they support a small area of northern hardwood forest. A few small pockets of jack pine also persist within the dunes. This is the largest dune on Lake Superior.

The poorly drained deposits are concentrated in northern Luce County. These are of the same age and support vegetation similar to that of the more extensive peatlands to the south in the landscape.
Outwash plains are concentrated along the southern edge of the sub-subsection, and a relatively small area of poorly drained outwash is at the extreme west edge. Along the shoreline, outwash is restricted to areas west of Munising and west of Grand Marais.

Most of the moraine ridges and pitted outwash have well-drained, sandy soils. Kettles within the pitted outwash and moraines contain bogs with thick deposits of sphagnum peat. At the far western edge of the sub-subsection, where sandstone bedrock is only thinly covered by till, soils are moderately well drained.

Much of the central portion of the landscape supports the vast peatland-forest. Sandy lake plain deposits compose the vast majority of the glacial drift underlying this ecosystem. The peatlands support a variety of communities from mineral-poor, highly acidic bogs and muskeg, to the more mineral-rich, more alkaline patterned fens and rich conifer swamps. The sandy uplands are relict shoreline features seen as undulating or isolated ridges within the vast peatlands. See Diagram 3.1. These upland ridges support a variety of pine, mixed pine-hardwood, and northern hardwood forests (Michigan Dept. of Natural Resources 1978).

Diagram 3.1 – Bog patterns showing ridge and swales (Anderson, 1982)

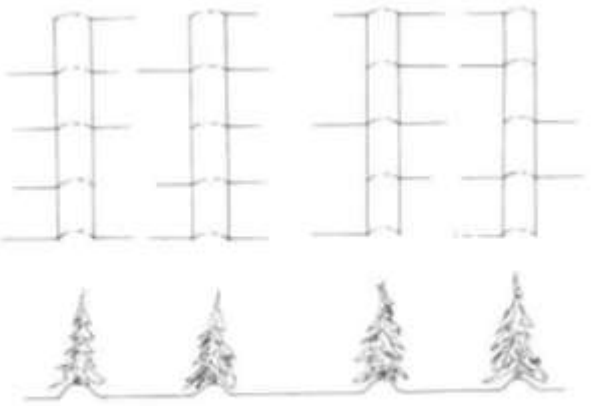


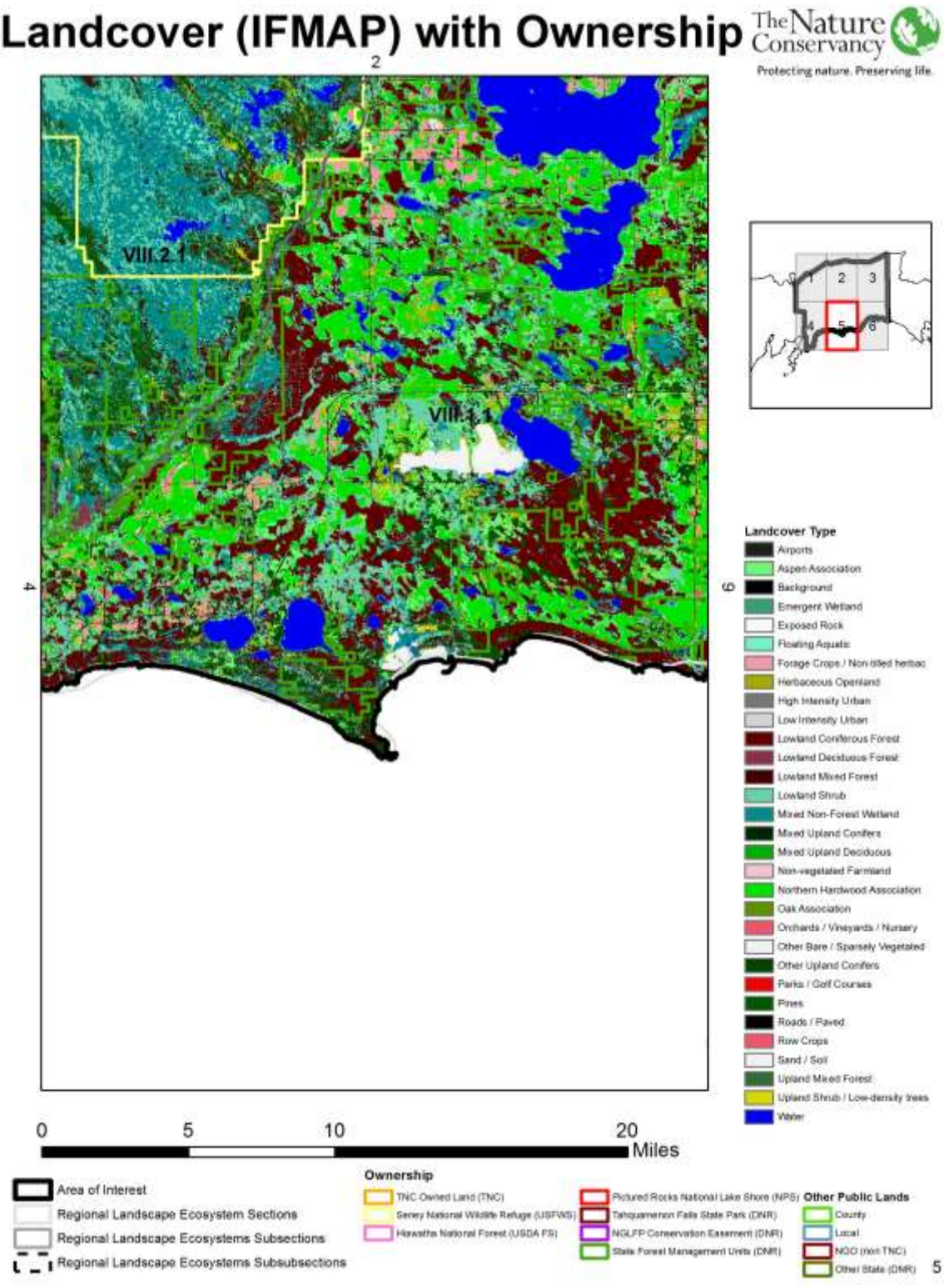
Fig. 5. Bog pattern showing ridges which often had tamarack and hollows.

The next page shows the landcover Table 3.3 and Map 3.11

Table 3.3. Land Cover Type

Class Name	Acres	Hectares	Sq. Mi
Northern Hardwood Association	359,719.67	145,573.39	562.06
Lowland Coniferous Forest	335,950.56	135,954.37	524.92
Pines	240,895.00	97,486.75	376.40
Lowland Shrub	240,399.50	97,286.23	375.62
Mixed Non-Forest Wetland	221,737.51	89,733.99	346.46
Aspen Association	123,306.64	49,900.43	192.67
Herbaceous Openland	71,963.64	29,122.65	112.44
Upland Shrub / Low-density trees	69,091.38	27,960.29	107.96
Water	59,759.39	24,183.77	93.37
Mixed Upland Conifers	29,203.83	11,818.37	45.63
Lowland Mixed Forest	26,926.26	10,896.67	42.07
Forage Crops / Non-tilled herbac	24,979.40	10,108.80	39.03
Upland Mixed Forest	24,650.92	9,975.87	38.52
Mixed Upland Deciduous	16,972.89	6,868.68	26.52
Roads / Paved	15,029.58	6,082.26	23.48
Floating Aquatic	10,897.00	4,409.86	17.03
Other Upland Conifers	7,118.70	2,880.84	11.12
Emergent Wetland	6,683.25	2,704.62	10.44
Lowland Deciduous Forest	6,403.92	2,591.57	10.01
Sand / Soil	4,828.90	1,954.19	7.55
Oak Association	2,770.84	1,121.32	4.33
Other Bare / Sparsely Vegetated	2,567.57	1,039.06	4.01
Low Intensity Urban	1,156.24	467.91	1.81
Row Crops	710.11	287.37	1.11
Non-vegetated Farmland	685.65	277.47	1.07
Exposed Rock	578.45	234.09	0.90
High Intensity Urban	264.65	107.10	0.41
Parks / Golf Courses	258.65	104.67	0.40
Airports	129.44	52.38	0.20
Orchards / Vineyards / Nursery	88.51	35.82	0.14
Background	11.56	4.68	0.02

Map 3.11 Landcover Type



3.1.8 Presettlement Vegetation

Pre-settlement vegetation is the vegetation that occurred across Michigan's diverse landscapes at the time of European settlement. Before settlement, elk, bison, wolf, moose, and woodland caribou were abundant and Native Americans inhabited Michigan. Imagine the county or township without roads, supermarkets, power lines, or industrial forest. Imagine a backyard filled with 500-year-old white pines that seemed to touch the sky, trees so wide that even two people could not put their arms around them. Maple forests would be dark and moist with huge buttressed trees.

Knowing where such landscapes occurred historically helps in habitat planning today. A pre-settlement vegetation map allows us to see this. It describes the landscape when Michigan was first surveyed, and it shows where distinct plant communities occurred. This map is a tool that improves our understanding of patterns and processes across landscapes. This information offers insights for managing lands as large as state forests or as small as a city lot. Knowledge of the type, location, and ecological context of Michigan's native vegetation helps landowners choose effective land management goals. Today's patterns of land-use, wildlife distribution, wetland water levels, and system functions are far more meaningful when placed in a historical context.

This historical information becomes very important when a landowner wants to better understand and manage their own land. What presettlement shows is what were the underlying conditions – like soil and geology that are then reflected in what grows in an area. Before man began to manipulate trees and other species they grew where conditions were best for them to grow.

Before land in Michigan could be sold for the first time to settlers, the federal government required that it be surveyed. Deputy surveyors from the General Land Office visited Michigan prior to the logging era between 1816 and 1856. These surveyors' township plat maps and transcribed field notes provide the best available record about Michigan’s native landscape. The General Land Office required surveyors to note the location of wetlands, lakes, and streams; to comment on the agricultural potential of soils; and to note the quantity and quality of timber resources. The surveyors recorded recently burned areas, beaver floodings, windthrows from storms, and Native American settlements. At each section corner and half-mile point they pounded a wooden post into the ground. These markers would later be used to establish legal property boundaries. The measuring tools they used were a compass and a "chain." A chain contained 100 links and was 66 feet long. A total of 80 chains marked a mile. The surveyors left markers to indicate township and section borders for the first private property owners. They also recorded enough land resource information for the settlers to make sight-unseen purchases, and to help them find the parcels they bought (Sargent, M.S and Carter, K.S., ed. 1999).

Recently, ecologists from the Michigan Natural Features Inventory (MNFI) used information from these original field notes and plat maps to compile pre-settlement vegetation maps for Michigan's 83 counties. Because the surveyors took information only along section lines and because small plant communities such as 20-acre wetlands were not included, the MNFI ecologists also relied on other references. They

studied surface geology maps, soil maps, and other technical data to make the pre-settlement maps as accurate as possible.

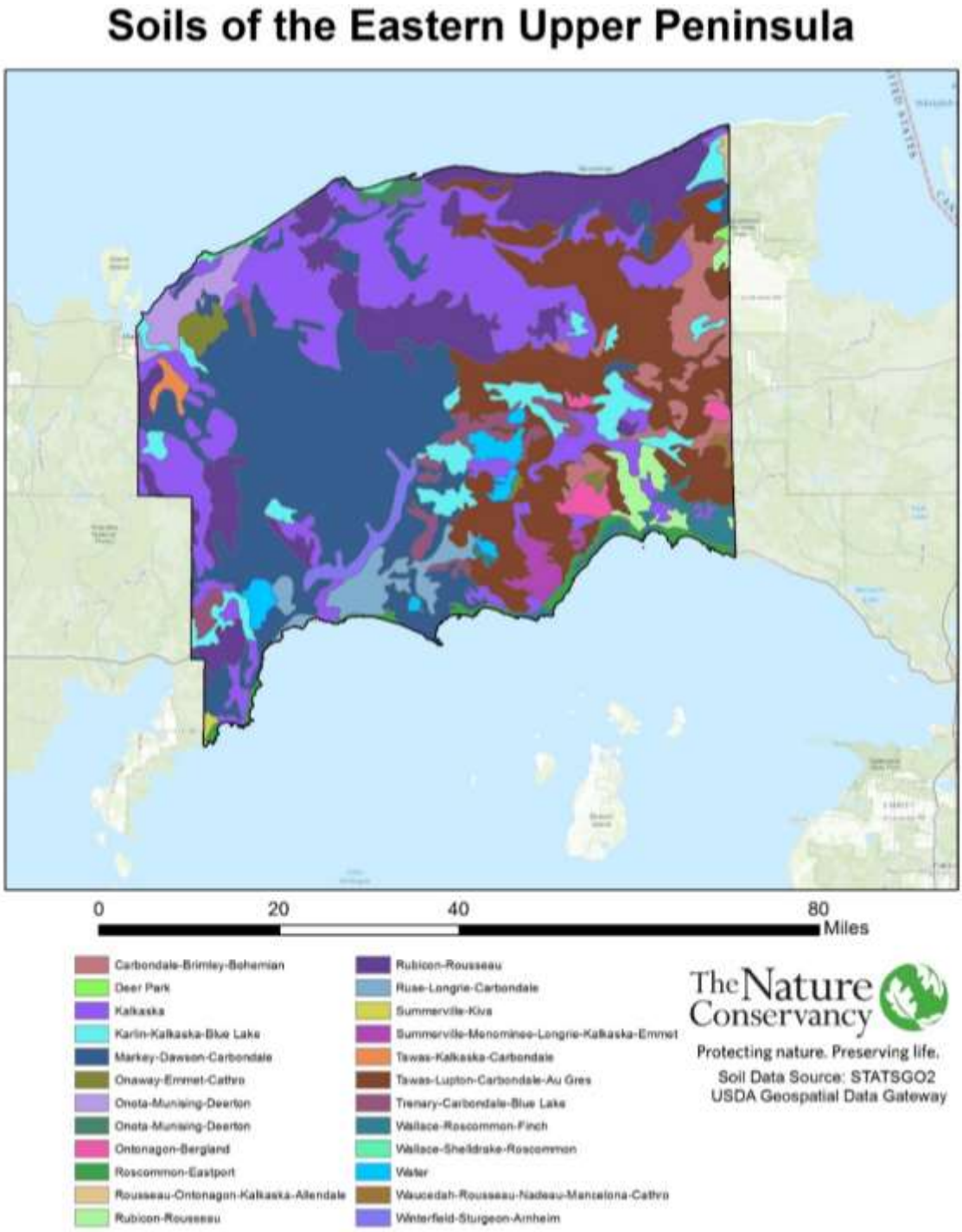
From the survey notes and other resources (other explorer and logging notes) they determined that more than 80 different native plant communities historically occurred in Michigan. These communities ranged from pockets of unique wetlands that depended on fluctuating water levels, to tracts of hardwood-conifer forests that stretched over several counties. Ecologists combined all 83 counties into a statewide pre-settlement vegetation map (Sargent, M.S and Carter, K.S., ed. 1999).

3.1.9 Soils

As discussed above, soils are a very important influencer on the vegetation that grows on top of it. As demonstrated by the forest cover types, this report Landscape is a juxtaposition between very dry, well-drained beach sands contrasted with the acidic peat muck soils of the vast wetlands of the area and include peats, poorly drained sands, and excessively drained sands. Excessively drained sand soils occur on level lake plain, outwash plains, and transverse dune ridges. The last glaciation ended approximately 10,000 years ago, leaving graduated beach ridges, sand dune-like in nature. This region includes some of the most extensive sand beaches on Lake Superior, including the Grand Sable Dunes. Much of the pine resource of the area grows on these dry sandy soils. Nearer Lake Michigan, the limestone of the Niagara escarpment comes closer to the surface, pH rises and the soils take on more of a clay component. Where bedrock is near the surface, soils are often calcareous and poorly drained. In these areas white cedar becomes more common along with hardwoods. The most common soil orders here are Alfisols (Boralfs), Histosols, and Entisols (Aquepts), with some Orthods and Aquods (USDA Soil Conservation Service 1967).

Below is soil map 3.12 of the report Landscape.

Map 3.12 – Soils of the Report Landscape



Coarse, sandy and exceptionally well drained soils and wet, peat soils characterize Michigan's central Upper Peninsula. These soils promote both the dry pine plains and the large wetlands and related rivers and hydrology regimes that allow the Fox and Two Hearted to be important cold-water fisheries.

Detailed soil information for an area is provided both in hard copy (less- and-less) and on line – through the USDA Natural Resources Conservation Service and on-line in Web Soil Survey maps – found Here or at https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm. There are even soil apps now available for a smart phone such as SoilWeb which uses the phone's GPS location to display the most common one or two soils at that site. The readout has basic information that includes a soil profile, landscape position, and simple graphs that display sand, silt, clay, organic matter, and pH with depth.

Another tool is to analyze the soil – as is done for landscaping and gardening. This is not practical at a large forestry scale, but can be done if a landowner is interested in the general makeup of the soil. For commercial testing – for forestry operations or those who wish to test soil for wildlife plots should contact their local MSU Extension office Here or the Soil and Plant Nutrient Laboratory by calling 517-355-0218 or visiting www.css.msu.edu/SPNL/ for soil testing instructions and costs.

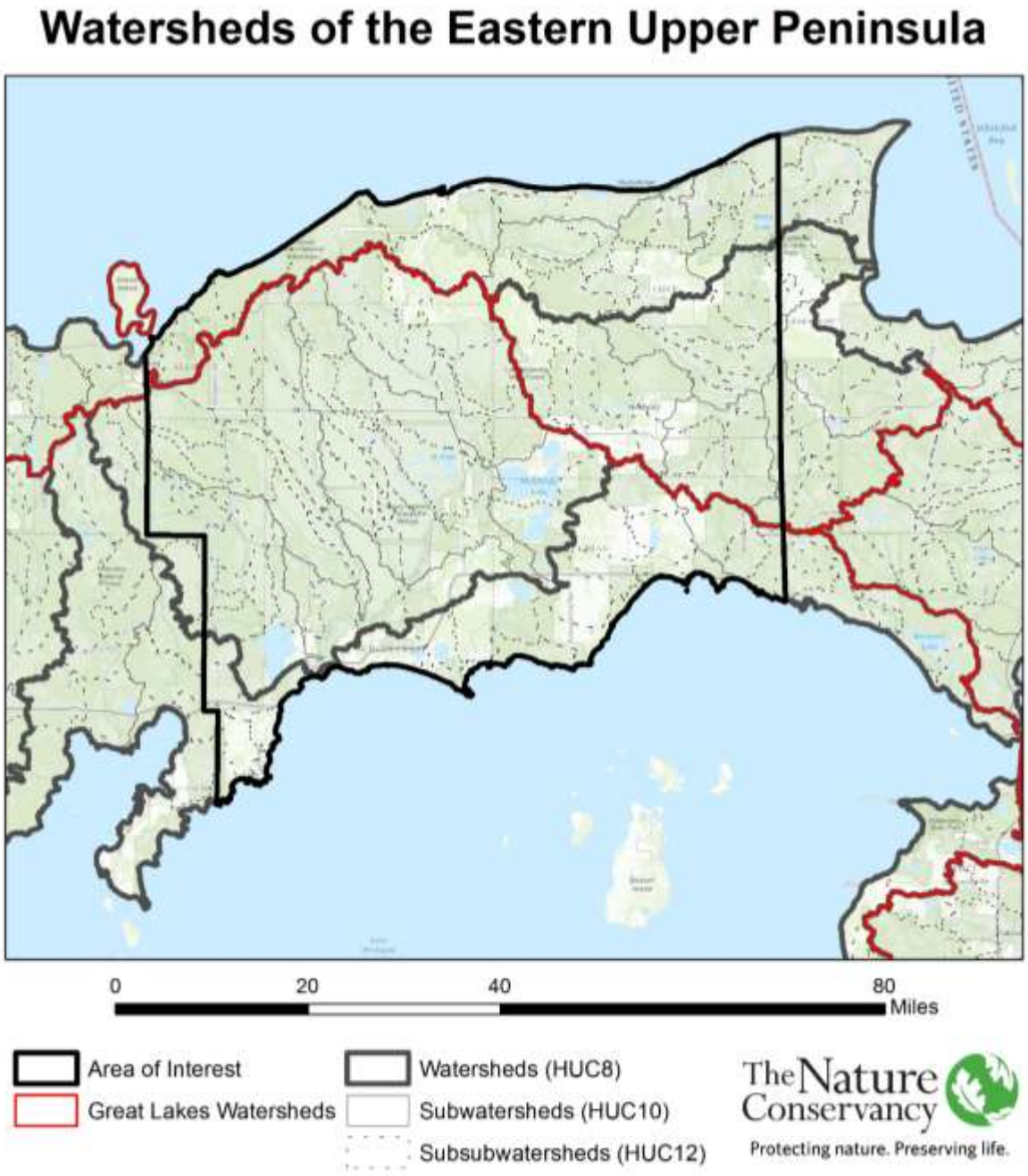
3.1.10 Water

Water defines this central UP report Landscape. The area is head waters to several major rivers traveling south into Lake Michigan and several smaller whole watersheds that travel north into Lake Superior. See Map 3.13 for Watershed of this Landscape. The waters provided by this area contributes clean, non-industrial water to two great Lakes. All rivers in this report Landscape meander, creating broad oxbows on the flat landscape. Most of the rivers, including the Manistique, Fox Driggs, Creighton and Sturgeon, flow to the southeast, perpendicular to the regional bedrock slope.
This report Landscape includes:

- 1,000 sq. miles of the Manistique River
- 500 sq. miles of the Tahquamenon River
- All of the Two Hearted River
- All of the Fox River
- All of the Sucker River
- All of the Blind Sucker River
- All of Hurricane River
- Many smaller streams, lakes, and rivers

Perhaps more than any other characteristic, the sparse population and associated lack of development contribute to maintaining the excellent water quality of the river and the wilderness character of most of these associated watersheds. Typical sources of water pollution such as agriculture, manufacturing, and extensive land development have never existed in these watersheds (Luce County Historical Society, 1985). Although there are signs that extensive logging at the turn of the century resulted in considerable erosion and stream sedimentation, much of the damage has been mitigated by watershed groups.

Map 3.13 – Watersheds of the Report Landscape



Several large inland lakes are found within this landscape. The largest are on ground moraine, including Manistique and South Manistique Lakes. On the sandy lake plain, south of the Manistique Lakes there are two large lakes, Millecoquins and Brevoort, and several smaller lakes. Even further south near Lake Michigan, on bedrock, or where limestone and dolomite bedrock is near the surface, there are numerous lakes, including Merwin, and Gulliver. Within the Kingston Outwash area of eastern Alger and northern Schoolcraft Counties, Stanley, Dutch Fred and Spring Lakes have been identified as cold water lake

special conservation areas. The area around Stanley Lake flooding is identified as a special conservation area of wildlife management.

Within this landscape are two Natural Rivers designated by the Michigan DNR. The Natural Rivers Program was developed to preserve, protect and enhance our state's finest river systems for the use and enjoyment of current and future generations by allowing property owners their right to reasonable development, while protecting Michigan's unique river resources. There are sixteen rivers total within the State of Michigan. Both UP rivers are within this landscape. Map 3.14 Displays the MI Natural Rivers

Map 3.14 – Michigan's Natural Rivers

The Two Hearted River

The Two Hearted River is a medium-sized, cold-water stream that flows into Lake Superior in the eastern portion of Michigan's Upper Peninsula. Together with its principal tributaries the North, South, East, and West Branches, as well as Dawson Creek, the Two Hearted River System totals approximately 108 linear miles, and covers approximately 180 square miles (115,200 acres) within northern Luce County and the extreme east-central portion of Alger County (Michigan Dept. of Natural Resources, 1973). The Natural River Plan is found Here

The Fox River

The Fox River system is in Alger, Schoolcraft and Luce counties. The mainstream of the Fox flows south from numerous kettle lakes in northeastern Alger County through flat sand plains of jack and red pine and lowland hardwoods to its confluence with the Lake Branch of the Manistique River, which continues to Lake Michigan. The Fox's East Branch, West Branch and Little Fox are its main tributaries. The East Branch joins the Fox River Mainstream about a mile above the Manistique River and is nearly equal to the Mainstream in length and discharge. The basin is approximately 26 miles long and 10 miles wide. The Natural River Plan is found Here (Fox River Plan, DNR, 1988). Photo 3.1 shows a sign on the East Branch of the Fox River.

Photo 3.1 – Sign on the Fox River – East Branch

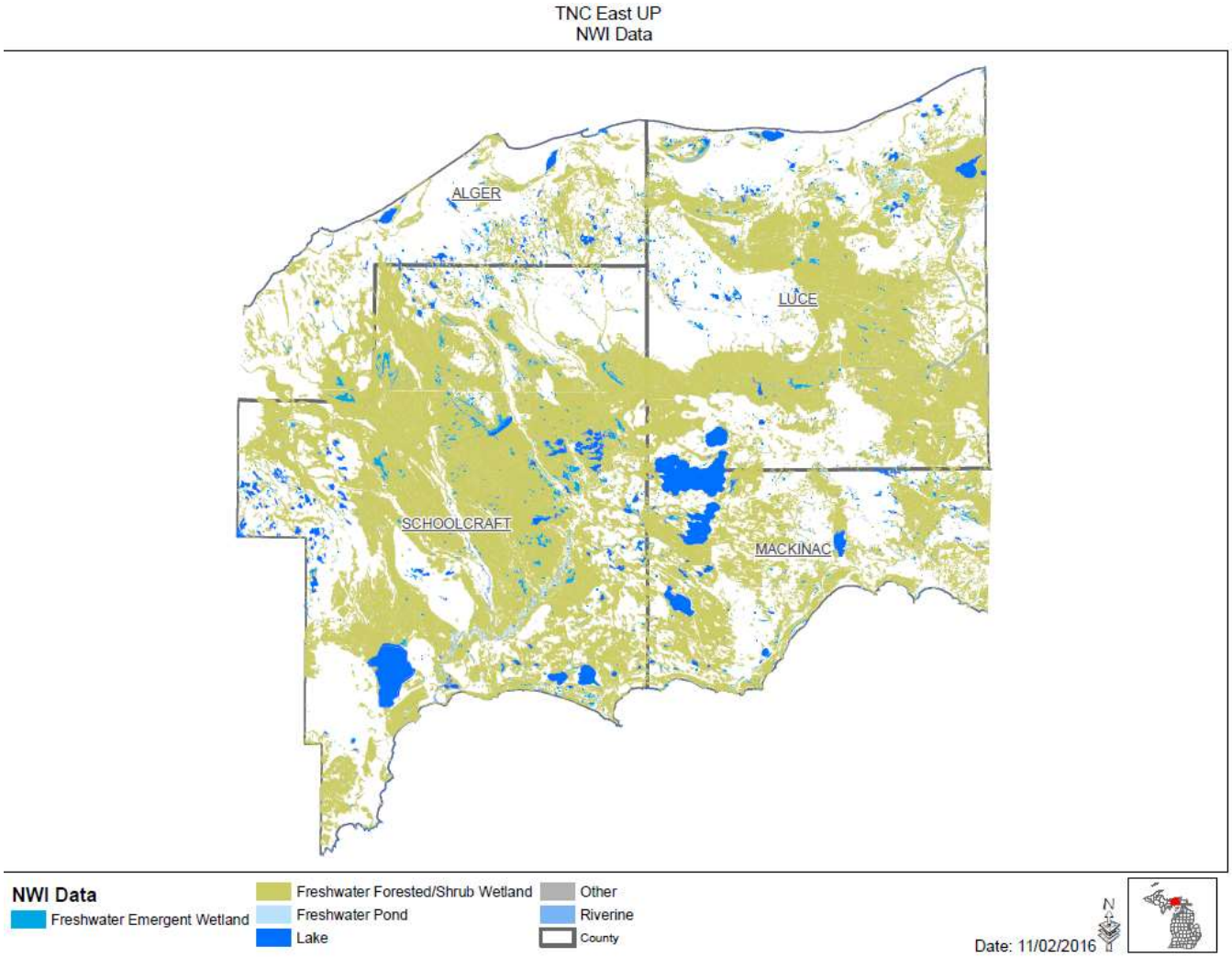
The Biodiversity Plan for Lake Superior lists Munising Bay as important to Lake Sturgeon, and AuTrain Bay is important for Lake Whitefish and Lake Trout. This region is impacted by shoreline hardening and invasive species (Lake Superior Biodiversity Plan, 2015). A helpful resource for landowners is the Michigan Department of Environmental Quality's Inland Lakes and Streams program to promote natural shoreline landscaping to protect Michigan's Inland Lakes. One of the major goals of the program is to educate property owners about using native plants and shoreline management that benefit lake ecosystems. The link for the program is found Here or at http://www.mishorelinepartnership.org/.

3.1.11 Wetlands

The wetlands within this report Landscape are the most extensive and vast in the entire state of Michigan. See Map 3.15. These wetlands feed both the headwaters of rivers that flow into Lake Michigan – Manistique-Fox Rivers and rivers that flow into Lake Superior – Two Hearted, and Tahquamenon. These huge wetlands play a giant sponge function, holding snowmelt and rain water and slowly allowing the water to flow into streams and rivers and into the Great Lakes. These wetlands are varied and contain several rare communities, rare plants such as orchids, and rare animals such as yellow rail. These wetlands, however, can also dry out and have been the source of several large fires which began with lightning strikes into dry wetlands. These wetlands play a major role in filtering water into the Great Lakes. Many of these wetlands have remained unaltered from human disturbance. Other areas like Seney National Wildlife Refuge had, prior to refuge days, been drained by ditches to attempt agricultural pursuits by early settlers. Eventually these endeavors failed and under refuge ownership the diches have been broken up and more natural,slow drainage, restored.

Wetlands have been mapped by the US Fish and Wildlife Service through a program called the National Wetlands Inventory. The program uses the Cowardin System of Classification – a taxonomy of describing wetlands, devised by Lewis M. Cowardin et al. in 1979 for the United States Fish and Wildlife Service. The classification divides wetlands into palustrine (inland wetland which lack flowing water), lacustrine (wetlands associated with lakes), and riverine wetlands systems. The wetlands mapper integrates digital map data along with other resource information that displays wetland type and extend using a biological definition of wetlands. See the link Here or link here https://www.fws.gov/wetlands/data/mapper.HTML.

Map 3.15 – Wetlands of the Report Landscape



3.1.12 Biological Diversity

Both the State DNR and The Nature Conservancy have identified high biodiversity areas with in this landscape. Multiple assessments have been done and are summarized below.

Michigan Natural Features Inventory (MNFI) Michigan Natural Heritage Assessment:

This assessment provides the foundation for all the assessments that follow. Map 3.16 and Table 3.4 displays dots that are "occurrences" of rare and exemplary examples of natural communities and species.

Map 3.16 – MNFI Map of Tracked Occurrences (Blue Dots = a community or species of State or National Rarity)

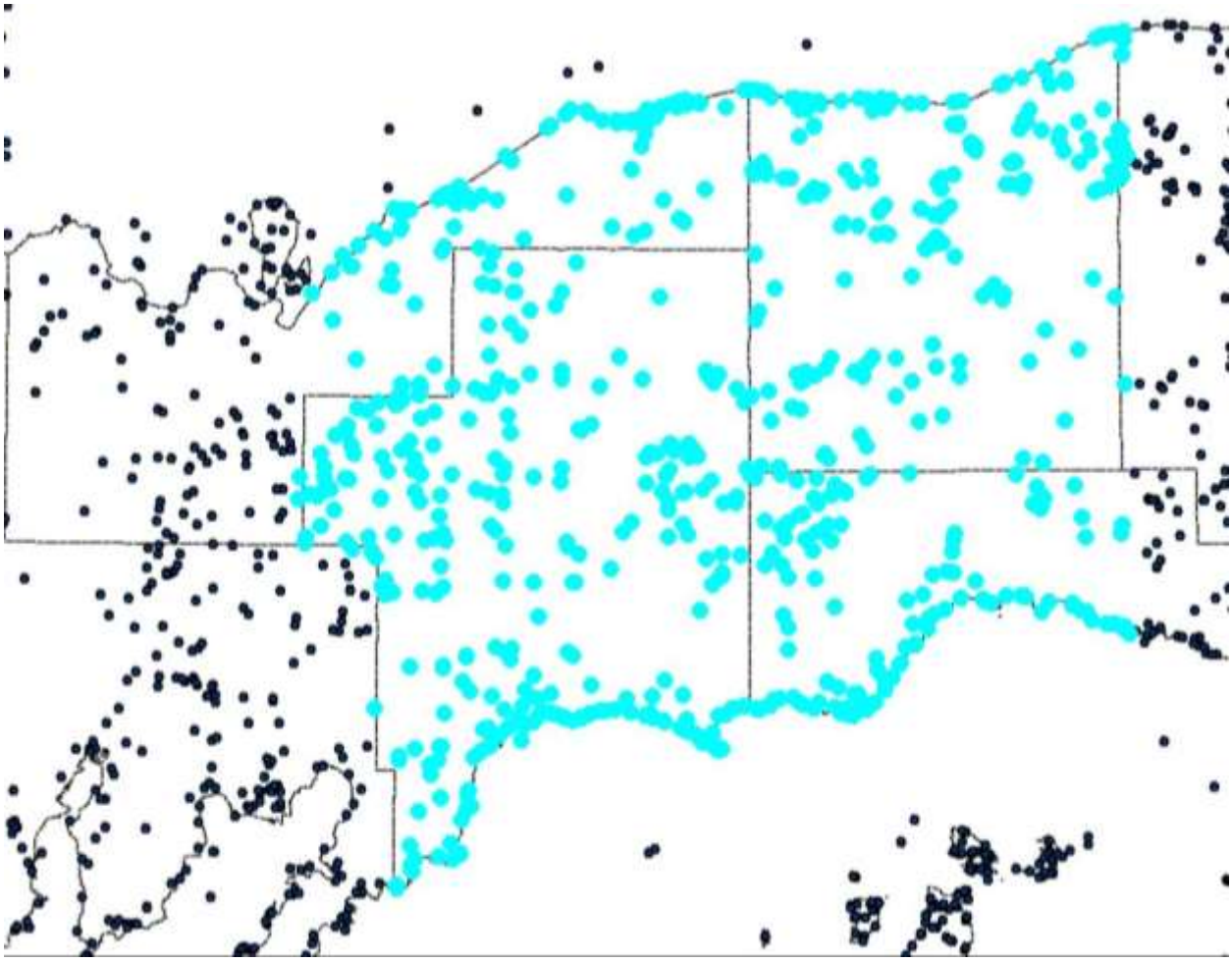


Table 3.4 Species and Communities

Common Name	Count		Common Name	Count
A land snail (no common name)	1		Lake Huron tansy	37
Alga pondweed	12		Lake sturgeon	3
Alkaline Shore Dunes Pond/marsh, Great Lakes Type	3		Least bittern	1
Alkaline Shrub/herb Fen, Upper Midwest Type	1		Lichen	2
Alternate-leaved water-milfoil	4		Limestone bedrock glade [Alvar glade]	2
American bittern	2		Little brown bat	3
American dune wild-rye	18		Long-eared owl	1
American shore-grass	7		Merlin	5
Ashy whitlow grass	1		Moonwort	1
Auricled twayblade	12		Moor rush	2
Autumnal water-starwort	3		Mystery vertigo	2

Aweme borer	1		New England sedge	1
Bald eagle	63		Northern appressed clubmoss	1
Beach/shoredunes, Great Lakes Type	2		Northern blue	2
Black crowberry	7		Northern goshawk	12
Black sandshell	2		Northern long-eared bat	1
Black sedge	1		Northern ragwort	1
Blanding's turtle	1		Osprey	53
Blue wild-rye	4		Panicled screwstem	2
Butterwort	8		Pine-drops	1
Calypso or fairy-slipper	6		Piping plover	7
Campeloma spire snail	1		Pitcher's thistle	26
Canada rice grass	6		Poor Shrub/herb Fen, Upper Midwest Type	5
Caspian tern	1		Prairie Moonwort or Dunewort	1
Clinton's bulrush	4		Prairie warbler	1
Common loon	73		Purple clematis	1
Common tern	2		Ram's head lady's-slipper	3
Douglas's hawthorn	3		Red-shouldered hawk	19
Downy oat-grass	1		Rich Shrub/herb Fen, Upper Midwest Type	13
Dry Woodland, Upper Midwest Type	9		Ringed boghaunter	1
Dwarf bilberry	6		River fingernail clam	1
Dwarf lake iris	18		Satiny willow	2
Dwarf raspberry	4		Scrub Bog, Upper Midwest Type	11
Eastern flat-whorl	1		Sedge	1
Eastern pondmussel	1		Sharp-tailed grouse	12
Ebony boghaunter	3		Slender spike rush	1
Elktoe	1		Slippershell	4
English sundew	4		Small blue-eyed Mary	1
Farwell's water milfoil	3		Small round-leaved orchid	1
Fir clubmoss	4		Small yellow pond lily	1
Fleshy stitchwort	1		Spatulate moonwort	1
Forested Bog, Central Midwest Type	1		Spruce grouse	3
Frigga fritillary	5		Sterki's granule	1
Goblin moonwort	2		Stitchwort	14
Grasshopper sparrow	1		Sweet coltsfoot	10
Great Blue Heron Rookery	15		Tapered vertigo	2
Green spleenwort	2		Tawny crescent	1
Hill's pondweed	1		Torrey's bulrush	2
Hoary comma	1		Vasey's rush	3
Houghton's goldenrod	15		Walking fern	2
Hubricht's vertigo	3		Western moonwort	1
Hudson Bay sedge	1		Wet Meadow, Upper Midwest Type	1
Incurvate emerald	2		Wet Scrubland, Upper Midwest Type	3
Infertile Pond/marsh, Great Lakes Type	7		Widgeon grass	1

King rail	2		Wiegand's sedge	1
Kirtland's warbler	5		Wild oat grass	1
Lake cress	2		Wood turtle	8
Lake herring or Cisco	5		Yellow rail	3
Lake Huron locust	28		Grand Total	706

Federally Threatened and Endangered Species:

Below Table 3.5 summarizes 2016 information from US Fish and Wildlife Service, link Here.

Of special note:
Bald eagles are no longer protected under the federal Endangered Species Act and Section 7 consultation with the U.S. Fish and Wildlife Service is no longer necessary. However, the bald eagle remains protected under the Bald and Golden Eagle Protection Act.
Information about Eagle Permits and the Bald and Golden Eagle Protection Act

Gray Wolf - Due to a Federal court decision, gray wolves in the western Great Lakes area (including Michigan, Minnesota, and Wisconsin) were relisted under the Endangered Species Act, effective December 19, 2014.

Some species in the table below *could* be found in this report Landscape but are not well documented or well know – for example Canada lynx.
All – All Counties in Report Landscape
MAC = Mackinac County only

Table 3.5 Federally Threated or Endangered Species

County		Species	Status	Habitat
All		Canada lynx (*Lynx canadensis*)	Threatened	A Canada lynx was recently documented in the Upper Peninsula. The counties listed here have the highest potential for Lynx presence. **Alger**, Baraga, Chippewa, Delta, Dickinson, Gogebic, Houghton, Iron, Keweenaw, **Luce**, **Mackinac**, Marquette, Menominee, Ontonagon, **Schoolcraft**.
All		Gray wolf *(Canis lupus)*	Endangered	Northern forested areas
All		Northern long-eared bat *(Myotis septentrionalis)*	Threatened	Hibernates in caves and mines - swarming in surrounding wooded areas in autumn. Roosts and forages in upland forests during spring and summer.
All		Kirtland's warbler	Endangered	Nests in young jack pine

		(*Setophaga kirtlandii*)		
All		Piping plover (*Charadrius melodus*)	Endangered	Beaches along shorelines of the Great Lakes
All		Piping plover (*Charadrius melodus*)	Critical Habitat	
All		Rufa Red knot *(Calidris canutus rufa)*	Threatened	Only actions that occur along coastal areas during the Red Knot migratory window of MAY 1 - SEPTEMBER 30
All		Pitcher's thistle (*Cirsium pitcheri*)	Threatened	Stabilized dunes and blowout areas
Mac		Hine's emerald dragonfly *(Somatochlora hineana)*	Endangered	Spring fed wetlands, wet meadows and marshes; calcareous streams & associated wetlands overlying dolomite bedrock
Mac		Dwarf lake iris (*Iris lacustris*)	Threatened	Partially shaded sandy-gravelly soils on lakeshores
Mac		Houghton's goldenrod (*Solidago houghtonii*)	Threatened	Sandy flats along Great Lakes shores
Mac		Lakeside daisy (*Hymenoxys herbacea*)	Threatened	Dry gravelly or sandy thin-soiled fields and alvars with dolomitic or limestone bedrock at or near the surface
Mac		Michigan monkey-flower (*Mimulus michiganensis*)	Endangered	Soils saturated with cold flowing spring water; found along seepages, streams and lakeshores
MAC		Pitcher's thistle (*Cirsium pitcheri*)	Threatened	Stabilized dunes and blowout areas

State of Michigan Threatened and Endangered Species:

All plants and animals located in the Eastern UP Eco-Region that have State Status - as noted by Michigan DNR and Michigan Natural Features Heritage Program are shown in Table 3.6
196 species total.

Table 3.6 – State Threatened and Endangered Species

Scientific Name	Common Name	Taxonomic Group	State Status
Accipiter gentilis	Northern goshawk	Birds	SC
Acipenser fulvescens	Lake sturgeon	Fish	T
Adlumia fungosa	Climbing fumitory	Flowering Plants	SC
Alasmidonta marginata	Elktoe	Mussels	SC
Alasmidonta viridis	Slippershell	Mussels	T
Alces americanus	Moose	Mammals	SC
Allium schoenoprasum	Chives	Flowering Plants	T
Amerorchis rotundifolia	Small round-leaved orchis	Flowering Plants	E
Ammodramus savannarum	Grasshopper sparrow	Birds	SC
Armoracia lacustris	Lake cress	Flowering Plants	T
Asio flammeus	Short-eared owl	Birds	E
Asio otus	Long-eared owl	Birds	T
Asplenium rhizophyllum	Walking fern	Ferns and Fern Allies	T
Asplenium ruta-muraria	Wall-rue	Ferns and Fern Allies	E
Asplenium scolopendrium var. americanum	Hart's-tongue fern	Ferns and Fern Allies	E
Asplenium trichomanes-ramosum	Green spleenwort	Ferns and Fern Allies	SC
Astragalus canadensis	Canadian milk vetch	Flowering Plants	T
Astragalus neglectus	Cooper's milk vetch	Flowering Plants	SC
Bartonia paniculata	Panicled screwstem	Flowering Plants	T
Beckmannia syzigachne	Slough grass	Flowering Plants	T
Boloria freija	Freija fritillary	Insects	SC
Boloria frigga	Frigga fritillary	Insects	SC
Botaurus lentiginosus	American bittern	Birds	SC
Botrychium acuminatum	Moonwort	Ferns and Fern Allies	E
Botrychium campestre	Prairie Moonwort or Dunewort	Ferns and Fern Allies	T
Botrychium hesperium	Western moonwort	Ferns and Fern Allies	T
Botrychium mormo	Goblin moonwort	Ferns and Fern Allies	T
Botrychium spathulatum	Spatulate moonwort	Ferns and Fern Allies	T
Buteo lineatus	Red-shouldered hawk	Birds	T
Cacalia plantaginea	Prairie indian-plantain	Flowering Plants	SC
Callitriche hermaphroditica	Autumnal water-starwort	Flowering Plants	SC
Calypso bulbosa	Calypso or fairy-slipper	Flowering Plants	T
Canis lupus	Gray Wolf	Mammals	SC
Carex albolutescens	Sedge	Flowering Plants	T
Carex assiniboinensis	Assiniboia sedge	Flowering Plants	T
Carex heleonastes	Hudson Bay sedge	Flowering Plants	E
Carex nigra	Black sedge	Flowering Plants	E
Carex novae-angliae	New England sedge	Flowering Plants	T
Carex richardsonii	Richardson's sedge	Flowering Plants	SC

Carex scirpoidea	Bulrush sedge	Flowering Plants	T
Carex wiegandii	Wiegand's sedge	Flowering Plants	SC
Catinella exile	Pleistocene catinella	Snails	T
Cerastium brachypodum	Shortstalk chickweed	Flowering Plants	T
Charadrius melodus	Piping plover	Birds	E
Chlidonias niger	Black tern	Birds	SC
Cincinnatia cincinnatiensis	Campeloma spire snail	Snails	SC
Circus cyaneus	Northern harrier	Birds	SC
Cirsium hillii	Hill's thistle	Flowering Plants	SC
Cirsium pitcheri	Pitcher's thistle	Flowering Plants	T
Cistothorus palustris	Marsh wren	Birds	SC
Clematis occidentalis	Purple clematis	Flowering Plants	SC
Collinsia parviflora	Small blue-eyed Mary	Flowering Plants	T
Coregonus artedi	Lake herring or Cisco	Fish	T
Coturnicops noveboracensis	Yellow rail	Birds	T
Crataegus douglasii	Douglas's hawthorn	Flowering Plants	SC
Cygnus buccinator	Trumpeter swan	Birds	T
Cypripedium arietinum	Ram's head lady's-slipper	Flowering Plants	SC
Cystopteris laurentiana	Laurentian fragile fern	Ferns and Fern Allies	SC
Cystopteris tennesseensis	Tennissee bladder fern	Ferns and Fern Allies	T
Danthonia intermedia	Wild oat grass	Flowering Plants	SC
Dendroica cerulea	Cerulean warbler	Birds	T
Dendroica discolor	Prairie warbler	Birds	E
Dendroica kirtlandii	Kirtland's warbler	Birds	E
Dodecatheon meadia	Shooting star	Flowering Plants	E
Draba arabisans	Rock whitlow grass	Flowering Plants	SC
Draba cana	Ashy whitlow grass	Flowering Plants	T
Drosera anglica	English sundew	Flowering Plants	SC
Dryopteris filix-mas	Male fern	Ferns and Fern Allies	SC
Eleocharis compressa	Flattened spike rush	Flowering Plants	T
Eleocharis nitida	Slender spike rush	Flowering Plants	E
Elymus glaucus	Blue wild-rye	Flowering Plants	SC
Empetrum nigrum	Black crowberry	Flowering Plants	T
Emydoidea blandingii	Blanding's turtle	Reptiles	SC
Erigeron hyssopifolius	Hyssop-leaved fleabane	Flowering Plants	T
Erora laeta	Early hairstreak	Insects	SC
Euconulus alderi	A land snail (no common name)	Snails	T
Euxoa aurulenta	Dune cutworm	Insects	SC
Falcipennis canadensis	Spruce grouse	Birds	SC
Falco columbarius	Merlin	Birds	T
Falco peregrinus	Peregrine falcon	Birds	E
Flexamia delongi	Leafhopper	Insects	SC
Flexamia huroni	Huron River leafhopper	Insects	T
Galium kamtschaticum	Bedstraw	Flowering Plants	E

Gastrocopta holzingeri	Lambda snaggletooth	Snails	E
Gavia immer	Common loon	Birds	T
Gentiana linearis	Narrow-leaved gentian	Flowering Plants	T
Geum triflorum	Prairie smoke	Flowering Plants	T
Glyptemys insculpta	Wood turtle	Reptiles	SC
Gnaphalium sylvaticum	Woodland everlasting	Flowering Plants	T
Gomphus quadricolor	Rapids clubtail	Insects	SC
Guppya sterkii	Sterki's granule	Snails	E
Gymnocarpium robertianum	Limestone oak fern	Ferns and Fern Allies	T
Haliaeetus leucocephalus	Bald eagle	Birds	SC
Hedysarum alpinum	Alpine sainfoin	Flowering Plants	E
Hendersonia occulta	Cherrystone drop	Snails	T
Hiodon tergisus	Mooneye	Fish	T
Huperzia selago	Fir clubmoss	Ferns and Fern Allies	SC
Hymenoxys herbacea	Lakeside daisy	Flowering Plants	E
Incisalia henrici	Henry's elfin	Insects	T
Iris lacustris	Dwarf lake iris	Flowering Plants	T
Ixobrychus exilis	Least bittern	Birds	T
Juncus stygius	Moor rush	Flowering Plants	T
Juncus vaseyi	Vasey's rush	Flowering Plants	T
Lanius ludovicianus migrans	Migrant loggerhead shrike	Birds	E
Leymus mollis	American dune wild-rye	Flowering Plants	SC
Ligumia nasuta	Eastern pondmussel	Mussels	E
Ligumia recta	Black sandshell	Mussels	E
Linum sulcatum	Furrowed flax	Flowering Plants	SC
Listera auriculata	Auricled twayblade	Flowering Plants	SC
Littorella uniflora	American shore-grass	Flowering Plants	SC
Luzula parviflora	Small-flowered wood rush	Flowering Plants	T
Lycaeides idas nabokovi	Northern blue	Insects	T
Lycopodiella subappressa	Northern appressed clubmoss	Ferns and Fern Allies	SC
Lynx canadensis	Lynx	Mammals	E
Mimulus michiganensis	Michigan monkey flower	Flowering Plants	E
Muhlenbergia richardsonis	Mat muhly	Flowering Plants	T
Myotis septentrionalis	Northern long-eared bat	Mammals	SC
Myriophyllum alterniflorum	Alternate-leaved water-milfoil	Flowering Plants	SC
Myriophyllum farwellii	Farwell's water milfoil	Flowering Plants	T
Nicrophorus americanus	American burying beetle	Insects	X
Nuphar pumila	Small yellow pond lily	Flowering Plants	E
Nycticorax nycticorax	Black-crowned night-heron	Birds	SC
Obovaria olivaria	Hickorynut	Mussels	E
Oryzopsis canadensis	Canada rice grass	Flowering Plants	T
Pandion haliaetus	Osprey	Birds	SC

Panicum philadelphicum	Philadelphia panic-grass	Flowering Plants	T
Papaipema aweme	Aweme borer	Insects	SC
Parnassia palustris	Marsh grass-of-parnassus	Flowering Plants	T
Pellaea atropurpurea	Purple cliff brake	Ferns and Fern Allies	T
Penstemon calycosus	Beard tongue	Flowering Plants	T
Petasites sagittatus	Sweet coltsfoot	Flowering Plants	T
Phyciodes batesii	Tawny crescent	Insects	SC
Physella magnalacustris	Great Lakes physa	Snails	SC
Picoides arcticus	Black-backed woodpecker	Birds	SC
Pinguicula vulgaris	Butterwort	Flowering Plants	SC
Piperia unalascensis	Alaska orchid	Flowering Plants	SC
Planogyra asteriscus	Eastern flat-whorl	Snails	SC
Pleurobema sintoxia	Round pigtoe	Mussels	SC
Poa alpina	Alpine bluegrass	Flowering Plants	T
Polygonia gracilis	Hoary comma	Insects	SC
Potamogeton confervoides	Alga pondweed	Flowering Plants	SC
Potamogeton hillii	Hill's pondweed	Flowering Plants	T
Pterospora andromedea	Pine-drops	Flowering Plants	T
Pupilla muscorum	Widespread column	Snails	SC
Rallus elegans	King rail	Birds	E
Ranunculus lapponicus	Lapland buttercup	Flowering Plants	T
Rhexia virginica	Meadow beauty	Flowering Plants	SC
Rubus acaulis	Dwarf raspberry	Flowering Plants	E
Rumex occidentalis	Western dock	Flowering Plants	E
Ruppia maritima	Widgeon grass	Flowering Plants	T
Salix pellita	Satiny willow	Flowering Plants	SC
Sander canadensis	Sauger	Fish	T
Scirpus clintonii	Clinton's bulrush	Flowering Plants	SC
Scirpus torreyi	Torrey's bulrush	Flowering Plants	SC
Scutellaria parvula	Small skullcap	Flowering Plants	T
Senecio indecorus	Northern ragwort	Flowering Plants	T
Silphium laciniatum	Compass plant	Flowering Plants	T
Sistrurus catenatus catenatus	Eastern massasauga	Reptiles	SC
Solidago houghtonii	Houghton's goldenrod	Flowering Plants	T
Somatochlora hineana	Hine's emerald dragonfly	Insects	E
Somatochlora incurvata	Incurvate emerald	Insects	SC
Sorex fumeus	Smoky shrew	Mammals	T
Sphaerium fabale	River fingernail clam	Fingernail and Pea Clams	SC
Spiza americana	Dickcissel	Birds	SC
Sporobolus heterolepis	Prairie dropseed	Flowering Plants	SC
Stellaria crassifolia	Fleshy stitchwort	Flowering Plants	E
Stellaria longipes	Stitchwort	Flowering Plants	SC
Sterna caspia	Caspian tern	Birds	T
Sterna forsteri	Forster's tern	Birds	T

Sterna hirundo	Common tern	Birds	T
Striatura meridionalis	Median striate	Snails	SC
Stylurus amnicola	Riverine snaketail	Insects	SC
Subularia aquatica	Awlwort	Flowering Plants	E
Tanacetum huronense	Lake Huron tansy	Flowering Plants	T
Trichostema brachiatum	False pennyroyal	Flowering Plants	T
Trimerotropis huroniana	Lake Huron locust	Insects	T
Trisetum spicatum	Downy oat-grass	Flowering Plants	SC
Tympanuchus phasianellus	Sharp-tailed grouse	Birds	SC
Vaccinium cespitosum	Dwarf bilberry	Flowering Plants	T
Vallonia gracilicosta albula	A land snail (no common name)	Snails	E
Vertigo bollesiana	Delicate vertigo	Snails	T
Vertigo cristata	Crested vertigo	Snails	SC
Vertigo elatior	Tapered vertigo	Snails	SC
Vertigo hubrichti	Hubricht's vertigo	Snails	E
Vertigo morsei	Six-whorl vertigo	Snails	E
Vertigo nylanderi	Deep-throat vertigo	Snails	E
Vertigo paradoxa	Mystery vertigo	Snails	SC
Vertigo pygmaea	Crested vertigo	Snails	SC
Vertigo tridentata	Honey vertigo	Snails	SC
Villosa iris	Rainbow	Mussels	SC
Viola novae-angliae	New England violet	Flowering Plants	T
Viola pedatifida	Prairie birdfoot violet	Flowering Plants	T
Williamsonia fletcheri	Ebony boghaunter	Insects	SC
Williamsonia lintneri	Ringed boghaunter	Insects	SC
Woodsia obtusa	Blunt-lobed woodsia	Ferns and Fern Allies	T
Zizia aptera	Prairie golden alexanders	Flowering Plants	T

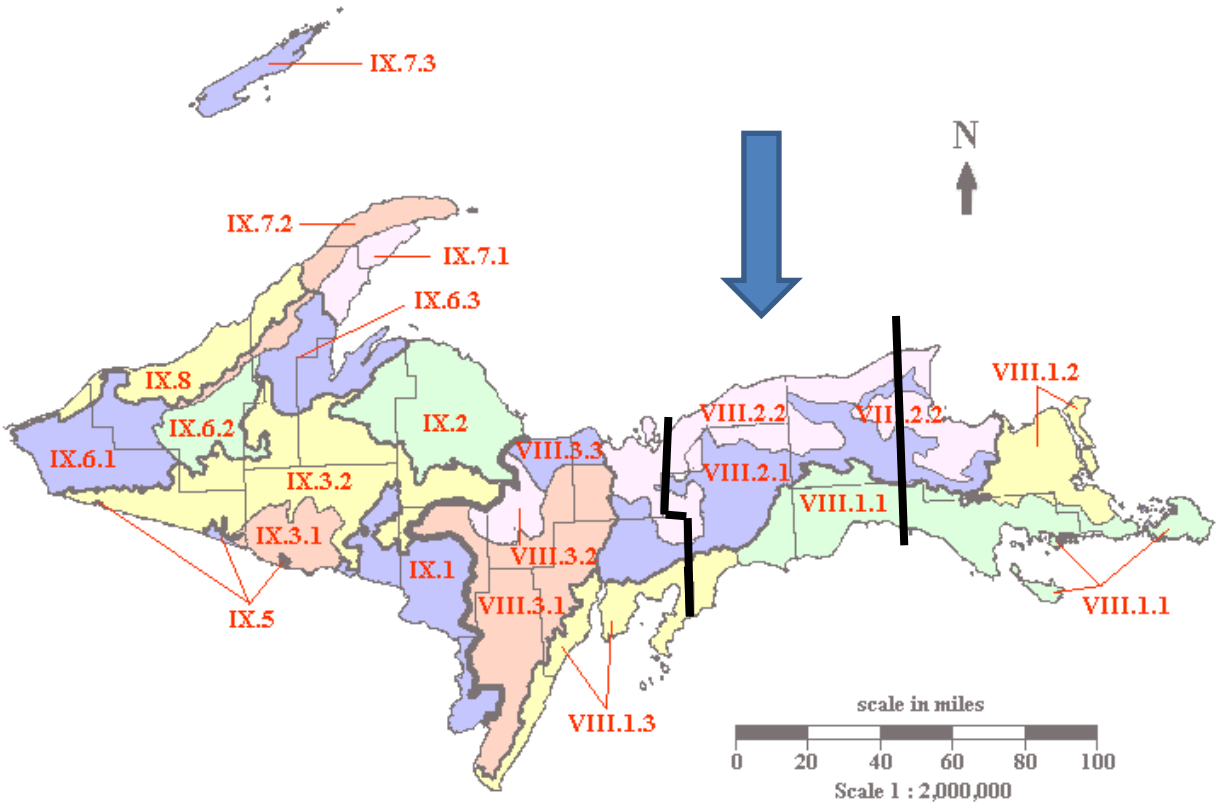
The above lengthy list of federally or state listed species highlights that this area contains a great many small habitats such as dry alvar, or vernal pools, as well as a diversity of forest and wetlands types that support a large array of habitats, plant and animal species. The Lake Michigan limestone escarpment hosts several limestone-phyllic species including Houghton's goldenrod, pitcher's thistle, and lakeside daisy.

3.1.13 Regional Landscape Assessments for Great Lakes – Michigan Natural Features Inventory

The Heritage Program in Michigan (Michigan Natural Features Inventory) also did ecosystems assessments for the three regional landscapes found in this report Landscape. Below is a summary of each assessment as shown outlined on Map 3.17. The map and classification developed by Albert, Denton, and Barnes (1986) provided the basis for the Michigan part of this study. The aim of landscape ecosystem classification and mapping is to distinguish appropriately sized ecosystems—useful and functional land units that differ significantly from one another in abiotic characteristics as well as in their related biotic components. The subdivision of a large area into distinctive landscape ecosystems

provides a much-needed framework for integrated resource management and planning; for biological conservation; and for comparsion of differences in composition, occurrence, interactions, and productivity of plants and animals among ecosystems (Albert, Denton, and Barnes, 1986).

Map 3.17. Biodivesity Assessment Breakdown for this Landscape



SUB-SUBSECTION VIII.1.1. St. Ignace:

This sub-subsection consists of limestone bedrock and sand lake plain; conifer-dominated upland and wetland forests, northern hardwoods, fens, coastal emergent marshes, alvar. is typified by sandy lake plain and limestone bedrock at or near the surface. Lacustrine features include sand dunes, embayments with complexes of parallel beach ridges and swales, and extensive conifer-dominated wetlands on sand or bedrock. The elevation varies between .580 to 1,040 feet (177 to 317 m).

Presettlement vegetation: Along the Lake Michigan shorelines, there were many broad coastal marshes in protected coves and embayments. The substrate in these marshes was often clay or marl (Albert *et al*. 1989).

The forests of the flat lake plain were generally dominated by conifers, especially on the poorly drained or excessively drained portions (Comer *et al*. 1993a). The most common swamp conifers were northern white-cedar, tamarack, balsam fir, and black spruce. The most common upland conifers were white pine

and hemlock, with increased red pine on dry sand ridges and localized areas of jack pine on droughtiest sites.

Extensive complexes of beach ridges and swales were in large embayments; these supported forests of white pine, red pine, red oak, and other hardwoods on the driest ridges and conifer swamp and shrub swamp in the drier swales. Emergent vegetation grew in the swales near the present Great Lakes shoreline.

In some of the embayments, there were extensive fens, dominated by stunted white pine, northern white-cedar, tamarack, and black spruce. Government Land Office (GLO) surveyors noted marly pools in these fens. Much of the coastal zone along Lake Michigan, where soils were thin overlay bedrock, was dominated by balsam fir-spruce-cedar forests and northern hardwoods.

The flat, sandy lake plain supported diverse swamp forest types, including extensive cedar swamps, tamarack swamps, and mixed conifer swamps. Hemlock and northern hardwood forest also dominated many uplands on sandy lake plain.

On the low parabolic dunes along the sandy lake plain of Lake Michigan, the moist air and presumably higher precipitation and soil moisture caused most of the dunes to be dominated by northern hardwood forests of sugar maple, beech, hemlock, red oak, yellow birch, paper birch, and basswood. The Brevort Lake dunes, located near the Lake Michigan shore, are a good example of this forest type. In contrast, the dunes located near Round Lake, several miles inland from Lake Michigan, support forests dominated by red and jack pines; this possibly indicates the lack of local microclimatic influence bringing moisture from Lake Michigan. Ground-moraine ridges were dominated by northern hardwoods, hemlock-beech, and hemlock-white pine forests.

Natural disturbance: Within this landscape GLO surveyors recorded many occurrences of fire in upland and swamp forests on both sand and bedrock. There were both wildfires and windthrows on the beach ridges near the mouth of the Crow River which were burned off at the time of the surveys.
Many windthrows were noted by surveyors on both the uplands and wetlands along the shorelines of Lake Michigan. White pine appears to be especially susceptible to coastal wind storms.

Rare plant communities: Some of the more resistant dolomites and shales, when exposed at the surface, proved to be too droughty for successful forest establishment; instead, they support alvar communities. As a result of severe droughtiness, alvar contains grasses, herbs, and occasional shrubs as well as stunted clones of trembling aspen on thin soil. Thin organic soils develop, but they appear to be subject to destruction by fire. Some of these remaining alvar, are found south of Gulliver Lake in Schoolcraft County.

Rare plants of note in this sub-subsection**:** *Amerorchis rotundifolia* (round-leaved orchid), *Asplenium rhizophyllus* (walking fern), *Asplenium scolopendrium* var. *americana* (Hart's-tongue fern), *Asplenium viride* (green spleenwort), *Calypso bulbosa* (Calypso orchid), *Carex richardsonii* (Richardson's sedge), *Carex scirpoidea* (bulrush sedge), *Cirsium pitcheri* (Pitcher's thistle), *Cypripedium arietinum* (ram's-head lady's-slipper), *Eleocharis compressa* (flattened spike-rush), *Empetrum nigrum* (black crowberry), *Erigeron hyssopifolius* (hyssop-leaved fleabane), *Iris lacustris* (dwarf lake iris), *Juncus stygius* (moor rush), *Mimulus glabratus* var. *Michiganense* (Michigan monkey-flower), *Muhlenbergia richardsonis* (mat muhly), *Piperia unalascensis* (Alaska orchid), *Ranunculus lapponicus* (Lapland buttercup), *Scutellaria parvula* (small skullcap), *Solidago houghtonii* (Houghton's goldenrod), *Sporobolus heterolepis* (prairie dropseed), *Stellaria longipes* (stitchwort), *Sterna forsteri* (Forster's tern), *Sterna hirundo* (common tern), *Tanacetum huronense* (Lake Huron tansy).

Rare animals of note in this sub-subsection: *Alces alces* (moose), *Canis lupus* (gray wolf), *Charadrius melodus* (piping plover), *Chlidonias niger* (black tern), *Haliaeetus leucocephalus* (bald eagle), *Pandion haliaetus* (osprey), *Sterna caspia* (Caspian tern), *Trimerotropis huroniana* (Lake Huron locust).

Conservation concerns: Low sand dunes and beach ridges along the shoreline support healthy populations of Pitcher's thistle (federally threatened), a Great Lakes endemic, as well as Lake Huron tansy. Three other Great Lakes endemics are found near the shoreline: dwarf lake iris (federally threatened) is found on calcareous till or sand deposits near the shoreline, Houghton's goldenrod (federally threatened) grows in moist interdunal swales along the shore, and Michigan monkey-flower (federally threatened) grows in cold, spring fed streams near the Great Lakes shoreline.

SUB-SUBSECTION VIII.2.1. Seney Sand Lake Plain:

The portion of the report Landscape in this sub-subsection contains very poorly or excessively drained sand lake plain, transverse dune, outwash; shallow, paludified (formation of wet conditions on formally dry mineral soils) peatlands (many patterned), jack pine barrens, hardwood-conifer and conifer swamp.

This sub-subsection of sand lake plain contains the largest expanses of wetland in the State. Landforms of lacustrine origin typify the sub-subsection. The elevation ranges from 600 to 880 feet (183 to 268 m) and includes an area of 1,662 square miles (4,307 sq km) almost all of this sub-subsection is within this report Landscape.

Presettlement Vegetation: Marshes, peatlands, and low productivity swamps were the predominant vegetation on the very poorly drained topography, as noted by GLO surveyors (Albert 1990, Comer *et al*. 1993a). Many of the broad wetlands occupy embayments of Glacial Lake Algonquin (10,000 years B.P.), but peat began to accumulate only during the moister, cooler climatic conditions of the last 3,000 to 4,000 years (Futyma 1982). Jack pine dominated the droughtiest outwash plains; red pine, white pine, and big tooth aspen occupied the seasonally moist lake plains and the transverse dunes (Comer *et al*. 1994).

Natural Disturbance: Based on the surveyors' notes, fires occurred regularly on both the extensive peatlands and on the transverse dunes within the peatlands. The fires were probably not extreme on the dunes because of their steep slopes. Beaver floodings were quite common, with several noted within a single peatland.

Present vegetation and land use: Much of the land here is part of either a state or national forest or wildlife refuge; land management is primarily for timber or wildlife. The original logging occurred shortly after 1900 for much of the area; white pine and red pine were logged from the uplands, and northern white-cedar was logged from margins of the wetlands.

In the early 20th century, attempts were made to drain and farm parts of the wetlands that are now the Seney National Wildlife Refuge. These attempts failed due to low soil productivity, soil erosion, and the extremely short growing season. During the Seney fire in the 1970's, the peat fire was difficult to extinguish along the drainage ditches, where the peat was dry enough to smolder and burn to great depths.

Rare plant communities: Almost all the State's patterned peatlands occur here.

Rare plants in this portion of the landscape may include: *Amerorchis rotundifolia* (round-leaved orchid), *Danthonia compressa* (flat oatgrass), *Eleocharis nitida* (slender spike-rush), *Juncus vaseyi* (Vasey's rush), *Oryzopsis canadensis* (Canada rice-grass), *Petasites sagittatus* (sweet coltsfoot), *Vaccinium cespitosum* (dwarf bilberry).

Rare animals: *Coturnicops noveboracensis* (yellow rail).

Conservation concerns: The peatlands of the sub-subsection are among the largest and least disturbed wetlands of the State. At present, there appears to be little threat of development. Parts of the Seney National Wildlife Area have been hydrologically altered in the past. Many of the large patterned peatlands have been inadequately surveyed for biotic diversity. The large, shallow peatlands are breeding habitat for sandhill cranes.

Photo 3.2 Sub-subsection VIII.2.1: Indian River Pines, Schoolcraft County, Michigan

Photo by D. Albert.

Poor drainage characterizes much of the sand lake plain and outwash of this sub-subsection. Here, red pine and white pine form small groves on islands of drier outwash surrounded by sedge-dominated wet meadows and shallow peatlands. Many of the wetlands are quite young; they were dominated by upland conifers until 3,000 to 4,000 years ago, when cooler, wetter climatic conditions resulted in the transformation of upland forests to wetlands.

SUB-SUBSECTION VIII.2.2. Grand Marais Sandy End Moraine and Outwash:

This portion of the report Landscape includes sandy end-moraine ridges and outwash aprons, Lake Superior shoreline features, transverse dunes, sand spits; white pine-red pine forest, jack pine barrens, red pine forest, northern hardwood forest, and patterned peatlands. The elevation is 602 to 1,300 feet (184 to 396 m). and includes 1,765 square miles (4,562 sq km). Many kettle lakes are in this portion of the report Landscape in local areas of the pitted outwash.

Presettlement vegetation: The sandy lake plain along Lake Superior supported several wetland and upland communities. Emergent marshes, bogs, and speckled alder-willow swamps were common in the swales associated with the shoreline and small lakes immediately inland.

Peatlands were dominated by stunted black spruce, northern white-cedar, and tamarack; narrow beach ridges within the peatlands were dominated by white and red pine (Comer *et al*. 1993a). Excessively drained, fire-prone portions of the lake plain supported forests dominated by jack pine and red pine-jack pine. Jack pine-dominated forests were extensive along the shoreline between Grand Marais and Whitefish Point. Upland portions of the lake plain that were better protected from wildfires were extensive along the shoreline west of Grand Marais. These areas supported forests dominated by hemlock, northern hardwoods, and hemlock-white pine.

Extensive complexes of beach ridges and swales occurred on the sandy lake plain along Lake Superior. Most examples were excessively drained throughout and supported jack pine and red pine. The Grand Sable Dunes were active, supporting only local areas of forests. At their protected east end, they supported a small area of northern hardwood forest and a few, small pockets of jack pine. Narrow strips of clay lake plain along the shore in Luce County supported hemlock-white pine forests.

Coarse-textured moraines, most common south of Tahquamenon and Pendills Bays, supported northern hardwoods, often with significant amounts of hemlock. Forests of red pine and white pine and red pine "openings" were also common on these moraines; and small swamps dominated by northern white-cedar, tamarack, and spruce were also found in depressions on these moraines. On somewhat poorly drained tills, where bedrock is near the surface, hemlock and white pine were dominant species. Small cedar and tamarack-dominated swamps also occurred on the end moraines east of Munising.

Poorly drained outwash was uncommon in this sub-subsection. Where it did occur, just west of Munising, there was cedar-dominated swamp. Well-drained outwash supported northern hardwood forest. Somewhat poorly drained outwash near the edges of wetlands often supported hemlock. Droughty, flat outwash plains supported open jack pine barrens, or where conditions were not quite so fire prone, forests of jack pine, red pine, and occasionally, white pine.

Natural disturbance: GLO surveyors mentioned fires in the pineries on the sand ridges between Whitefish Point and Grand Marais. A large windthrow was noted in the cedar-tamarack swamps near the Lake Superior shoreline.

Rare plants: *Botrychium acuminatum* (acute-leaved moonwort), *Botrychium campestre* (prairie moonwort), *Botrychium hesperium* (western moonwort), *Cirsium pitcheri* (Pitcher's thistle), *Elymus mollis* (American dune wild-rye), *Empetrum nigrum* (black crowberry), *Littorella americana* (American shore-grass), *Potamogeton confervoides* (alga pondweed).

Rare animals: *Charadrius melodus* (piping plover), *Falco peregrinus* (Peregrine falcon), *Gavia immer* (common loon), *Haliaeetus leucocephalus* (bald eagle), *Lycaeides idas nobokovi* (northern blue), *Martes americana* (marten), *Pandion haliaeetus* (osprey), *Sterna hirundo* (common tern), *Trimerotropis huroniana* (secretive locust).

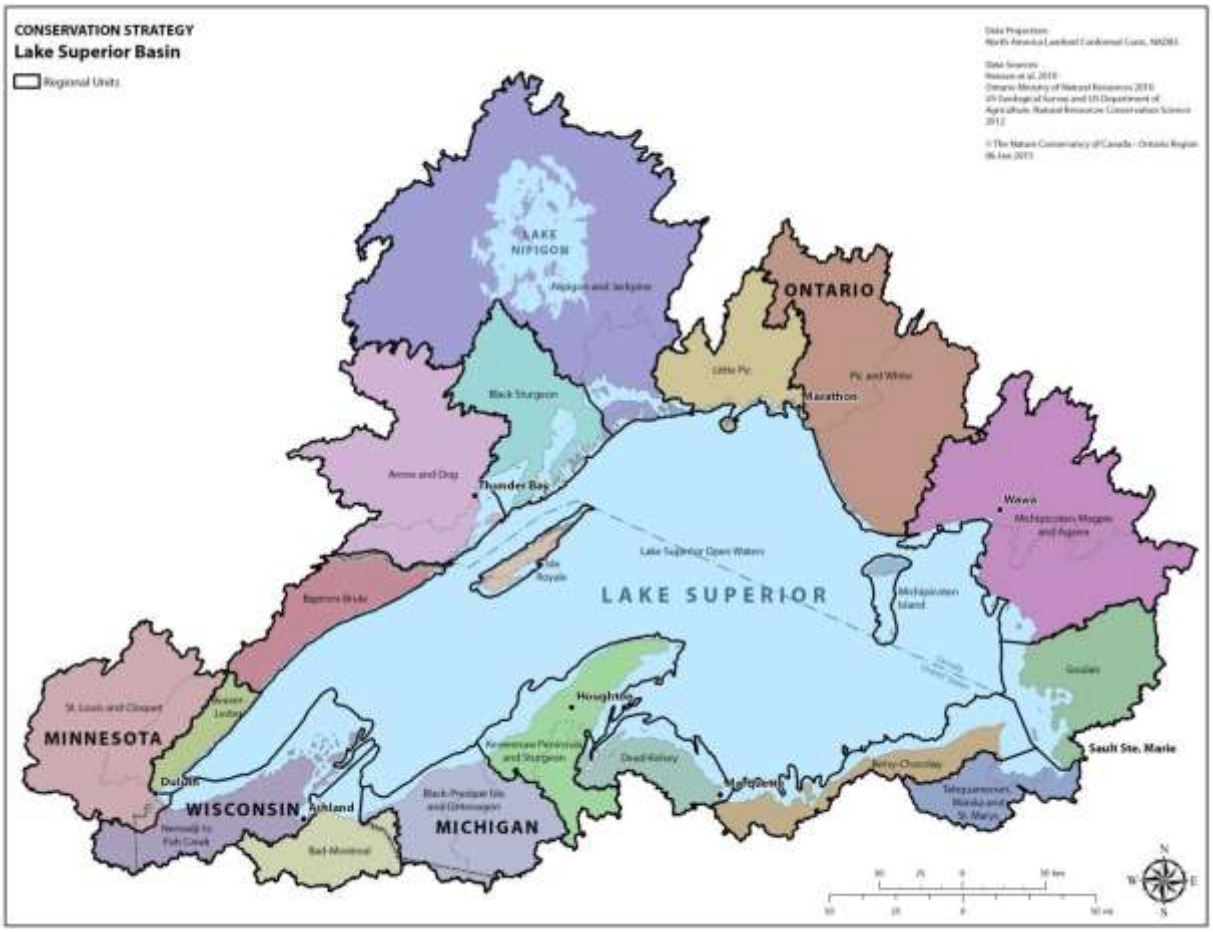
Conservation concerns: Parts of the Lake Superior shoreline support some of the most extensive natural stands of red pine in the State; none of these red pines have special designation.

Protection should be considered for some areas of the "pine stump plains" for scenic and educational value. Identification of potential future natural areas where white pine is successfully regenerating should also be considered; our present natural areas of white pine are over mature stands that may not survive long into the future.

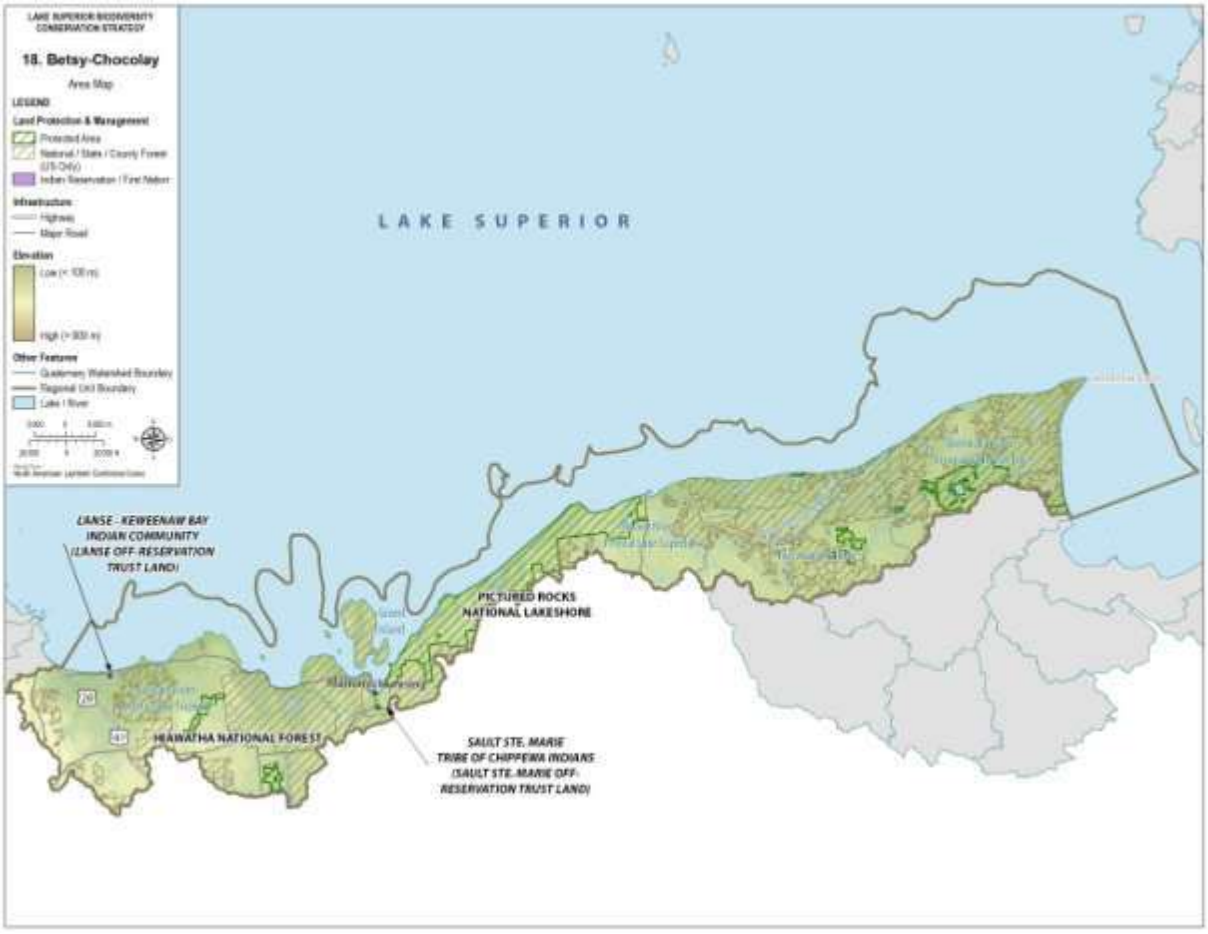
Great Lakes Biodiversity Assessments:

The three Maps below Map 3.18, Map 3.19 and Map 3.20 all are from the Lake Superior Biodiversity Conservation Assessment done by the Nature Conservancy of Canada and the Lake Superior Binational Program Superior Work Group (Lake Superior Biodiversity Conservation Assessment - Volume 2: Regional Unit Summaries). Over a 15-month period the project team collected and reviewed biological diversity data, both in the open waters, nearshore, and terrestrial along the Lake Superior Watershed.

Map 3.18 Overarching Base Map of Lake Superior Biodiversity Assessment



Map 3.19 Near Shore Assessment for Betsy – Chocolay Subsection



Map 3.20 Ownership of Biodiversity Hotspots

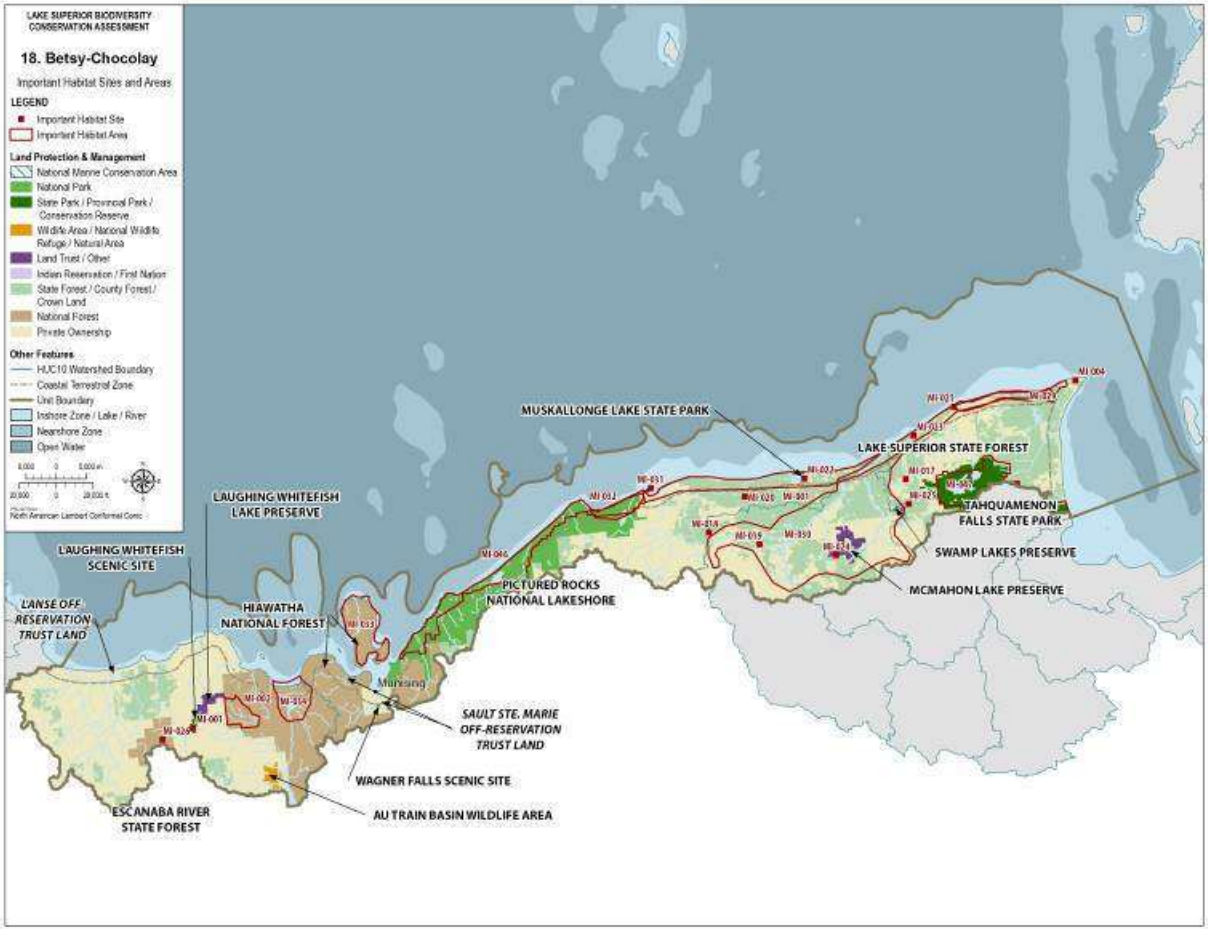


Table 3.7 Betsy-Chocolay Important Habitat Sites and Areas:

Code	*Site/ Area*	*Important Habitat Site/Area Name*	*Key Features*
MI-017	Site	Barclay Lake	Bog, dry northern forest, rare plant habitat
MI-018	Site	Barfield Lakes	Bog, dry northern forest, rich conifer swamp, mesic northern forest
MI-019	Site	Beavertown Lakes	Dry northern forest, hardwood-conifer swamp, rich conifer swamp, muskeg, dry-mesic northern forest
MI-020	Site	Blind Sucker River	Rare plant and animal habitat
MI-021	Site	Crisp Point	Rare plant and animal habitat
MI-022	Site	Deer Park	Rare plant and animal habitat
MI-023	Site	Little Lake	Rare plant and animal habitat

MI-024	Site	McMahon Lake	Patterned fen, rare plant habitat
MI-025	Site	Swamp Lakes	Intermittent wetland, dry-mesic northern forest, rare plant habitat
MI-029	Area	Vermilion	Lake Superior beach community, rare plant and animal habitat
MI-030	Area	Two-Hearted River	Representative landscape complex, old growth red/white pine forest, old growth cedar forest, hemlock and white pine forest, rare plant habitat, migrant bird habitat, relatively undisturbed wetland communities, coastal plain marsh, patterned fen, muskeg
MI-031	Site	Grand Marais	Rare plant and animal habitats
MI-032	Area	Grand Sable Dunes	Perched dunes, open dunes, geologic feature, rare plant habitat
MI-033	Area	Grand Island	Great Lakes marsh, mesic northern forest, rare plant and animal habitat
MI-046	Area	Pictured Rocks	Rare plant habitat, geomorphic features

Note only areas within this landscape are within the Table

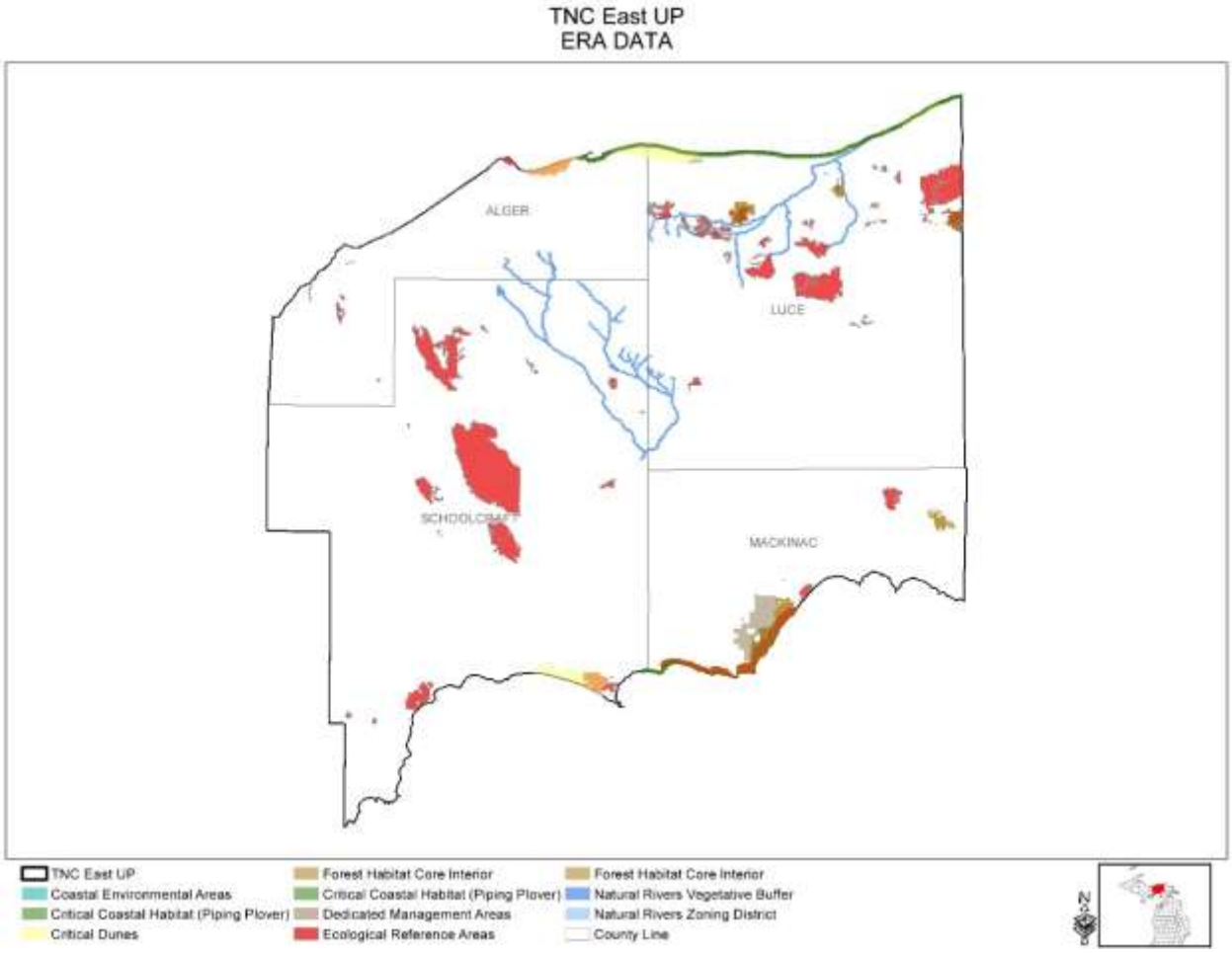
Ecoregional Assessments by The Nature Conservancy:

In the 1990's The Nature Conservancy used Natural Heritage data, stakeholder input, and expert knowledge to complete a Great Lakes Ecoregional Assessment for the entire Great Lakes. Although at a very large scale, The Nature Conservancy identified within this specific report Landscape several communities and species of high biodiversity:

- *White Pine/Blueberry Dry-Mesic Forest* on the East Branch Fox River and Seney Fens as a critical ecological resource.
- *Seney sand lake plain streams* has been identified as a critical ecological system and it is located on the lower reaches of Tahquamenon and Manistique Rivers.
- The Auricled Twayblade has been identified as a critical species at the Seney Fens and the East Branch Fox River.

DNR Ecological Reference Area Assessments:

Map 3.21 The Eastern Upper Peninsula Ecological Reference Area Sites – in Red.



As part of Forest Stewardship Council (FSC) forest certification, the MI DNR has performed a reference area review. The map above (Map 3.21) displays the DNR Ecological Reference Areas for this area which includes:

- Cusino Management Area: Central Schoolcraft County includes two large patterned peatlands one of 871 acres and one of 330 acres.
- Seney Manistique Swamp Management Area: Schoolcraft Counties identifies an area that may meet the definition of Type 1 and Type 2 old growth (as defined by FSC criteria) of 164 acres in three patches. There are three patterned fen ecological reference areas (104 acres, 4,548 acres and 6, 945 acres).
- Bullock Ranch Management Area: Central Schoolcraft County includes a dry northern forest ecological reference area of 109 acres.
- Garden Thompson Plains Management Area: Smaller area in southwest Schoolcraft County – a intermittent wetland of 40 and 95 acres, and a bog of 62 acres.

- Deer Park Management Area: Luce County, includes two bog natural communities 139 and 27 acres and an intermittent wetland 46 acres.
- Two Hearted Headwaters Management Area: Luce County identified an area within the Two Hearted as potential Type 1 or Type 2 old growth (as defined by FSC criteria) of dry-mesic northern forest (194 acres and 848 acres), hardwood-conifer swamp (37 acres) and three areas of rich conifer swamp (444 acres, 207 acres and 334 acres). There is one ecological reference area in this management area representing the hardwood-conifer swamp natural community (37 acres).
- Lake Michigan Shoreline Management Area: Mackinac and Schoolcraft Counties identifies an area that may meet the definition of Type 1 and Type 2 old growth (as defined by FSC criteria) of 5,856 acres in three patches shown in the grayish color above. The southeast Lake Michigan shoreline in this specific report Landscape is rich in ecological reference areas with 17 identified including, three areas of limestone bedrock glade or alvar (10,103, and 127 acres), two areas of limestone bedrock lakeshore (5 and 17 acres), two areas of Great Lakes march (10 and 29 acres), open dunes (16 acres), two areas of interdental wetland (16 and 57 acres) and seven areas of wooded dune and swale (167, 774, 954, 1757, 2346, 2783, and 3144 acres).
- Mackinac Mix Lake Michigan Management Area: a 48-acre natural bog community
- Battydoe Deer Yard Management Area: Along Lake Michigan in Mackinac County includes two wooded dune and swale complexes of 145 and 11 acres.
- Tahquamenon River Patterned Fens Management Area: Luce County, one fen of 1,399 acres and one of 1,375 acres.

Review of all the above is helpful for a landowner or plan writer to understand and better associate habitat with rare communities and species. Landowners and plan writers should consult MNFI to identify any possible unique natural communities and report their presence or absence in the forest management plan. MNFI lists and ranks unique natural communities that occur throughout Michigan. Most of these communities would be rather small (just a few acres or so) and may be contained within a single landowner's property. Communities with a state ranking of S1 or S2 should be considered special sites, even communities without trees that occur within the certified forestland. A helpful list of natural communities is found Here or at https://mnfi.anr.msu.edu/communities/.

3.1.14 Wildlife and Fish Habitat

Wildlife Habitat

Besides the rare animals above, this report Landscape provides quality habitat for many more common species, and some species which are common but at edge of range. Black bear and moose both have large home ranges and seasonally varying habitat requirements that can only be provided by a landscape with a variety of plant communities and large contiguous areas of forest with low levels of human activity. Black bear and moose populations in the Luce County area are relatively high compared to much of the Upper Peninsula. Moose, a mammal characteristic of boreal landscapes, requires wetland habitats for spring and summer foraging, hardwoods for browsing, and small areas of mature conifers for shelter and resting. The moose is this portion of Michigan came to Michigan from

Canada, via a frozen Lake Superior. The moose located in Marquette County (west of this location) were transported there by the DNR.

Bears utilize forest gaps for feeding on berries and insects found in downed and dead trees. Natural gaps in forest cover caused by wind throw, insects infestations, or disease provide the variety of successional stages that both bear and moose rely on. ·

Pine marten and fisher also require large areas (roughly 2,400-acre block/,) of fairly continuous closed-canopy forest. Pine martens prefer mixed deciduous-coniferous forest with complex forest structure. Pine martens and fisher are supported by natural disturbance regimes that create small patches of early successional habitat within the larger forest area.

Both are sensitive to clearcutting. Fisher are uncommon mon in this landscape, however, pine marten are doing quite well after great losses in the last century. Records show the American Marten extirpated in the 1930s. However, efforts for their recovery began as early as 1958 and then redoubled in the 1970s. The Research Station at Cusino (See Story) played a role in relocation on these animals. After a recent review of the state endangered species list, the marten was deemed recovered with a sustainable population (Michigan Nature Association, 2010). The presence of these predators reflects an abundance of prey species as well as high quality habitat.

The last remaining wolf pack in the last century was found in this report Landscape, moving between the Beaver Basin (now Pictured Rocks) and Long Lake (just to the south of H58). This pack disappeared in the early 1950's. By the 1990's wolves were beginning to come back into the UP via Wisconsin. Wolf packs are now well established across the entire UP and within this report Landscape, although numbers along Lake Superior are lower due to the winter migration of white-tailed deer out of the area. Wolves continue to be a controversial species to manage as they continue to expand back into old range and interact with people and peoples' animals both hunting animals and livestock. Some would argue that wolves have met the social carrying capacity and need to be hunted and expansion limited or halted, others (as national law suits have played out) think that wolves are still vulnerable to discrimination and hunting and trapping will have negative impacts on their populations. Peyton, et. Al. 2009 performed a study with Michigan residence to document social carrying capacity. The study confirmed what the years of national law suits have shown; that although considerable support for the presence of UP wolves existed, analysis revealed insufficient overlap among group tolerances to establish population goals that would not be met with extensive controversy. The Michigan DNR wolf management plan can be found Here.

The DNR Wildlife Division has an excellent publication on managing wildlife habitat at www.michigandnr.com/publications/pdfs/huntingwildlifehabitat/Landowners_Guide/index.htm.
Other resources for wildlife and birds can be found below.
DNR Wildlife Division – www.Michigan.gov/Wildlife
Michigan United Conservation Clubs - https://mucc.org
Quality Deer Management Association – www.qdma.com
Audubon Society - www.MichiganAudubon.org
Foresters for the Birds – http://vt.audubon.org/foresters-birds
Ruffed Grouse Society - www.RuffedGrouseSociety.org
National Wild Turkey Federation - www.nwtf.org
Michigan Trout Unlimited – www.MichiganTU.org
US Fish and Wildlife Service - www.fws.gov/partners

Fish Resources

Sport fishing is well known in several of the major rivers within this report Landscape. Several rivers have all five trout species and are well known as trout fisheries. This includes the Fox and Two Hearted. Over 53 fish species have been documented within the Two Hearted River (Nature Conservancy, 1995)

The DNR tracks surveys on the major sports fishery including walleye, musky, pike, bass, and sunfish. Specific lake surveys for this report Landscape can be found Here.

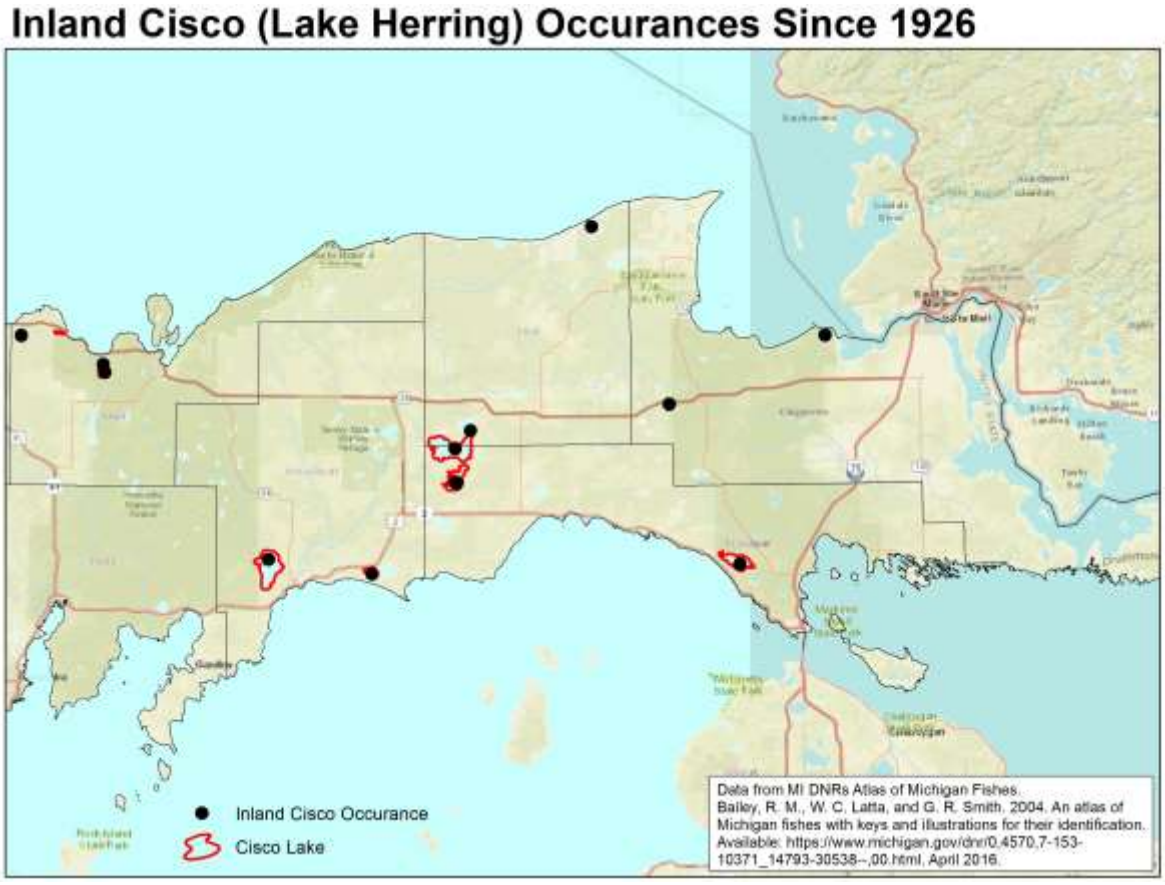
Recreational fishing has changed significantly over the course of Michigan's history. Fish that were originally native to waters thousands of miles away, such as Chinook and Steelhead salmon, now make up a major part of Michigan's sport fishery within the large Great Lakes. Others that were once of primary importance to state anglers — such as grayling — are now gone, having been fully extirpated from state waters. Many people in the UP remember smelt runs along the streams feeding into Lake Michigan within this report Landscape. In the 1970's-1980's fishermen were reported on harvesting buckets of smelt (Matheny, 2015) However smelt have declined very quickly across the Great Lakes and the runs are now no longer seen. The Rainbow smelt (*Osmerus mordax*) is actually native to both the Pacific and Atlantic coast – but can live in both salt and fresh water. The fish is a non-native that was either introduced or invaded the Great Lakes and is found in all five Great Lakes. In Michigan the fish was first stocked in Crystal Lake in Benzie County in 1912, after several unsuccessful attempts to stock smelt in the St. Mary's River to support another transplanted fish, Atlantic salmon. Smelt were found in Lake Michigan in 1923 and then spread throughout the Great Lakes.

Smelt found success in their new fresh water home. The commercial harvest of smelt on the Great Lakes reached 4.8 million pounds by 1941. The population showed large fluctuations over the years, impacted by lamprey eels and the emergence of whitefish and lake trout.

Some 94% of smelt harvested from the Great Lakes come from Lake Michigan — on both the Michigan and Wisconsin sides. It was around 1993 when smelt stocks began to plummet (Matheny, 2015). DNR biologists began to notice that with the rise of the zebra mussel within the Great Lakes, smelt were beginning to decline. However, many changes were happening at the same time – including changes in nutrients in the lake, cannibalism within the smelt, and changes in the water temperature.

Another fish that has gone through a decline is the Lake Herring or Cisco. Though some recreational fisheries still exist — most notably in the late summer in the St. Mary's River — Cisco were once an important recreational, as well as commercial, species in Michigan. Though most commonly associated with the Great Lakes, Ciscoes existed in several inland waters, too, where they provided limited recreational opportunities and the occasional, unusual by-catch to anglers who are seeking other species. At one time, small recreational gill net fisheries existed in some inland lakes. Recreational anglers — who were required to buy a cisco stamp — were allowed to harvest fish for their personal use with what most consider commercial gear. And though those fisheries are part of Michigan's past, the Cisco are not. The state did away with recreational gill netting many years ago. Cisco still exist in several inland water bodies but within this report Landscape they remain at very low levels – see Map 3.22 below. (Hanshue, 2016)

Map 3.22 Map of Inland Cisco Occurrences



3.1.15 Timber

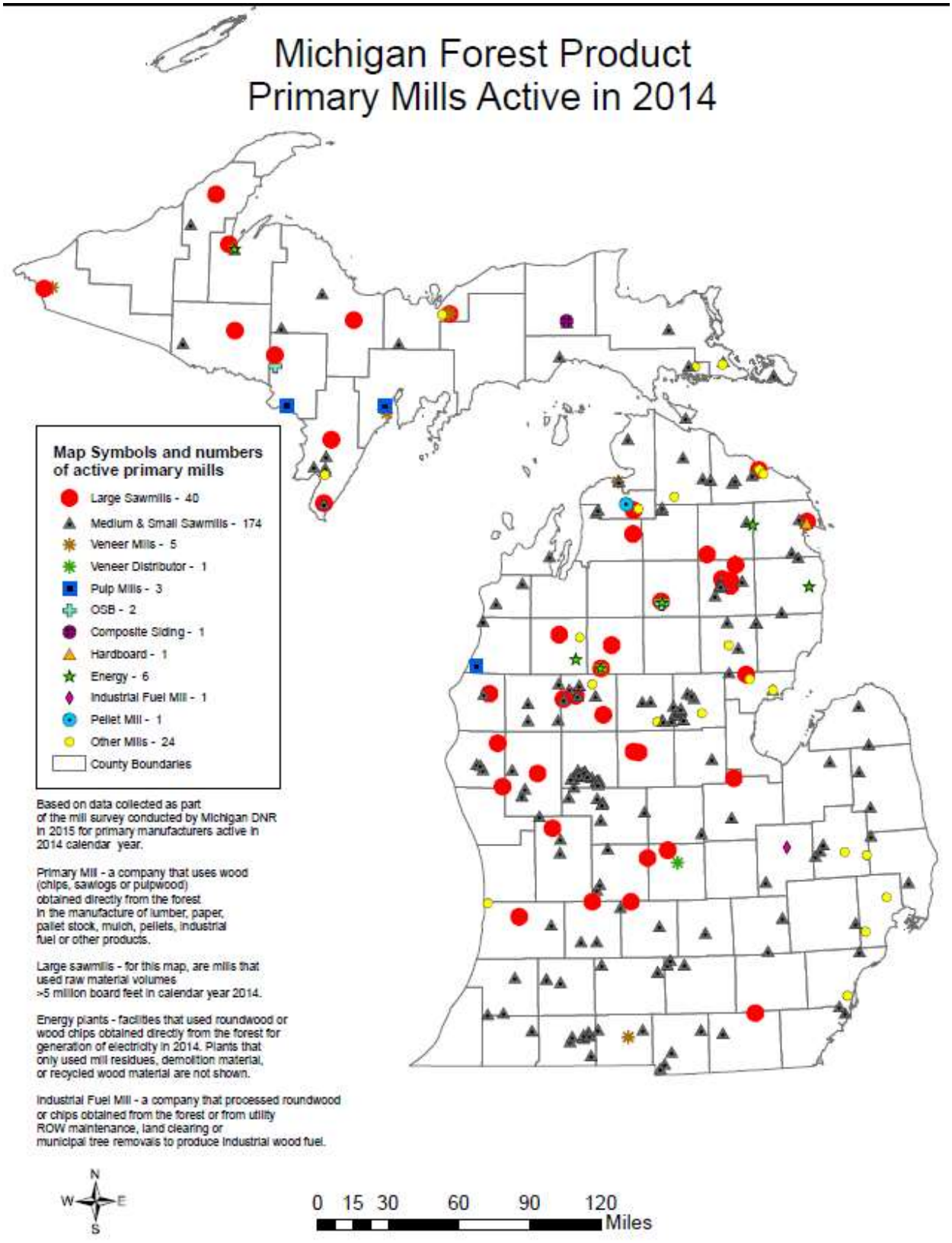
Almost all forested areas of this report Landscape not in national or state park, are currently are enrolled in commercial timber production or were in the past. Much of the land was owned by the Ford Motor Company and then sold to Cleveland Cliffs Industries. Each large owner high graded timber off the land especially yellow birch last century and white pine in the late 1800's and early 1900's. Most of the forest has been cut over three to four times since early European times. First rivers, then rail was used remove timber from the area. Rail ways, roads, and small dams all had impact on wetland hydrology, during a time when it was little thought of.

The Kingston Plains in the center of this report Landscape, were originally dominated by forests of red and white pine, and northern hardwoods with white pine. On the areas of these plains most severely burned by post-logging fires, the only existing vegetation consists of lichens, sedges, and scattered understory fire cherries (*Prunus pensylvanica*). Subsequently, parts of both plains have been planted to red pine or jack pine. However, over 100 years later much of the plains still look barren and many old stumps are still seen.

Today the forest of this report Landscape for the most part, has grown back – not as diverse as it was historically – trees such as elm and beech are gone and in many places, hard maple has been aggressively managed at the expense of other species. However, this report Landscape supports a diverse timber products economy. Across the four-county area over 80 different companies work in the timber products arena including logging, hauling, saw mills, finishing, and specialty products. Use this Link to search for business by county.

Map 3.23 displays the major mills and companies state-wide. Within this specific report Landscape, the Timber Products Mill just east of Munising in Alger County is considered a large mill, mainly a drying, saw log and veneer hardwood mill. The facility manufactures a full range of lumber from premium hardwoods—and are best known for the whitest white maple in America. A second large mill is found in Newberry; the Louisiana Pacific siding mill. This mill produces engineered wood siding.

Map 3.23 – Primary Mills as of 2014



3.1.16 Forest Health

Tree Disease:

Unfortunately, this report Landscape has seen one major tree disease sweep through the entire region – Beech Bark Disease from 2002 – 2015 removed 99% of all Beech in area. The disease is caused by a small mite like insect piercing the tree and then those wounds being infected with a fungus. The tree dies slowly often snapping off three-quarters of the way to the crown. Many public ownerships had to remove trees for public safety issues and most large landowners including the State DNR and larger timber companies performed massive salvage cuts. See story on this issue.

Tree mortality caused by infestations of native insects was also a significant disturbance feature of the pre-settlement landscape. Inferences from surveyor's notes show mixed conifer swamp forest incurred by far the greatest number of insect outbreaks covering the largest area within any forest type. Mortality was successively less frequent in the mixed upland, mixed pine, and jack pine forest types. No evidence of insect-induced mortality was found in mixed lowland and northern hard wood forest types. The insects causing the greatest mortality are believed to have been jack pine bud worm, spruce budworm, and the eastern larch beetle.

Today, insect-induced mortality, particularly in jack pine, appears to be far more frequent and extensive than in pre-settlement times. Historically few widespread infestations occurred, and insect outbreaks were limited to small stands or portions of stands. Outbreaks in jack pine alone now represent a six- to twelve-fold increase over historic levels. An exception to this trend is seen in mixed conifer/deciduous lowlands where insect mortality is far less common than previously. The jack pine mortality is likely due to much less frequent (low intensity) burns that culled insect pests. There are likely additional reasons for this increase in insect-related mortality. Currently, pine tends to be managed in "purer" stands of individual species that are more densely stocked than were the virgin pine forests. These characteristics reduce the inherent buffers that acted to slow and disrupt the dispersal of forest insects. Also, current silvicultural practices actively preclude fire and artificially extend the lifespan of jack pine. Thus for jack pine, stands are both older and denser than they were historically, making them more vulnerable to insect infestations.

DNR Resources for Forest Health:

The DNR publishes the annual “Forest Health Highlights” that has information about the forest insect and disease problems in Michigan. See www.Michigan.gov/ForestHealth for a pdf of the most recent edition. To report an unusual insect or disease in your forest, please email several photos to DNR-FRD-Forest-Health@Michigan.gov. Additional information is provided by the DNR below:

DNR Forest Health - www.Michigan.gov/ForestHealth
DNR Invasive Species Info - www.Michigan.gov/InvasiveSpecies
MDARD Exotic Forest Pests – www.Michigan.gov/ExoticPests
USFS Forest Health - http://fhm.fs.fed.us/

Natural Disturbance Regimes:

By their nature, disturbance regimes are very dynamic and often unpredictable. While it is essential to understand natural disturbance processes in order to maintain them, it is not possible to precisely quantify these processes. Attaining a general understanding and developing a model of occurrence rates, range of magnitude, and impacts of various disturbance regimes increases our ability to set parameters for management as we try to maintain the essential processes of the landscape ecosystem.

This discussion of natural disturbances is based primarily on a study by Price (1994) of western Chippewa County, which is very similar to this report Landscape in climate, geology, and forest community composition. Price describes natural disturbance regimes of pre-European settlement forests and how those disturbances have changed since that time. However, since this paper was published, we now know that climate change will likely alter many of these natural disturbance regimes or at least exaggerate them. Still it is good to review the general processes that shape this central UP area.

Working with General Land Survey records from the mid-1800's, Price offers a snapshot in time of the landscape. This perspective does not provide the full breadth of dynamics over many years, but does provide comparative information on types of disturbances and occurrence patterns.

Price found that fire, wind throw, insect outbreaks, and beaver activity were the chief disturbances governing the structure and species composition of pre-settlement forests in western Chippewa County. Land survey records indicate that disturbances were frequent and extensive enough to maintain a shifting mosaic of different successional com munities across the landscape. Price believes that current management of these landscapes via silvicultural practices, farming, recreational, or residential land uses greatly suppresses or dramatically alters the effects of natural disturbance, causing the character of these systems to be extensively modified and simplified.

General Comparisons of Past and Present Forest Conditions and Ecosystem Processes:

From early land survey records Price identified six distinct forest types in western Chippewa County prior to European settlement: (1) jack pine; (2) mixed pine; (3) mixed conifer/deciduous upland; (4) mixed conifer/deciduous lowland; (5) northern hard wood; and, (6) mixed conifer swamp forest. These forest types match those currently occurring within the central UP landscape (Michigan Dept. of Natural Resources, 1978). Price attributed changes in forest compositional to alterations in disturbance regimes and land use patterns, including an increase in open herbaceous or shrub land, the presence of developed tracts of land, the appearance of a distinguishable aspen/ white birch association, an increased coverage of the northern hardwood and pine forests, and large-scale losses of the mixed conifer upland forests. Another striking change is the decline in dominance of eastern hemlock, a trend that has been noted throughout the entire northern Great Lakes region (Eckstein, 1980 as cited by Price).

Price identified changes not only in forest species composition but in forest structure as well. He found all pre-settlement forest types had fewer and larger trees than today. Also, there was significant diversity in the structure of most pre-settlement forest types owing to variably sized pockets of seral species caused by wind throw, tree fall gaps, beaver activity, and fires. Pine-dominated systems (primarily jack pine and mixed pine forests) experienced stand replacing fires, which favored even-aged development. However, superimposed on this age structure were the effects of other less frequent disturbance events, such as low-intensity fires, wind throw, and tree fall gaps each introducing seral heterogeneity to the forest systems. For this reason, Price found all age classes were represented in every forest type except jack pine and these systems displayed features we commonly associate with "old- growth" (e.g., snags, cavity trees, and downed woody material). This could be important information for foresters wanting to push their forests towards older age classes, as most forests now are missing these older stands.

The remainder of this section describes the primary disturbance regimes operating in Price's study area, and the general effect each had on the overall structure and composition of pre-settlement forest versus the forests of today.

Wind throw

Price found that wind throw accounted for about 20 percent of all disturbances in pre-settlement forests. Wind throw can take down a large number of trees in a forest stand, creating gaps in the forest canopy as large as several acres. Additionally, small tree fall gaps are caused by individual tree mortality, ice storms, and minor occurrences of insect infestations and disease. These gaps allow regeneration or increased growth of shade-intolerant species such as aspen, birch, and red oak which are suppressed in the understory. This new growth provides greater structural and compositional diversity as a wide array of species and younger trees take advantage of the canopy opening.

Price determined that the greatest incidence and extent of wind throw occurred in the mixed conifer/deciduous upland and mixed conifer/deciduous swamp forest types. Jack pine and mixed pine forests experienced relatively few wind throws. Despite a lower frequency of wind throw in northern hard woods this was viewed as the most important disturbance type affecting these forests.

Present-day forests are thought to be less vulnerable to wind throw because they are more densely stocked with younger, smaller trees. As second-growth forests mature and develop more old-growth structure the effects of wind throw will likely increase.

Fire had a profound effect on pre-settlement forests, totaling 24 percent of all disturbances in Price's study. Also, fuels specifically associated with wind throw accounted for an additional 27 percent of all disturbances. All forest types were affected, although fire was most common in the mixed conifer swamp and mixed conifer/deciduous upland forest types.

Pine-dominated systems of all types were subject to large area and high intensity fuels. Also, jack pine is a fire-dependent species, and fire likely operated as a stand-replacing event in the more homogeneous forests consisting of jack, red, and white pine.

Examining present-day incidence of fuel in the nearby Hiawatha National Forest (Bormann and Likens, 1979), Price estimates the average annual area burned by fires in his study area represents a five-to nine-fold decrease from the annual average burned before European settlement. This dramatic decrease in fire has greatly altered the composition of the forests. Formerly, fire reduced competition by deciduous species in forest types dominated by conifers (essentially every type but the northern hardwoods). Most conifers are, to various extents, fire-adapted species, whereas northern hard woods are not. Because of the past 60 years of fire suppression, hard woods are more prevalent in conifer and mixed conifer/deciduous forests. Even "pure" red, white, and jack pine stands are found to contain big tooth aspen (Populus grandidentata) and red maple (Acer rubrum) in densities that could not have existed in the fire influenced landscapes of pre-settlement times. On more mesic sites it appears that deciduous species are replacing conifer altogether.

Beaver Activity

Beaver (*Castor canadensis*) related disturbance regimes may be more frequent and extensive in today's landscapes than in pre-settlement times. This is due to the remarkable comeback of beaver, which had been heavily trapped in the 1800s, but are now found in medium to high densities in the Upper Peninsula (Baker 1983). Evidence of beaver activity (as evidenced by dams, flooding, and felled trees) covered greater area and was far more frequent in the mixed upland forests than in any other forest type. This likely was due to the prevalence of preferred tree species for food and construction materials, such as aspen and maple, and the presence of suitable nearby riparian areas. Beaver also were common in and affected large areas of the mixed swamp forests. The northern hardwoods and lowland swamps displayed comparably low incidence and extent of beaver impacts, probably due to the lack of preferred tree species and the presence of less desirable low gradient streams. As would be expected, jack pine and mixed pine forests showed no impacts from beaver. Beaver continue to be a major small patch community creator – both in terms of flooding areas with dams and drying areas when historical dams break.

Beaver activity influences the structure and composition of vast landscapes. In small streams, habitation by beaver results in numerous segments with open canopy conditions, large accumulations of detritus and nutrients, increased riparian and wetland areas, and a shift to anaerobic biochemical cycles. When beaver occupy midsized streams, dam and lodges result in large accumulations of debris and sediment in the main channel often creating small islands, oxbows, and increased flooding of riparian zones. These habitat alterations typically increase aquatic invertebrate species diversity as well as wetland plant diversity (Naiman et al., 1988).

Beaver alter the productivity as well as the structure of riparian areas. Beavers in northern regions are found to annually fell at least a metric ton of wood within 300 yards of their dams. Where riparian areas are dominated by preferred tree species, such as aspen, beaver may virtually clear-cut these sites. Once the canopy of the riparian zone is opened, shrubs and root suckers of aspen may dominate which may then eventually be succeeded by and replaced by black spruce (*Picea mariana*), balsam fir (*Abies balsamea*), or white cedar (*Thuja occiden1alis*). In northern forests, a complex pattern of community successional pathways evolves when beaver inhabit an area and it is difficult to predict how any one site will develop (Naiman et al., 1988).

In a recent study Beaver dams and activity that were recorded and hand mapped in the 1880's were still visible and some still active in the 2000's. Carol Johnston, a professor at South Dakota State University, compared an 1868 map prepared by amateur anthropologist and naturalist Lewis Morgan with a series of aerial photos from the 1940s through 2014. Morgan wrote a classic book still valued by experts, "*The American Beaver and His Works*."

The map shows 64 beaver ponds along streams where he fished between 1855 and 1867, in Marquette County – just west of this report Landscape. The study found physical evidence, called "artifacts," of 46 of the 64 ponds still visible in 2014. Sixteen remain largely intact, another 16 are beaver meadows and 14 still have shrub wetlands or other surviving bodies of water. The conclusion was that Beaver dams, ponds and meadows are durable landscape features (Johnson, 2015).

Disturbance Regimes in Open Herbaceous Communities:

While Price's study focuses on forested communities, some of these disturbances, particularly fire and beaver activity, also affected non-forested wetlands, including peatlands. It is probable that fires originating in forested communities, occasionally swept over adjacent wetlands when conditions were dry enough. Fire in open wetlands can set back woody invasion and, in peatlands, can burn off peat layers. The effects of beaver activity are now very prevalent in the Two Hearted peatland-forest ecosystem and have likely been a factor over many hundreds of years (as discussed above). Beaver typically alter wetland community diversity and plant species composition, creating a more complex mosaic. Insect infestations also occur in herbaceous communities, but these dynamics and their influences have not yet been yet investigated in the Two Hearted watershed.

The high-quality forest structure in the peatland-forest ecosystem is largely due to the low populations, especially in winter, of white-tailed deer (*Odocoileus virginianus*). White-tailed deer summer in the region at relatively low densities, and then migrate south of the Two Hearted River watershed in winter. High populations of deer in many areas of the Upper Peninsula and northeastern United States have been observed to thin forest understory and reduce regeneration of cedar, hemlock, yellow and white birch, and maples. These effects on forest structure have reduced the reproductive success of ground-nesting birds in these areas. However, in the Two Hearted area, these bird populations are very healthy because of the lack of over browsing by deer. Additionally,

lower densities of deer reduce the probability of transmitting brainworm from deer to moose. Brainworm is the leading known cause of death (28% of all necropsied animals) in moose.

Many area-sensitive species that require large tracts of forest and complex forest structure thrive in the peatland-forest ecosystem. This is particularly true of species suffering general declines elsewhere due to one or more factors: habitat fragmentation, habitat loss, brown-headed cowbird parasitism (for birds) and loss of habitat structure and preferred plant species due to deer browsing or logging practices. The scarcity of cowbirds should enhance the value of watersheds like the Two Hearted as a source population for many species of Neotropical migrant birds. Several such species of Neotropical migrant birds have successful breeding populations within the peatland-forest ecosystem. Among these are veerys (*Catharus fuscens*), black-throated blue warblers (*Dendroica caerulscens*), and Canada warblers (*Wilsonia canadensis*), which breed in the well-developed understory and complex ground layer in upland forests and the ecotone between upland and lowland forests. With continued regeneration hemlock, white pine, and white spruce, Blackburian warblers (*Dendroica fasca*) should increase and, with continued hemlock regeneration maintain their populations. However, Hemlock Woolly Adelgid should be monitored for, as this invasive has decimated eastern hemlock stands.

The hydrological regime of the peatland-forest ecosystem supports vast wetlands which provide habitat for the regionally rare yellow rail (*Cotumicops noveboracensis*) and rapidly declining grassland species like the bobolink (*Dolichonyx oryzivorus*) and sedge wren (*Cistothorus platensis*). Beaver dam construction and tree cutting temporally alter water levels in wetlands, generating a variety of wetlands and bands of dead trees which are favored by the globally declining olive-sided flycatcher (*Contopus borealis*) and locally rare species like the black-backed woodpecker (*Picoides arcticus*).

3.1.17 Fire Management

Fire has played a major role in shaping the central UP report Landscape. There is an interesting juxtaposition between the lands that are very wet and the dry sandy uplands that support fire dependent systems such as jack and red pine forests. Jenkins (1943) documented the history of forest fires and their effects on wildlife from the lumbering era to the late 1930's. Robson (1950) stated, "from time immemorial but more especially since the beginning of act of settlement, about 1825, forest fires have occurred annually in the Upper Peninsula of Michigan." In looking through field notes to try to determine the natural cover of the area, Jenkins (1943) found that almost every discussion made some mention of fire in those areas that had marsh-land mixed with dry sand ridges of pine. He noted that this was particularly true if the area was situated in any sizable area of Grayling sand. He went on to speculate that practically all the present jack pine areas have been burned over periodically. He suggested that about 250,000 ha in northern Michigan were fire dependent communities. Ancient fires that burned the jack pine were unhindered except by rain and natural barriers. The progress of most fires being slowed or stopped by the vast swamps. Several large fires, however, have occurred when the wetlands dried out and burned very readily and in some cases for long (months) time periods. Seney

National Wildlife Refuge had a history of prescribed burns for restoration of wetlands and pine systems. See Story in Section 4 for more details.

The DNR has also done experiments with fire within this landscape at Muskrat Lakes in eastern Luce County. See Story in Section 4 for more details.

Wildfires:
Seney fire

Photo 3.3 – Seney Wildfire 1976

In the summer of 1976 a wildfire burned 260 square km on the Seney National Wildlife Refuge in Michigan's Upper Peninsula. The fire began as an isolated lightning strike on 30 July. Because of its isolated nature and much water in the area the fire was difficult to locate and control by hand. By 10 August fire observers estimated the fire to cover about 500 ha. By 22 August dry winds moved the fire north and south. By the 24 of August the fire had grown to 4,000 ha and 160 fire fighters were on lines.

Map 3.24 Extent of Seney Fire of 1976

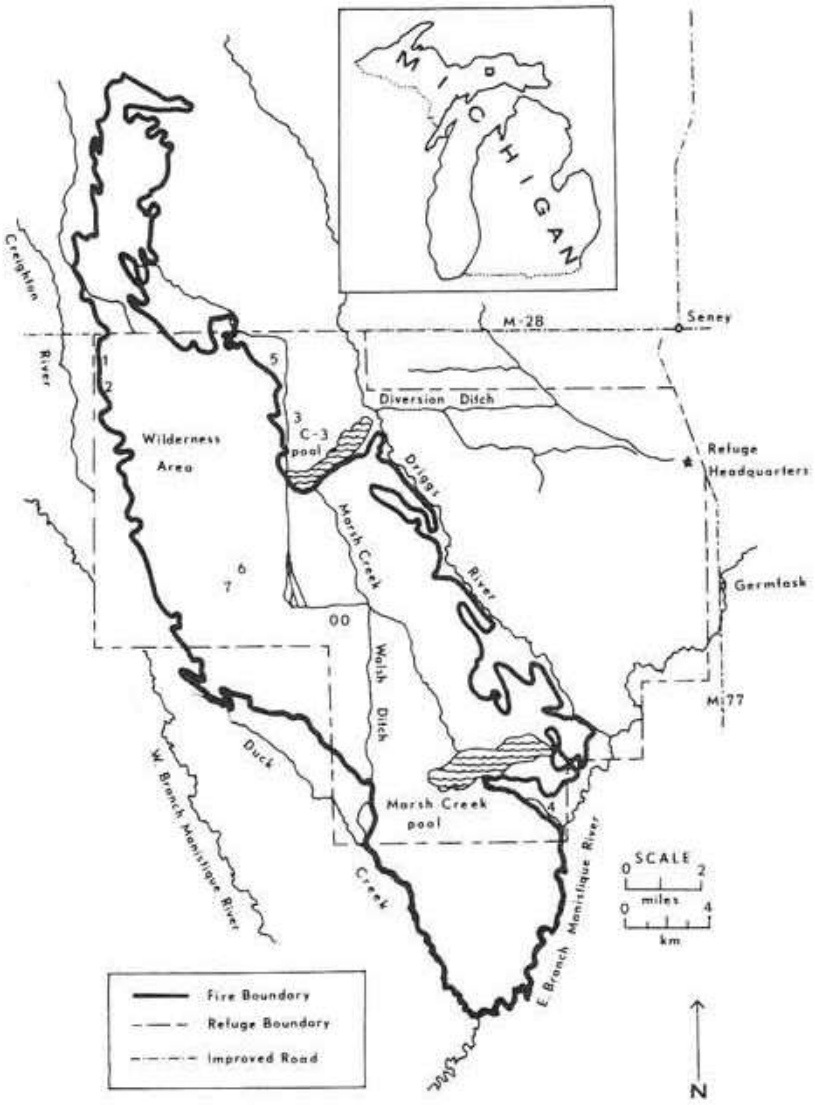


Fig. 1. Fire perimeter and location where 1976 fire began (point 00) on Seney National Wildlife Refuge, Seney, Michigan. Paired habitat and bird plots are numbers 1–7; each plot had an 8-ha burned an 8-ha unburned study area.

By August 28th the fire had grown to 7,700 ha and backfires were established as a containment attempt. By 06 September the fire had grown to 26,000 ha but by using even more backfires the fire was contained by 07 September. However, on the 12th of September hot gusty winds caused hotspots to burn and the fire jumped Highway M-28 running 9 km on a front about 2 km wide. This new burn covered parts of the Grand Sable State Forest and adjoining private forest holdings. more than 1,000 people were making a renewed effort to bring the fire under control. The fire was contained on 2l September and declared under control the following on private lands. See Map 3.24 for the map of this fire. The fire,

known as the Walsh Ditch Fire, covered over 260 km of which nearly half was burned by backfires' More than 1,200 people fought the fire (Anderson, 1982).

The U.S. Fish and Wildlife Service evaluated the fire's impact on wildlife and wildlife habitat by sampling in burned and adjacent unburned areas from 1977 through 1979 in a technical report for the agency. In the report researchers found that fire structurally changed the habitat allowing the reestablishment of wildlife species. Disturbances such as fire were common years ago. The size and configuration of the habitats, along with structurally altered habitat, had been changed with an increase in the edge of many habitats, further changing species composition. No species was completely destroyed or eliminated because no habitat was completely destroyed (Anderson, 1982). Aerial photos and field observations showed that changes were still occurring in the habitat three years after the fire. Some tree species, for example, had green vegetation for two or three years after the fire and then died. This was noted more recently in the Sleeper Lake fire below.

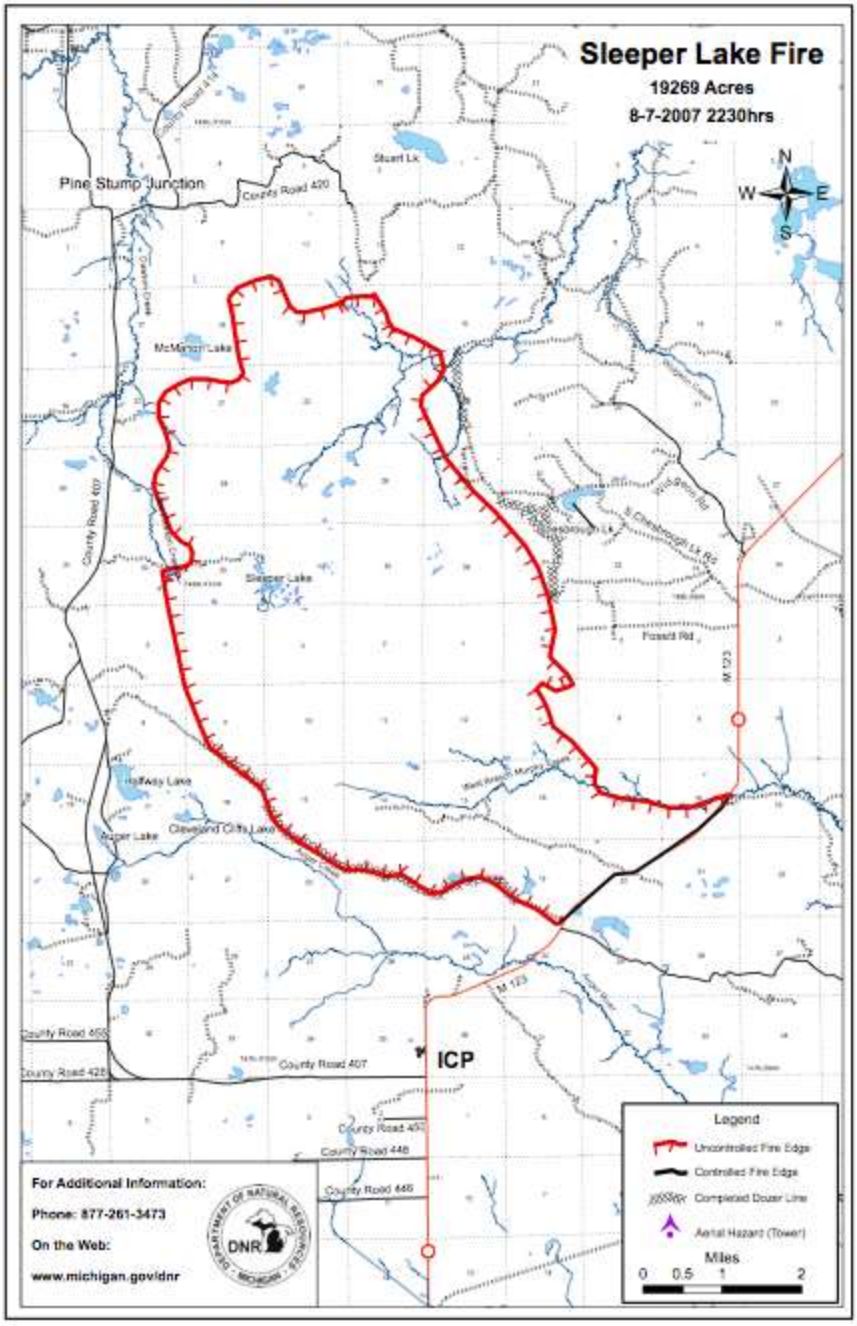
Sleeper Lake Fire

July of 2007 was very dry in the Upper Peninsula. In early August, a lightning strike started a fire in the dry bog area of Sleeper Lake, north and east of Newberry, Luce County. The fire fueled by strong south winds ran dramatically north after a slow start. The DNR created many fire lines in the peatlands and performed along with The Nature Conservancy several back burns. During the fire, just over 1,800 acres of commercial forest burned, along with about 14,000 acres of swamp and marshlands. The fire burned much of the McMahon Lake Preserve of The Nature Conservancy.

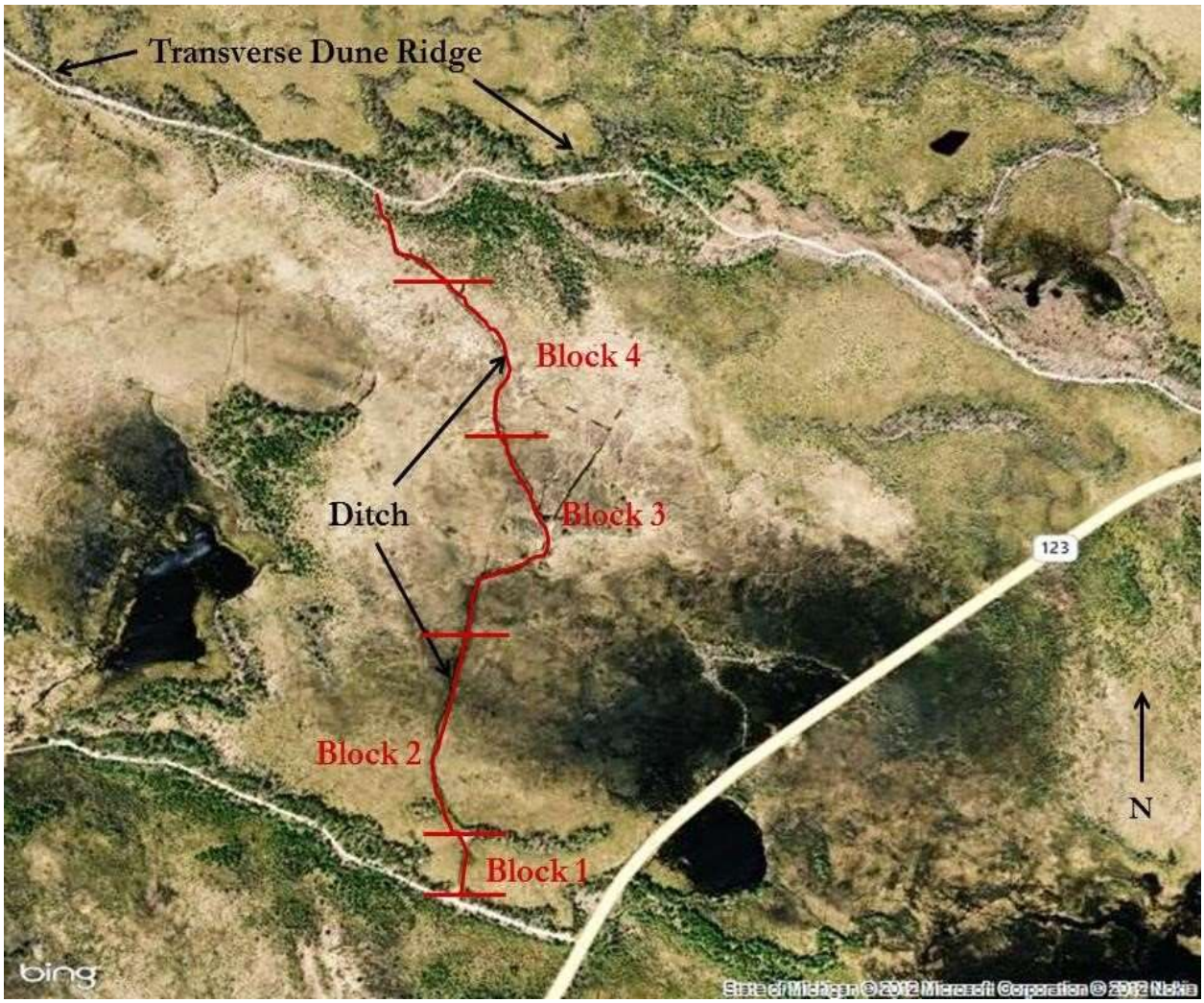
As the fire grew, more fire personal from surrounding states and Canada participated. At the fire's maximum extent there were more than 220 people working on the fire, including firefighters from Connecticut, Missouri, Wisconsin, Minnesota, and Ontario, Canada.

State fire officials said longstanding drought conditions made conditions favorable for the blaze to grow and intensity. Fortunately, only one main structure was lost in the fire and four minor injuries to firefighters were reported. As of 2016 trees within the Conservancy's preserve are still dying and falling over, although the regeneration of jack pine seedlings has been dramatic and young trees of several species are regenerating vigorously. One amazing outcome of the fire was a record crop of morels in the fire area for the next two years after the fire. Locals reporting being able to harvest many pounds of the sought-after mushroom at a time. Researchers from Michigan Technology University spent several years studying the peatlands that were degraded by bulldozed fire lines. Several years of experiments and restoration reconnected some of the hydrology that had been impacted by the fire lines (Bess, et al, 2012.) See Map 3.25 for range of Fire and Map 3.26 for Aerial map of MTU study.

Map 3.25 – Extent of Sleeper Lake Fire



Map 3.26 Aerial Portions of Sleeper Lake Fire



Research by Michigan Technological University on restoration of peatlands after the Sleeper Lake Fire (Bess, et al, 2012)

Duck Lake

The winter of 2012 had been unusually mild with snow leaving by March and very high March temperatures. April and May were very dry and hot south winds began on May 24 and blew strongly for several days. Because wildfire conditions were "very high" in the Upper Peninsula in Luce County, a May 21 lightning strike ignited a dry wetland area north and east of Newberry. The Duck Lake Fire was discovered on May 23 by a DNR wildfire aircraft detection pilot. While it was still small, department crews worked through the night and into the next day to contain and hold it against the wind that was forecasted.

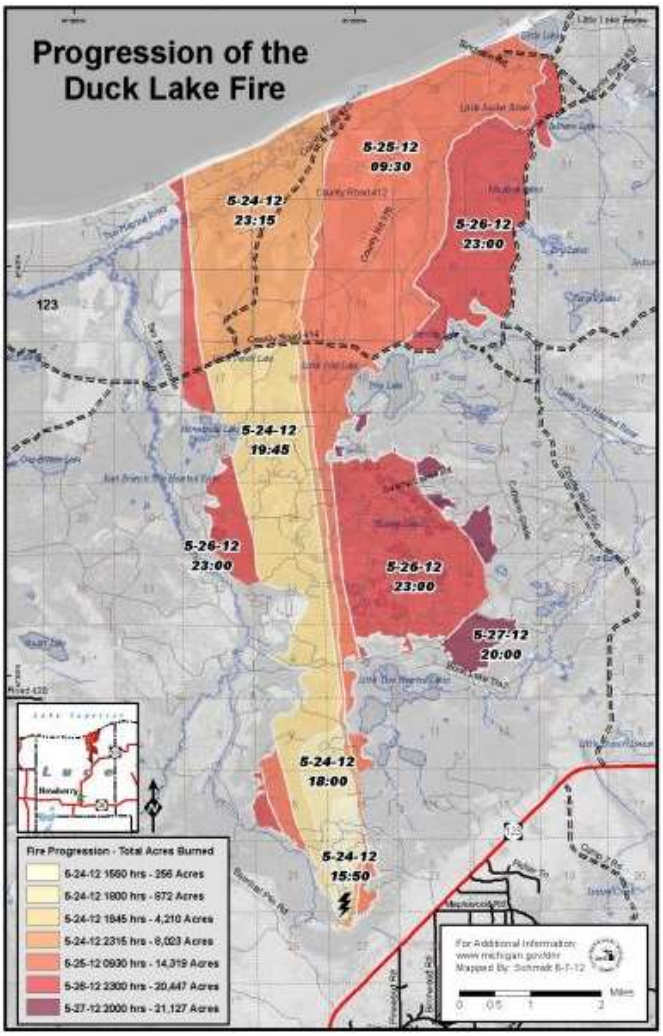
On the afternoon of May 24, a then-small wildfire blew up and began its 11-mile run to Lake Superior. When it was finally contained, the Duck Lake Fire had burned 21,069 acres. More than 230 residences,

161 outbuildings and nine commercial structures were threatened by the fire. Forty-nine residences, 58 outbuildings, two commercial structures and 26 campers were destroyed. The fire totaled more than $3 million in suppression costs. The Duck Lake fire was the largest fire Michigan had seen in the past 32 years.

The fire ran from Duck Lake in eastern Luce County all the way to Lake Superior including running very hot within DNR owned jack pine areas. The DNR with support, kept the fire from moving much east to west but did not attempt head on containment. Map 3.27 shows the extent and phases of the Duck Lake Fire.

After the fire, 9,784 acres at the Duck Lake Fire site were cut for salvage and 1,290 acres were planted with approximately 1.2 million jack pine seedlings. In addition to its own resources, the DNR received a donation for 150,000 seedlings from the Arbor Day Foundation to reforest the area impacted by the fire. As of 2016 trees are growing back and the burnt remains of trees added nutrients to the soil.

Map 3.27. From InciWeb – Incident Information System –http://inciweb.nwcg.gov/incident/map/2895/0/



3.1.18 Forest of Recognized Importance (High Conservation Value Forests)

As described in previous sections, much of this report Landscape has been intensively managed for 100-150 years, so there are few tracts of forest that are truly pristine. However, because several landowners are certified under Forest Stewardship Council certification, a search was performed to locate High Conservation Value Forests or Forests of Recognized Importance. Map 3.28 displays the forests that were deemed to characterizes high biodiversity value or older age classes; all are DNR ownership unless otherwise noted. Some forests need additional inventory to obtain condition and health.

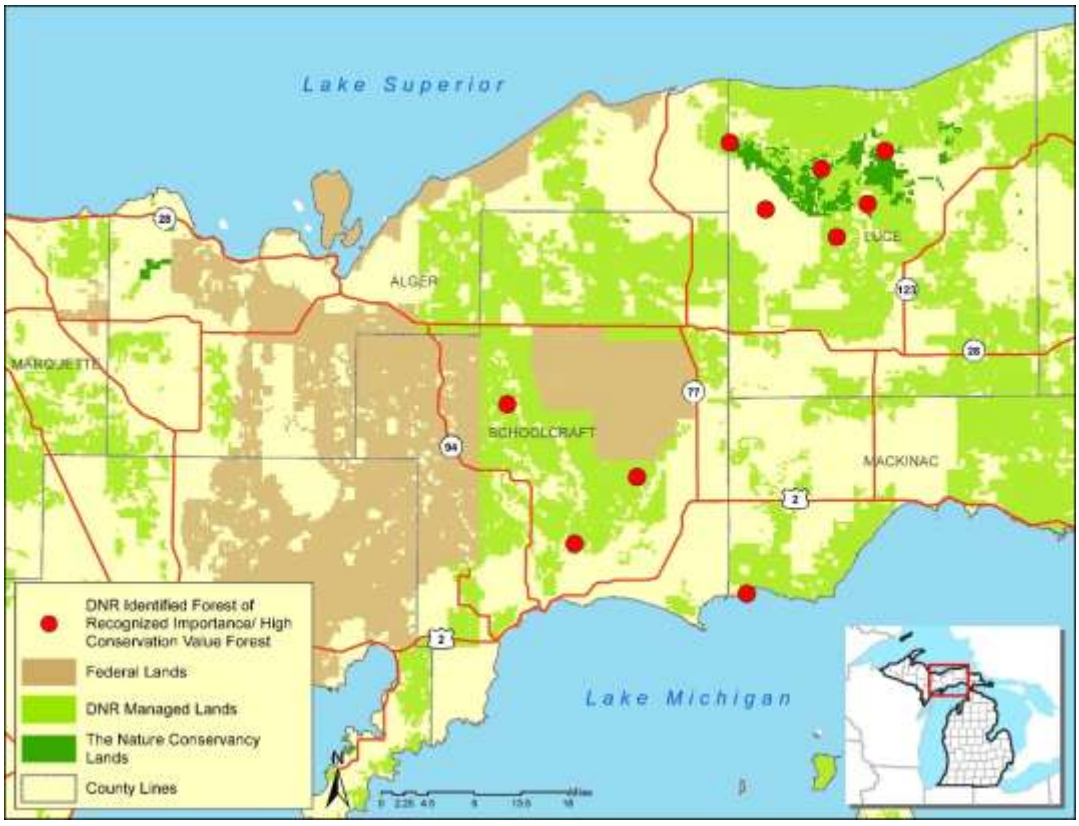
Luce County – Two Hearted:
- Dry-Mesic Forest (194 and 848 Acres)
- Hardwood-conifer swamp (37 Acres)
- Mesic Hardwood (117 Acres) The Nature Conservancy
- Rich conifer Swamp (444, 207, and 334 Acres)

Luce County – Deer Park:
- Dry-Mesic Forest (Type 1 old growth 47 Acres)
- Dry-Mesic Northern Forest (Type 2 old growth 100 acres)

Mackinac County – Lake Michigan Shoreline:
- Dry-Mesic Forest (Type 2 old growth 5,856 acres)

Schoolcraft County – Seney Manistique Swamp:
- Potential (Type 1-2 old growth 164 acres)
- Potential (Unidentified old growth 18,000 acres)

Map 3.28 Map of Forests of Recognized Importance



3.1.19 Archaeological, Cultural and Historic Sites

While native use was wide spread across this report Landscape, there is no data releasable by the state on specific sites identified as historic archaeological sites. See Map 3.29 and Table 3.8 for general information.

Map 3.29 Eastern UP Archaeology Sites

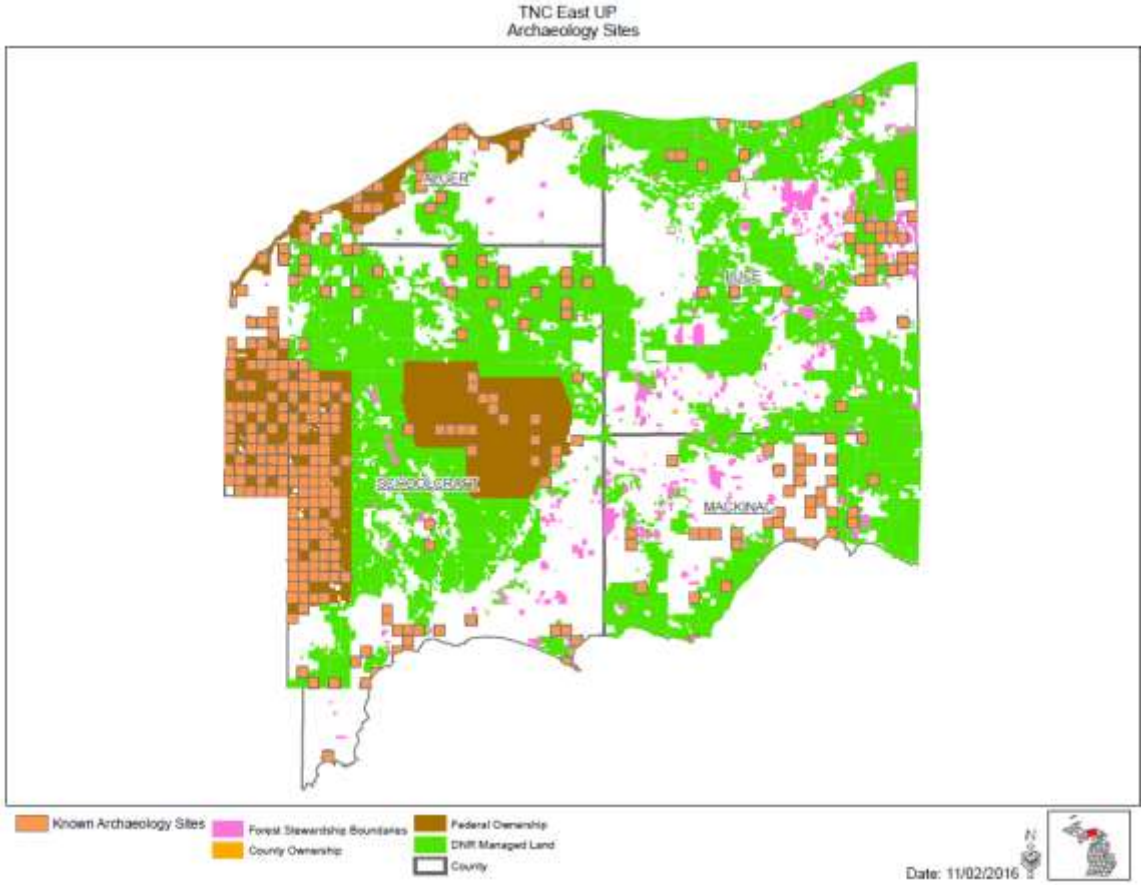


Table 3.8 – Number of Known Archaeological Sites

Landscape	Total Acres in Landscape	Total Square Miles in Landscape	# of Known Archaeological Sites	Archeological Sites per Square Mile
TNC East UP	1,916,241	2,994	5,461	1.8

From MI DNR (2016)

The Pictured Rocks areas does not have much found evidence of heavy use by the Ojibwa for subsistence or habitation, but it did serve as a place of burial at Sand Point and Grand Sable Dunes, and was frequently mentioned in Ojibwa lore (Kinietz, 1940).

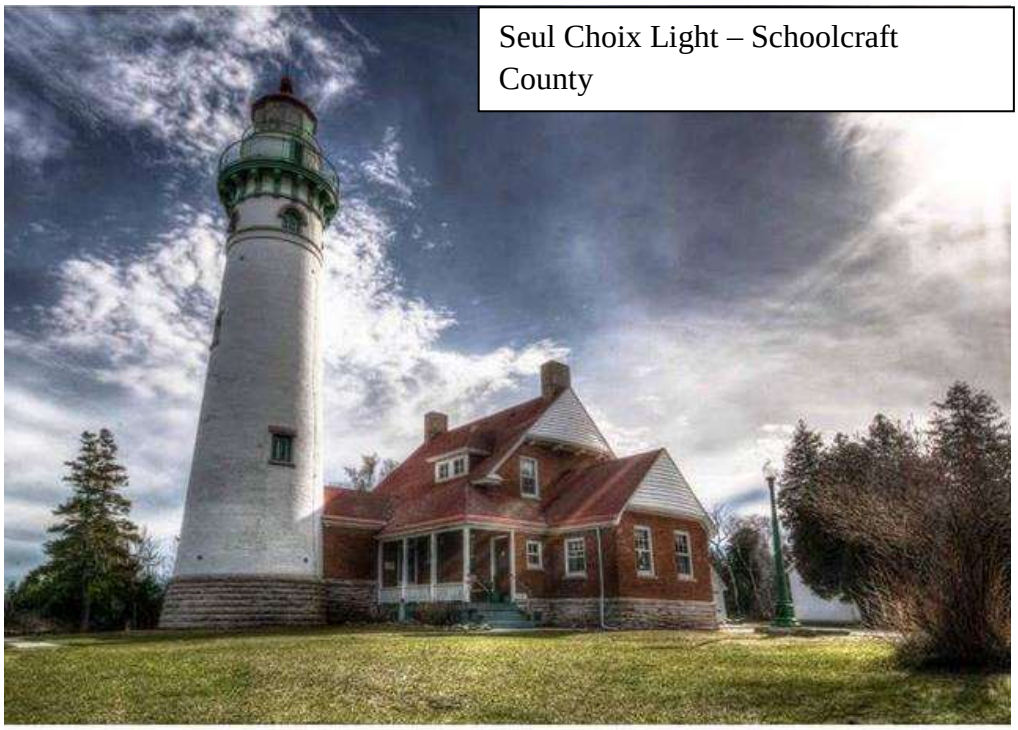
After the use of rivers for log runs in the 1800's, a few old, rotting spile dams (wood dams often with a drain) can still be seen on the Two Hearted River. A great number of old camps and old abandoned rail spurs from the logging days dot the report Landscape, especially in eastern Alger and northern Schoolcraft Counties – as was mapped and discussed earlier. Except for an occasional apple tree, and rusty metal, most of these sites are no longer noticeable.

Landowners and plan writers should consult the State Historic Preservation Office (SHPO) to determine if archeological or cultural sites may be present on the property, and report this result in their forest management plan. DNR Service Foresters provide this database check for all Forest Stewardship Plans. For plans not developed through the Forest Stewardship Program, landowners, plan writers or Inspectors may contact a DNR Service Forester for this database check, or they can directly contact SHPO to request this database check. Contact the State Archeologist, Dean Anderson, 517-373-1618, or andersond15@michigan.gov, for information.

One notable feature within this landscape are the several restored lighthouses on the shores of the Great Lakes. The three within the report Landscape are shown below in Photo 3.4. These lighthouses were all built in the 1800 or early 1900's, and all fell into disrepair before being restored by volunteer groups or the federal government. All three are now open to the public for visitation.

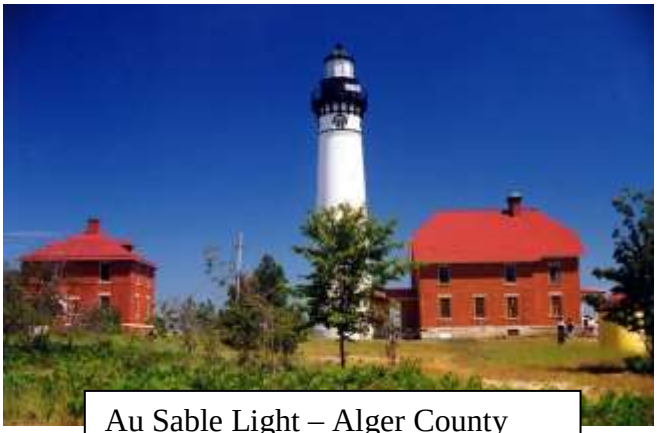
- The Seul Choix Station: The station was established in 1892 with a temporary light, (Roach, 2007). The light started service in 1895, and was fully automated in 1972. The light is an active aid to navigation. The French name was "only choice."
- The Crisp Point Station was one of five U.S. Life-Saving Service Stations along the coast of Lake Superior between Munising and Whitefish Point in the Upper Peninsula of Michigan. The lighthouse was completed in 1903 and the light was displayed for the first time in May 1904. This lighthouse and life-saving station have undergone massive damage. All buildings were destroyed by erosion, except for the tower and one wall of the entrance room. In the winter of 1997/98, the loss was stayed by the installation of one thousand cubic yards of stone in front of the tower. A new Friends of the Lighthouse now keeps the light in repair and has stayed further erosion.
- Au Sable Station was built in 1874 on Au Sable Point, a well known hazard on Lake Superior's "shipwreck coast". The Au Sable Point reef is a shallow ridge of sandstone that in places is only 6 feet (1.8m) below the surface and extends nearly 1 mile (1.6km) into Lake Superior. The lighthouse was automated in 1958 and is currently equipped with a 12-inch (300mm) solar-powered light. The Station is maintained by the National Park Service and has an active volunteer and restoration plan.

Photo 3.4 Lighthouses of this Landscape



Seul Choix Light – Schoolcraft County

Crisp Point Light – Luce County

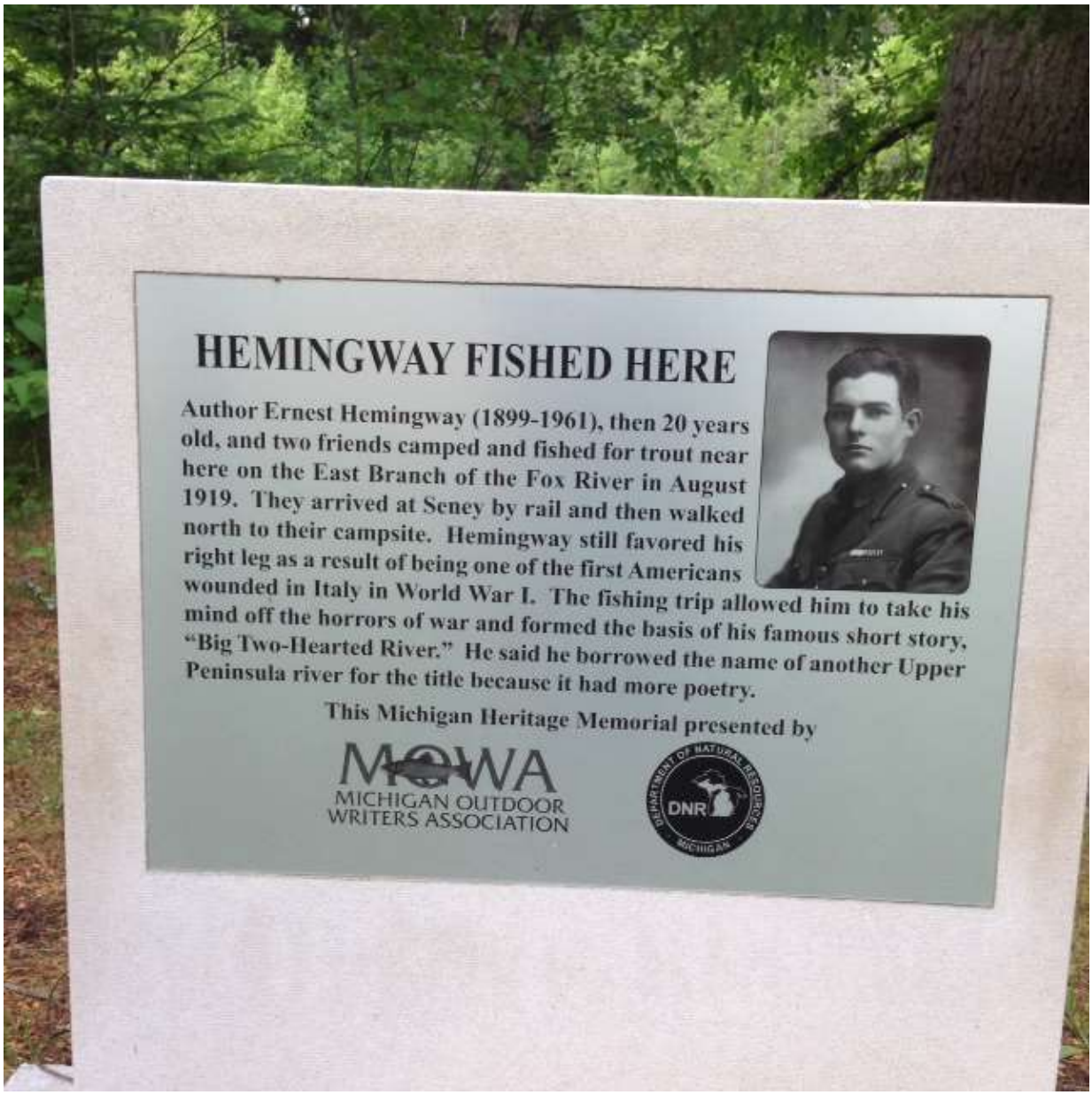


Au Sable Light – Alger County

Famous Authors, Famous Rivers:

In Henry Wadsworth Longfellow's once famous poem, *The Song of the Hiawatha,* the hero of the poem learned how to paddle a birch bark canoe on the Tahquamenon River. The Fox River was visited by Ernest Hemingway and was the basis of his Nick Adams short stories. Hemingway fished the Fox but named the river in the story after a nearby river – the Big Two Hearted. Both have trout and are very similar. A sign below in Photo 3.5 – was placed by the Michigan Outdoor Writers in 2014 to commemorate the author's choice of this Michigan notable river.

Photo 3.5 – Sign at the East Branch of the Fox DNR Campground.



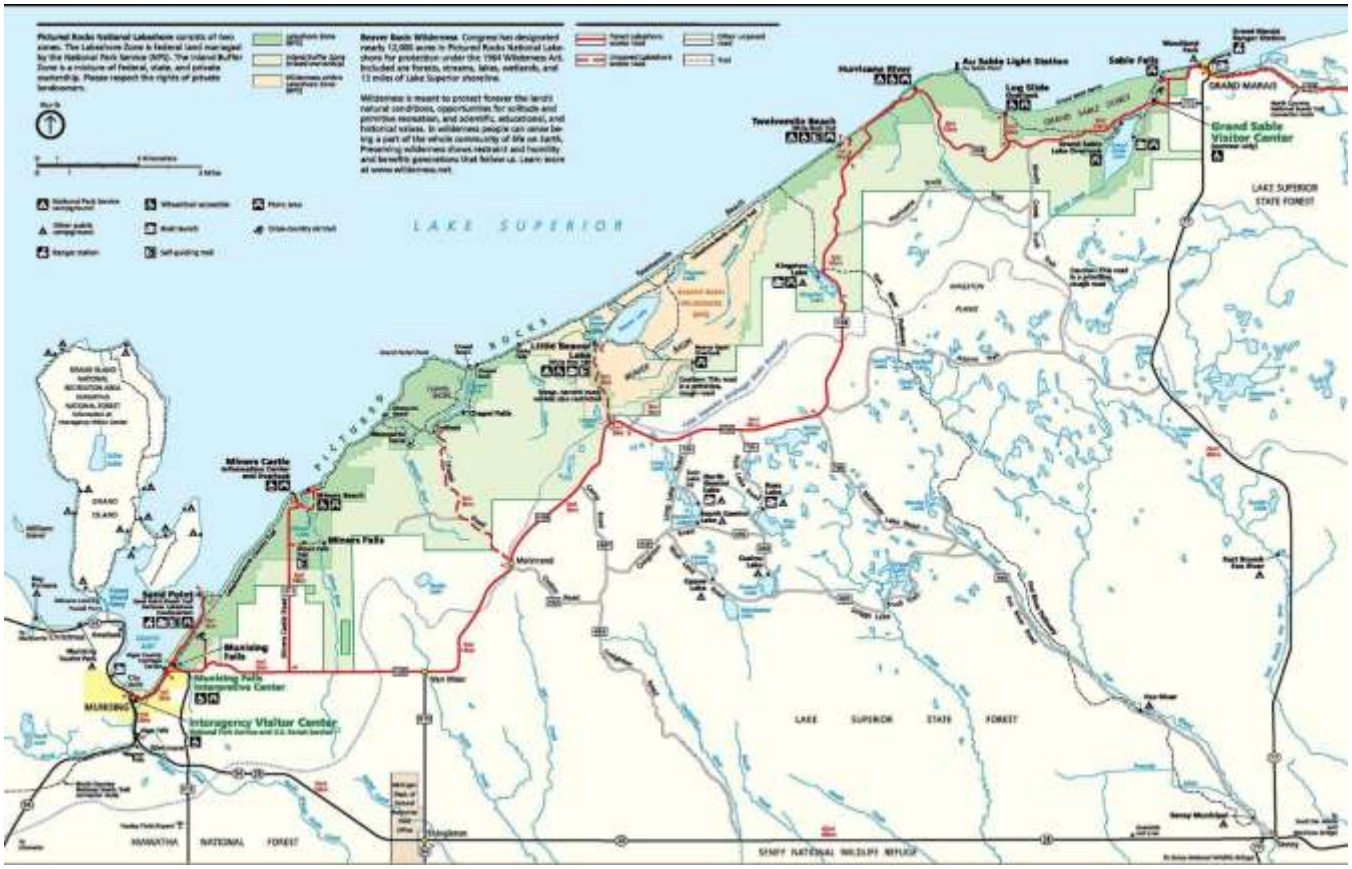
3.1.20 Tourism and Recreation

The report Landscape relies heavily on tourism and recreation, yet except for a strong upswing of use at Pictured Rocks – the specific report Landscape for this plan remains low when compared to the east and west of this specific report Landscape. Snowmobiling, hunting, and second homes make up most the tourism markets. There are 100's of inland lakes in this landscape that are open to fishing, and all state, and large timber company lands are open to hunting and fishing on foot as part of the enrollment in the Michigan Commercial Forest Act.

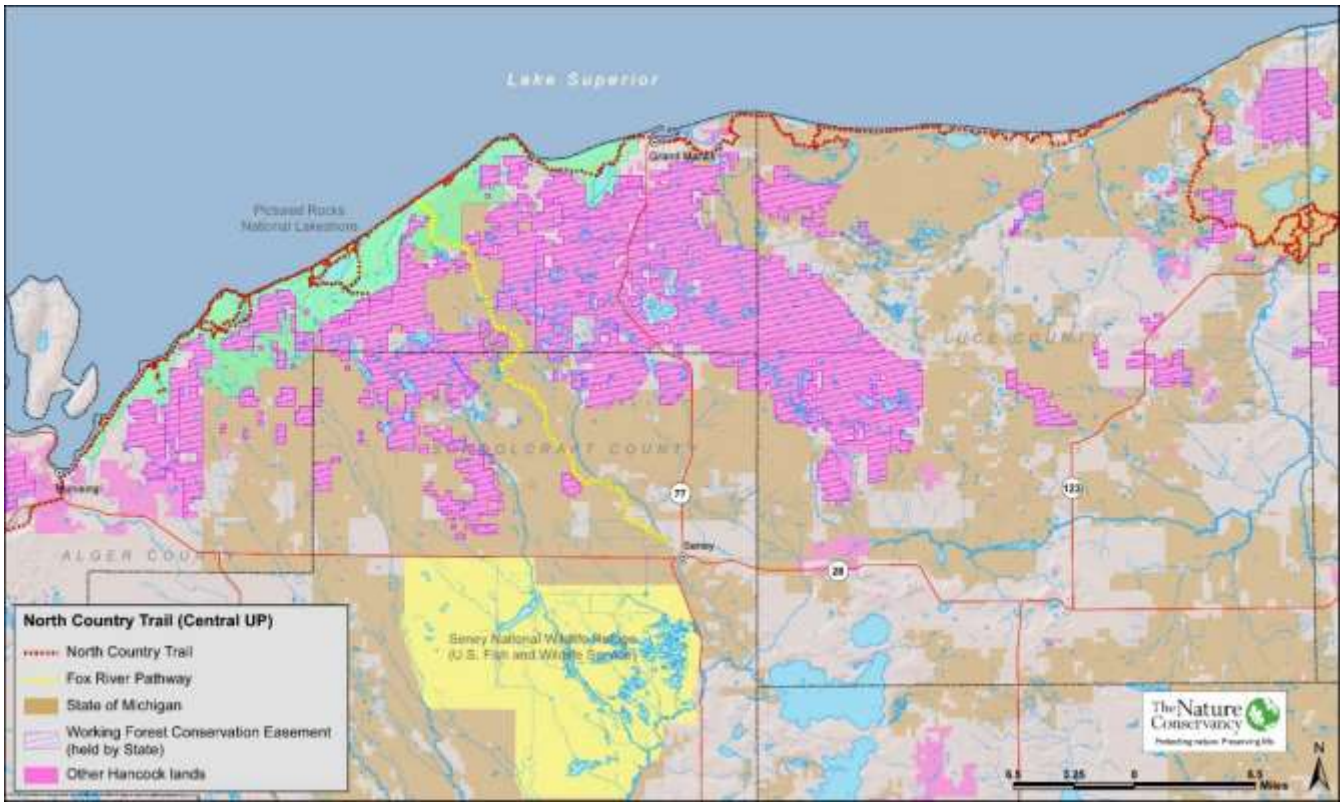
Hiking Trails

Pictured Rocks National Lakeshore has 90 miles of trails along 42 miles of Lake Superior. A portion of the North Country National Scenic Trail (NCNST), a congressionally recognized trail that stretches 4,600 miles from New York to North Dakota, runs through this report Landscape (Map 3.29). This trail is also part of the hiking route of Michigan's Iron Belle Trail from Belle Isle Park in Detroit to Ironwood at the Michigan-Wisconsin state line. The 27-mile DNR owned Fox River Pathway from Seney run north south and connects to the NCNST. The Fox Trail is in the process of being remarked and will be rededicated in 2017. See Map 3.31 for Pictured Rocks and Fox River Trails.

Map 3.30 Pictured Rocks, North County Trail and Fox River Trail



Map 3.31 Just North Country Trail



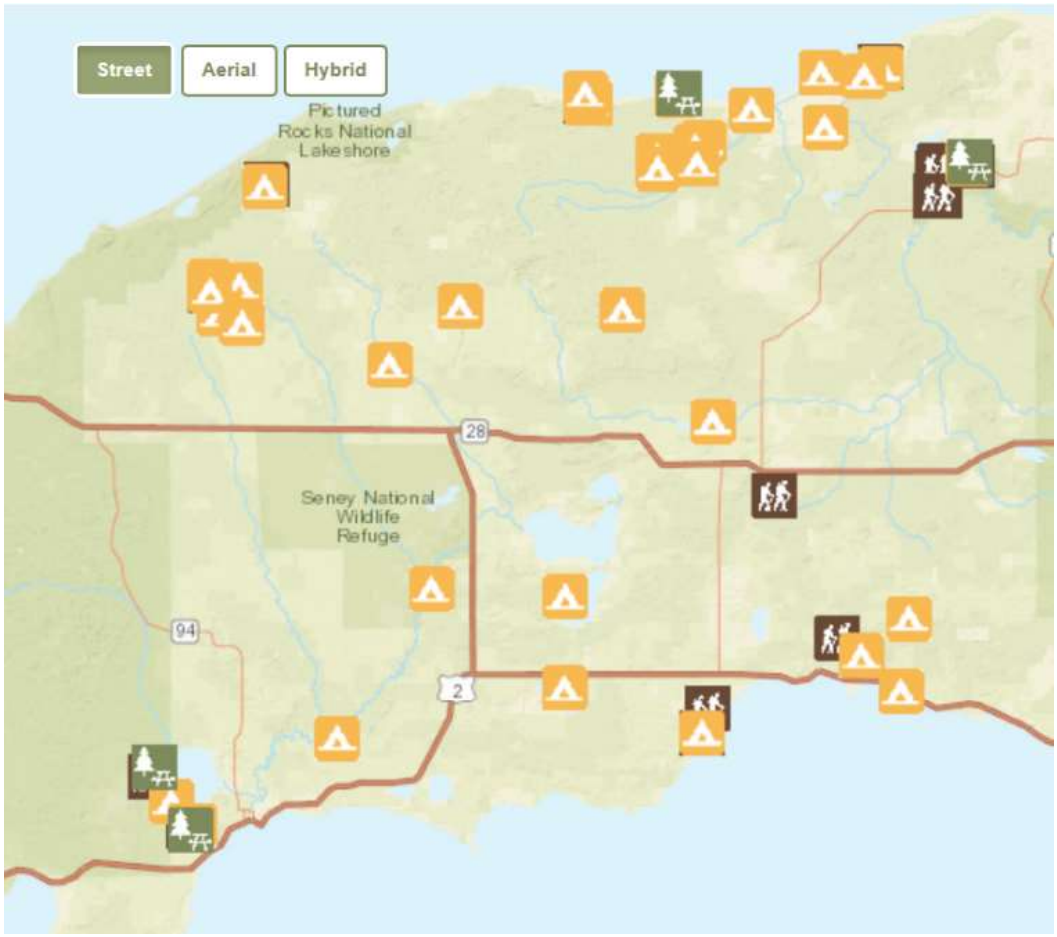
Besides the North Country trail (a federal designation), developed pathways or trails in this Landscape include:

- Canada Lakes Pathway – DNR – 14 miles of bike, ski, hike trails – just south of Newberry, Luce County
- Fox River Pathway – DNR – 21 miles of hiking trails – on the Fox River Road Seney, Schoolcraft County
- Big Knob/Crow Lake Pathway – DNR – 2.5 miles (Big Knob), and 2.6 miles (Crow Lake) of hiking trails, near Gould City, Mackinac County.
- Peters Creek Pathway – DNR – 2.5 miles of hiking trails north of Naubinway, Mackinac County.

Campgrounds

This Landscape is prime camping country – both the US Forest Service and the State DNR have numerous campgrounds in this area. Over 20 rustic DNR campgrounds, with basic water and outhouse – but many on undeveloped, wild lakes dot this Landscape. See Map 3.32 for general area of these campgrounds.

Map 3.32 DNR Pathways and Campgrounds



Pictured Rocks National Lakeshore has three developed campgrounds: Little Beaver Lake, Twelve Mile Beach, and Hurricane River. The Hiawatha National Forest has six campgrounds in the Steuben, Schoolcraft county area.

ATV Trails

Luce County, the majority of which is owned by the DNR – has develop over 200 miles of dedicated ATV trails complete with trail head parking, toilets, rental services and maps. Along with that use a local volunteer group that helps sign and block those areas that are not appropriate for ATV use. Some users are unaware that riding ATV's in any river, stream, shoreline, or wetland is prohibited. Better signing, and blockage of areas (steep hills) has improved the relationship between ATV users and non-motorized recreationalists. An example of the sign is found Here. The group Education to Control Off-Road Damage (ECORD) lead by a local volunteer was very effective in stemming damage of ATV's by creating more signage, better maps, and information for renters of ATV's.

Snowmobiling

Snowmobiling is the other major recreation. There are hundreds of connecting trails within this landscape. Table 3.9 and Map 3.33 display the extent of this recreational feature in the landscape.

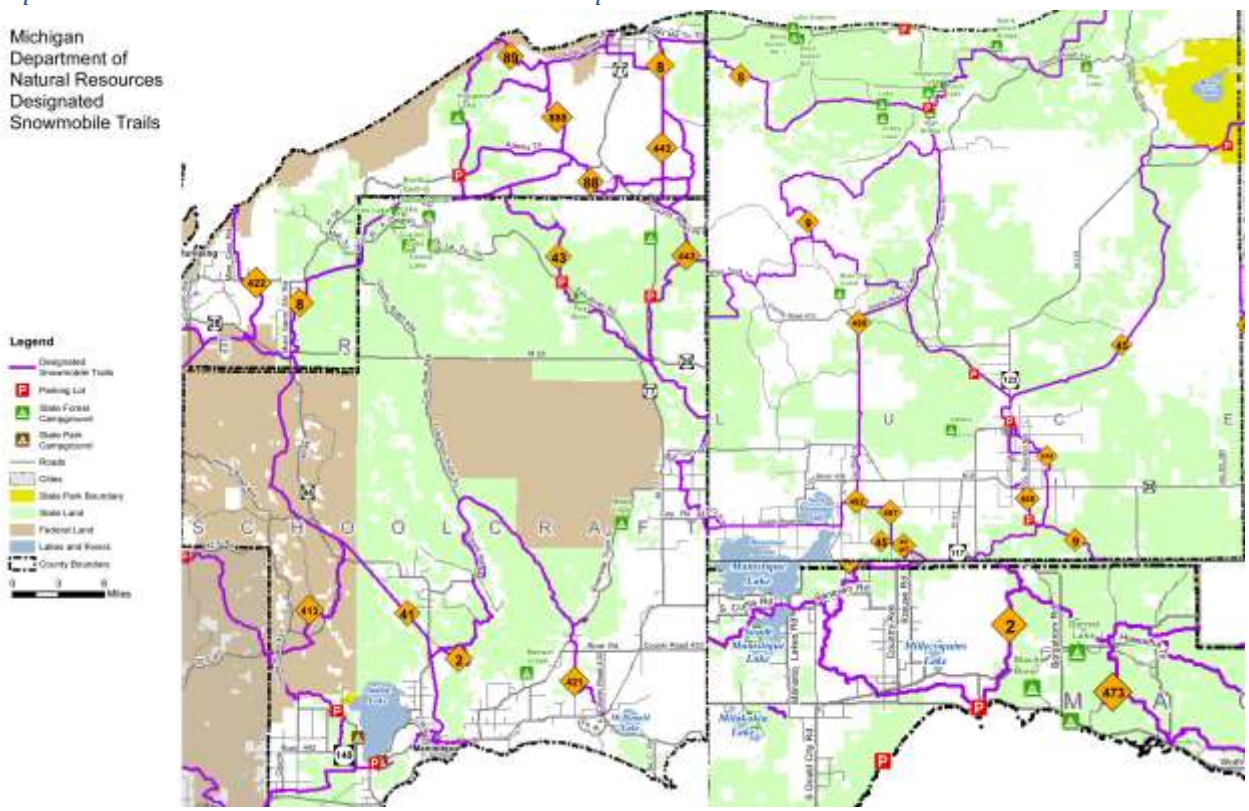
Table 3.9. Snowmobile Spending as a Proportion of all Tourism

Spending in Michigan by Region ($Millions)

Region	Snowmobile	All Tourism	Percent
Western UP	26	233	11.2%
Eastern UP	23	331	6.9%
Northwest LP	28	887	3.1%
Northeast LP	16	456	3.5%
Southern LP	1	3,845	0.0%
State Total	94	5,752	1.6%

a. Only includes spending on trips into region from outside
b. Tourism spending estimates for 1995 from Stynes (1998), excludes airline-related spending

Map 3.33 – Snowmobile Trails within this Landscape



Increase Use at Pictured Rocks

In 2015 use data demonstrated that over 723,000 visited Pictured Rocks National Lakeshore and it was estimated in a study by the Park Service, the visitors spent $30.6 million surrounding cities and towns. The full economic study can be found Here. The emerging issue however, while the economic impact is positive, the number of tourist dwarfs the Alger County total 2014 population of 9,400 by 77 times.

Each end of the park has a small town, Grand Marais on the east end with 350 full time residents and Munising on the west end with 2,300 full time residents. Dealing with the growing number of tourists has been a challenge. For the last two summers there has been a shortage of seasonal hotel lodging and campground facilities. There has also been major parking, traffic, and transportation concerns especially around kayak livery services. Restaurants have run out of food and have struggled to find the help needed to serve extra customers. At Miner's Beach, a popular kayak launch site, the use has increased 250 percent which has caused many traffic and parking issues as well as decreased the overall park solitude experience. The Park Service is now working with the city of Munising to invite citizens to help meet and address issues on seasonal employment and business opportunities, seasonal housing, public infrastructure, quality of like and park congestions, and water safety. 2016 was the fifth straight year of double digit increases for both park visitation and Pictured Rocks Cruises that offers scenic boat tours along the shoreline. The local Chamber of Commerce is also training local business owners to offer better pay and benefits to attract more workers. For water safety, boat outfitters and renters will now watch a boater safety video and all boat operators will use the same marine band frequency to communication – especially important for kayak guides.

3.2 Local Resource Providers and Existing Stewardship Plans

There are many resources for a landowner – from forestry companies who have written hundreds of plans to visiting and observing first hand management performed on public state or federal lands.

3.2.1 Government Agencies and Land Managers

The central UP has a high amount of public land owners both State and Federal. Each state or federal owner has a management plan.:

Michigan DNR Forestry: 755,000 Acres – over 40% over total report Landscape ownership.

- 4.1 MA 1 – 8 Mile Corner Management Area
- 4.2 MA 2 – Battydoe Deer Yard Management Area
- 4.3 MA 3 – Bullock Ranch Management Area
- 4.5. MA 5 – Charcoal Grade Management Area
- 4.6.MA 6 – County Line Hardwoods Management Area
- 4.8 MA 8 – Danaher Kingston Outwash Management Area
- 4.9 MA 9 – Deer Park Management Area
- 4.11 MA 11 – Fox River Complex
- 4.12 MA 12 – Garden Thompson Plains Management Area

- 4.15 MA 15 – Hiawatha Moraine Management Area
- 4.19 MA 19 – Lake Michigan Shoreline Management Area
- 4.20 MA 20 – Mackinac Mix Management Area
- 4.22 MA 22 – Milakokia Lake Management Area
- 4.22 MA 25 – Pictured Rocks Buffer Management Area
- 4.27 MA 27 – Seney Manistique Swamp Management Area
- 4.30 MA 30 – Tahquamenon River Patterned Fens Management Area
- 4.31 MA 31 – Two Hearted Headwaters Management Area

http://www.michigan.gov/dnr/0,4570,7-153-30301_30505_62551-284918--,00.html

Michigan State Parks
Tahquamenon State Park: 11,080 acres
Muskallonge Lake State Park: 250 acres
Palms Book State Park: 388 acres
Indian Lake State Park: 847 acres

Hiawatha National Forest
Portion of West Side of Hiawatha: 132,752 acres

Seney National Wildlife Refuge
Entire Refuge within this Landscape: 95,212 acres

State Owner – State Forest

The largest owner in this landscape is the State DNR – Forestry Division. The State Forest management Plan written in 2008 provides strategic direction with goals and objective for management of Michigan's State Forests. The plan was amended in 2014 with a 10-year time framework. That plan can be found Here or at http://www.michigan.gov/dnr/0,4570,7-153-30301_30505_62551-284918--,00.html
Michigan's 2010-2020 Forest Action Plan provides a statewide assessment of forest conditions and trends for all Michigan forest land. The plan focuses on private landowner assistance through cooperative programs for forest stewardship, urban and community forestry, forest health, wildfire management, and forest legacy. The link to that plan can be found Here or at http://stateforesters.org/forest-action-plans/michigan.

The Forest Resources Division also developed a five-year strategic plan to guide decisions and actions governing the health of Michigan's State Forest resources. The goals and objectives of the plan lay the groundwork for meeting the division's mission and complement the DNR's overall strategic direction. The first goal of the Forest Resources Division's Strategic Plan is: Sustainability and proactively manage and protection forest resources. That plan can be found Here or at https://www.michigan.gov/documents/dnr/FRD_Strategic_Plan_513006_7.pdf

There are over 17 individual plans within this report Landscape that contain the details on management. Much of the state ownership is in pine – jack and red. As stated above three fires impacted state lands in the last 40 years.

The DNR state forests are dual certified under both the Forest Stewardship Council® (FSC®) and the Sustainable Forestry Initiative® (SFI®). Independent auditors annually review the DNR for on-the-ground forest practices against biological, social, and economic requirements in the FSC and SFI standards and certified those practices as sound and comprehensive. The auditors also gather stakeholder and public comments and concerns as part of the audit process.

State Owner – State Parks

Muskallonge Lake State Park - at 217 acres is located 28 miles northwest of Newberry in Luce County. The 217-acre park is situated between the shores of Lake Superior and Muskallonge Lake and the area is well known for its forests, lakes and streams. Muskallonge Lake State Park was the former site of Deer Park, a lumbering town in the late 1880s, and prior to its lumbering history, an Indian encampment. Muskallonge Lake was a mill pond for millions of white pine logs that were brought to it by railroad lines. By 1900, the virgin stands of pines were depleted, the mill was closed, and the lumbering operation moved away. All that remains as evidence of the lumbering community are piles of sawdust and a few partly submerged pine logs in the lake. The park was also the old site of a Coast Guard Life Saving Station. The park includes a campground, a boat launch, short hiking trails and access to a wild, undeveloped section of Lake Superior beach. Clearzoning - Giffels Webster consulting is currently working with the DNR on a new updated management plan for this park. (DNR http://www.michigandnr.com/parksandtrails/details.aspx?id=424&type=SPRK)

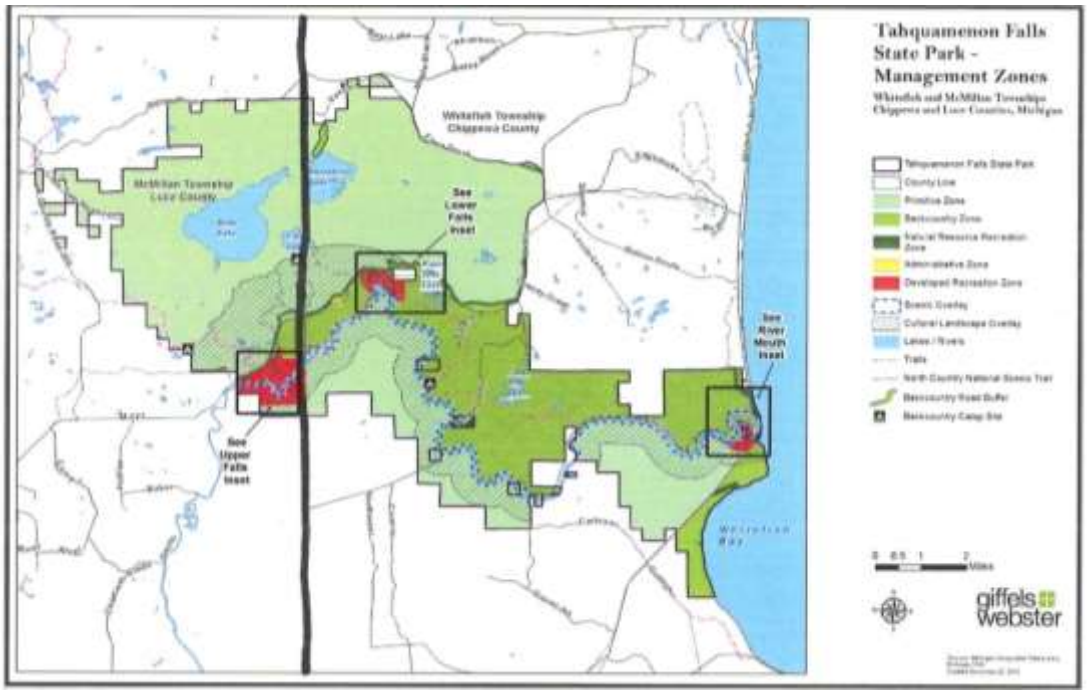
Tahquamenon Falls State Park – Of this 46,179-acre park, just over 11,000 acres is within this report Landscape. Tahquamenon is the second largest State Park in Michigan. Most of the park within this report Landscape is undeveloped woodland without roads, buildings or power lines. The centerpiece of the park, and the very reason for its existence, is the Tahquamenon River with its waterfalls. The Upper Falls is one the largest waterfalls east of the Mississippi. It has a drop of nearly 50 feet and is more than 200 feet across. A maximum flow of more than 50,000 gallons of water per second has been recorded cascading over these falls. One notable exception to the undeveloped nature is the Brew Pub and restaurant located within the Park but owned and managed by a private owner. This restaurant is located just off the parking area to the Upper Falls.

This is the land of Longfellow's Hiawatha - "by the rushing Tahquamenon" Hiawatha built his canoe. Long before the white man set eyes on the river, the abundance of fish in its waters and animals along its shores attracted the Ojibwa Indians, who camped, farmed, fished and trapped along its banks. In the late 1800's came the lumber barons and the river carried their logs by the millions to the mills. Lumberjacks, who harvested the tall timber, were among the first permanent white settlers in the area.

The park has many miles of hiking and ski trails, a campground, and is a popular destination for snowmobilers in the winter.

A new management plan for the park was completed in February 2017. The consulting firm Clearzoning - Giffels Webster guided the process along with the assembly of a Planning Team from various specialists within the DNR. The Planning Team included the Park Manager, Regional Planner, District Supervisor, Stewardship Unit staff, and the Park Management Plan Administrator. In addition, staff from all of the DNR Resource Division participated, including Law Enforcement, Wildlife, Fisheries, Forestry and Minerals Management. The management planning team convened several meetings to gather input from tribal representatives, stakeholders, and private citizens. The plan can be found Here or at http://www.clearzoning.com/wp-content/uploads/2017/03/TFSP-GMP-FINAL.pdf. Map 3.34 shows the park map within this report Landscape.

Map 3.34 Displays the park and portion of the park in this report Landscape – west of thick black line.



Palms Book State Park – Palms Book is home to-- Kitch-iti-kipi. Two hundred feet across and 40-feet deep, Kitch-iti-kipi is Michigan's largest freshwater spring. More than 10,000 gallons a minute gush from fissures in the underlying limestone at a constant 45 degree Fahrenheit. By means of a self-guided observation raft, visitors are guided to vantage points overlooking underwater features. Ancient tree trunks, lime-encrusted branches and large trout can be seen as they swim through crystal waters far below. Clouds of sand are kept in constant motion by the spring fissures. The self-guided observation raft and the trail leading to it are ADA accessible.

Although it was a black hole, all but hidden, in a tangle of fallen trees John I. Bellaire fell in love with the Big Spring in the early 1920s. Bellaire had come south from Seney, leaving the rip-roaring lumbering town after the white pine was gone to open a Five-and-Dime store in Manistique. Around the oval pool (measuring 300 feet by 175 feet) vegetation grew lush, draping over the piles of trash left by a lumber company which operated nearby. The Big Spring wasn't too different in formation from other sink holes in the area, except that it was fed by a large, fast-flowing spring. Bellaire, however, saw through the debris, envisioning the beauty of the emerald bottom of the pool. He watched the sand bubble and roll as hydrostatic pressure forced water through the narrow openings at the bottom. Bellaire could have bought the property for himself, but his vision of preserving it through public ownership prevailed. In 1926, through an arrangement with Frank Book who represented the Palms Book Land Company, he arranged for the sale of almost 90 acres (including the Big Spring) to the State of Michigan for $10. Deed stipulations called for the property to be forever used as a public park, bearing the name Palms Book State Park. Additional lands through tax delinquency and land exchange eventually added to the park.

The Civilian Conservation Corps and other groups eventually constructed a self-guided observation raft, dock, concession stand and ranger's quarters, leaving Bellaire the task of showing tourists the bubbling pool. Taking great pride in the spring, he often closed his store to personally escort interested visitors to the sacred site. In later years, Bellaire confessed that he and a poet of sorts from the Western U.P. made up the Indian legends of Big Springs themselves.

Indian Lake State Park Indian Lake State Park is located on Indian Lake, the fourth largest inland lake in the Upper Peninsula with an area of 8,400 acres. It is six miles long and three miles wide. According to 1850 surveyor records, Native Americans lived in log cabins near the outlet of the lake. The park is composed of two units which are three miles apart and separated by the waters of Indian Lake. Original land acquisition at the south shore was in 1932 and development began in 1933 using CCC and WPA labor. The original acquisition of land at the west shore was in 1939, however, development did not begin until 1965. There are two miles of trails that follow the woods and shoreline as well as two campgrounds.

State Owner – Wildlife Division

There are no state game areas within the report Landscape. However, an overarching Wildlife Action Plan coordinates work with the State Forest system. The goal of Michigan's Wildlife Action Plan is to provide a common strategic framework that will enable Michigan's conservation partners to jointly implement a long-term holistic approach for the conservation of all wildlife species. The Michigan DNR is in the process of revising its Wildlife Action Plan that addresses Species of Greatest Conservation Need and the habitats that support them. The document addresses aquatic and terrestrial landscape features within the Great Lake basin and ecoregion. The Wildlife Action Plan draft summaries for each landscape feature provide sets of priority species, significant threats to the landscape features and associated wildlife, and conservation actions needed to address the identified threats. An example in this

Landscape would be Yellow rails found in patterned peat lands. The link to the plan is found Here or at http://www.michigan.gov/dnr/0,1607,7-153-10370_30909---,00.html. Several older Wildlife Action Plans are found on the same page.

State Owner – Programs for Private Landowners

DNR Fish and Wildlife Habitat Programs

Most private forest landowner stewardship plans address wildlife habitat and there are many practices that can be used to create or improve support for animals. Support for wildlife habitat is available from both public and nonprofit entities. The DNR has several programs such as the Private Lands Program and the Wildlife Habitat Grant Program for government, profit or non-profit groups, and individuals interested in conservation. The US Fish and Wildlife Service has the Partners for Fish & Wildlife program which works with private landowners to improve fish and wildlife habitat on their lands through voluntary, community-based stewardship programs for conservation.

DNR Private Lands Program (PLP)

The primary goal of the Private Lands Program (PLP) is to provide private landowners with the resources to create and manage habitat to benefit a variety of wildlife. The PLP provides technical and financial assistance to eligible landowners for habitat improvements that address wildlife needs. In the UP, the Private Lands Program focuses on providing technical and limited financial assistance to landowners interested in management and restoration of forests. Currently financial assistance is available for writing forestry plans.

In the UP there is an emphasis on stewarding forests for riparian habitat and fish. The Forests For Fish Program brings together foresters, loggers and fisheries biologists to promote the message that "Michigan's forests provide abundance clean water and quality fish habitat."

The DNR's partners include Michigan Trout Unlimited, the Michigan Tree Farm Committee, the Michigan Association of Timbermen and the Michigan Association of Consulting Foresters. Forests for Fish is funded by the U.S. Forest Service, State and Private Forestry. The program offers additional guidance to landowners for fish habitat promotion. More information can be found Here or at http://www.michigan.gov/dnr/0,4570,7-153-30301_34240_78689---,00.html.

The Wildlife Habitat Grant Program purpose is to provide funding to local, state, federal and tribal units of government, profit or non-profit groups, and individuals to assist the Wildlife Division with developing or improving wildlife habitat for game species. The WHGP is administered by the Michigan DNR through a cooperative effort between Wildlife Division and Grants Management.

A useful publication for management of deer, found Here as well as many other game and non-game species is provided by the DNR Landowner's Guide. This 1999 publication also offers instructions on

land management planning for forests, grasslands, wetlands, cropland, and backyard habitats. Here or at http://www.michigandnr.com/publications/pdfs/huntingwildlifehabitat/Landowners_Guide/

Michigan Department of Environmental Quality
The Michigan Department of Environmental Quality regulates air, land, water, and waste generation activities in the state. Under the land category, earth change activities on areas greater than one acre or located within 500 feet of a lake or stream require a Soil Erosion and Construction Storm Water permit. The DEQ endeavors to protect water from both point and nonpoint pollution sources by partnering with watershed groups and others. They issue National Pollutant Discharge Elimination System (NPDES) and storm water discharge permits. Large scale water withdrawals are limited by law and the Water Withdrawal Assessment Tool is designed to predict the effect of groundwater use. Other programs cover regulation of wetlands, handling of permits, and use of flood plains.

DEQ's Water Resources Division administers MiWaters, a web-based database that provides a streamlined electronic permitting process to fulfill federal electronic reporting requirements and gives online access to public information. The focus of MiWaters is permitting and compliance, including National Pollutant Discharge Elimination System (NPDES), storm water, groundwater discharge, aquatic nuisance control, Part 41 construction, and land and water interface.

Permit Coordination is available through the Environmental Assistance Hotline at 800-662-9278.

Michigan Natural Shoreline Partnership
The Department of Environmental Quality's Inland Lakes and Streams program has been participating in the Michigan Natural Shoreline Partnership (MNSP) to promote natural shoreline landscaping to protect Michigan's Inland Lakes. Their mission is "Promoting Natural Shorelines" through the use of green landscaping technologies and bioengineered erosion control for the protection of Michigan inland lakes." One of the goals of the Michigan Natural Shoreline Partnership is to educate property owners about natural shorelines and technologies that benefit lake ecosystems. It provides support for practices that restore or preserve the ecological function of the shoreline and stabilize shorelines by reducing erosion. They offer educational resources and the website lists contractors who are certified by the program. The link to the Program is found Here or at http://www.mishorelinepartnership.org/.

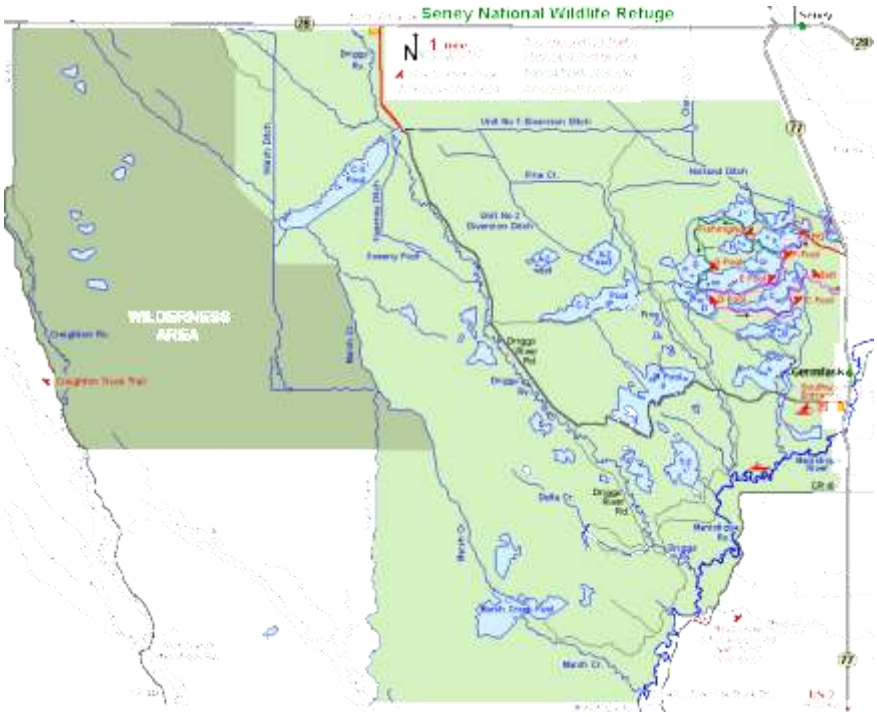
Federal Owner – Hiawatha National Forest
Only a small portion of the Hiawatha National Forest is within this landscape (little over 132,000 acres in a 900,000 forest). However, some notable areas include the 5,856-acre Big Island Lake Wilderness with 23 small lakes ranging in size from 5 to 149 acres. The Wilderness is open to non-motorized boating and dispersed camping. The Ironjaw non-motorized trail area is also found within this report Landscape and is featured in the Story Section. The full forest plan is found Here or at http://www.fs.usda.gov/detail/hiawatha/landmanagement/planning/?cid=STELPRDB5106336 .

Federal Owner - Seney National Wildlife Refuge

The entire ownership of the Seney National Wildlife Refuge at 92,623 acres, is within the report Landscape of this plan. The refuge is one of the largest in the upper Midwest. The Refuge is located upstream of the City of Manistique. On l0 December 1935, the Seney National Wildlife Refuge was officially established by presidential proclamation on the recommendation of the Michigan Conservation Department. The primary purpose was to provide resting and nesting areas for waterfowl. Extensive drainage changes and resulting lakes were made by the Civilian Conservation Corps during the late 1930's when they constructed many of the dikes and ditches on the Refuge. Twenty-one pools were made, ranging from 40 to over 400 ha and resulting in 2,800 ha of open water. The primary source of water for the Refuge pools was the Driggs River, which flows from north to south on the Refuge (Anderson, 1982).

The refuge is comprised of fields and secondary growth forest. Almost two-thirds of the refuge has varying types of wetlands that provide habitat for several threatened and endangered species. The refuge is home to 26 fish species, 50 mammalian species, and 200 bird species which include eagles, loons, and trumpeter swans. Within the refuge is the 25,150 acre Seney Wilderness Area, which contains the Strangmoor Bog National Natural Landmark. Seney is also home to much research in fire and pine restoration. Click on this Link to explore the journal articles, thesis, and other research performed on the Refuge. The Refuge has also performed much hydrologic restoration on the ditches and drainage around the Driggs River which was disturbed when agriculture was attempted in the last century. Map 3.35 displays the refuge. The overarching management plan can be found Here or at https://www.fws.gov/midwest/planning/seney/FinalCCP/seneyCCP.pdf

Map 3.35 – Seney National Wildlife Refuge



USFWS – Private Land Outreach

The US Fish and Wildlife Service offers several programs for private landowners. The Partners for Fish & Wildlife Program works with private landowners to improve fish and wildlife habitat on their lands through voluntary, community-based stewardship programs for conservation. To accomplish this work, the FWS teams up with private conservation organizations, state and federal agencies and tribes to share funding, materials, equipment, labor and expertise to meet the landowner's restoration goals. Landowners are required to sign an agreement to leave the project in place for a minimum of 10 years (longer agreements are encouraged) and landowners are responsible for project maintenance.

In the Midwest, Fish and Wildlife Service restoration projects generally occur in three habitat types: wetlands, prairies, and streams. The Partners Program also restores sensitive habitats supporting endangered or threatened species such as the piping plover and Hines emerald dragonfly

Wetlands provide critical nesting, feeding, resting and migration habitat for waterfowl and many other animals. Wetland projects usually involve restoring wetlands that have been drained, which requires heavy equipment to move dirt. Typical wetland restorations involve plugging drainage ditches, removing drainage tiles or building berms to impound degraded wetlands.

Grasslands (especially those larger than 20 acres) help provide adequate cover and food throughout the year for declining grassland birds such as bobolinks and meadowlarks, pheasants, and other wildlife.

Prairie restoration requires reseeding native warm-season grasses and wild flowers. Once grassland habitats are established, periodic mowing, burning or grazing is used to control invasive species and woody plants and to assist the growth of native prairie plants, which evolved with wildfire.

Stream restoration is available for landowners who are interested in protecting their small streams and river banks. These projects often involve reshaping stream banks and fencing to protect banks from erosion. Fish habitat is enhanced by strategically placing rocks and large woody debris to scour pools favored by fish. Fish passage is improved by removing barriers such as dams and non-functioning culverts.

US Fish and Wildlife Landscape Conservation Cooperatives (LCCs):

Landscape Conservation Cooperatives (LCCs) address large scale natural resource challenges that transcend political and jurisdictional boundaries and require a networked approach to conservation—holistic, collaborative, and grounded in science – to ensure the sustainability of America's land, water, wildlife and cultural resources. The geographic area of the Upper Midwest and Great Lakes LCC transcends state and the international borders and includes portions of Minnesota, Iowa, Wisconsin, Illinois, Indiana, Michigan, Ohio, Pennsylvania, New York and Vermont, as well as parts of Manitoba, Ontario and Quebec. The Great Lakes are among the world's largest and the Great Lakes Fishery Commission has estimated the value of Great Lakes fisheries at $7 billion annually.

Michigan is in the Upper Midwest and Great Lakes Landscape Conservation Cooperative. The area is home to a diverse range of fish, wildlife plants and habitats including the Great Lakes, coastal wetlands, boreal forests, major river systems and prairie-hardwood ecosystems. Physical and social stressors like climate change, energy development, water demands, invasive species and population growth are all threatening the ecological integrity of the upper Midwest and Great Lakes landscape. The Upper Midwest and Great Lakes LCC is a partnership of more than 30 natural resources agencies and organizations working on a collaborative approach to solve environmental problems.

USDA Natural Resources Conservation Service and Farm Service Agency

The United States Department of Agriculture (USDA) administers the Natural Resources Conservation Service (NRCS). The Natural Resources Conservation Service has tools and other technical resources to assist in Conservation Planning, Conservation Compliance on highly erodible land, nutrient and pest management, and Rapid Watershed Assessment. The agency also conducts the Soil Survey Program, the National Resource Inventory and the Conservation Effects Assessment Project.

For Schoolcraft County landowners in this report Landscape, the NRCS has a partnership with the American Bird Conservancy to offer financial assistance to forest to improve habitat for at-risk bird species and other wildlife. Applications for funding are accepted on a continuous basis for the Improving Forest Health for At-Risk Wildlife Resources Partnership was created through the USDA Regional Conservation Partnership Program. The funding is intended to create young forest habitat for

the benefit of the golden-winged warbler and other at-risk species. Financial assistance is available for selected core conservation practices, including forest stand improvement and early successional habitat development and management. Additional supporting practices include; brush management, tree, shrub and grass planting, and site preparation. In addition to improving habitat for at-risk species, many of these practices also improve habitat for other wildlife such as ruffed grouse and white-tailed deer. Landowners should make an appointment with their local NRCS office to begin the conservation planning process.

Office that serve this report Landscape include:
Gladstone (Delta & Schoolcraft counties)
2003 Minneapolis Avenue
Gladstone, MI 49837
Phone: 906/428-4076
Marquette (Alger & Marquette counties)
780 Commerce Drive
Marquette, MI 49855
Phone: 906/226-9460FAX: 906/228-4484
Sault Ste. Marie (Chippewa, Luce & Mackinac counties)
2847 Ashmun Street, M-129
Sault Ste. Marie, MI 49783
Phone: 906/632-9611
FAX: 855/813-7692

Cooperative Invasive Species Management Area
Michigan's DNR, DEQ, and Agriculture and Rural Development Department provided a grant to support a Cooperative Invasive Species Management Area (CISMA). This report Landscape is within two different CISMA's. Alger and Schoolcraft Counties are in the Central UP Cooperative Weed Management Area (CUCWMA) – Pictured Rocks, Seney and the Alger conservation district were all very involved in getting CUCWMA going. Most of the funding in 2016-2017 is through a grant to the conservation district in Alger County. Mindy Otto is the coordinator. Information on current work can be found Here or at https://www.sustainourgreatlakes.org/projects/central-upper-peninsula-cooperative-weed-management-area/.

Current activities include attending large public events such as the Boat, Sport and RV show to educate about invasives, and hiring weed removal crews every summer. CUCWMA is also involved in a Phragmities removal project along the Lake Michigan shoreline.

Luce and Mackinac Counties are in the Three Shores Cooperative Invasive Species Management Area which is run by the Chippewa/Luce/Mackinac Conservation District. They have a Facebook page:

https://www.facebook.com/threeshores/. This group has multiple projects including garlic mustard and Phragmities control as well as diligence on new invasives such as wooly aledgid.

The CISMA's are also attended and include membership by many non-profits discussed below.

3.2.2 Nonprofit, Non-Governmental Conservation Organizations

Conservation Districts:

Conservation Districts play an important role in conservation at the local level**.** Michigan's Conservation Districts are "unique" local units of State Government that utilize state, federal, and private sector resources to solve today's conservation problems. The guiding philosophy of Conservation Districts is that decisions on conservation issues should be made at the local level, by local people. The District staff, guided by a publicly elected board of directors, provides technical assistance along with partner agencies to county residents. All Conservation Districts are stand-alone entities who work with many state and local agencies. There are 79 conservation districts statewide with diverse, ever-changing programs adapted to each county's needs. Within this report Landscape there are three conservation districts serving landowners.

Alger Conservation District

The Alger Conservation District brings forestry assistance to residents of Alger County; conservation implementation cost-share opportunities for private landowners; a soil erosion and sedimentation control program; technical and educational assistance for water quality concerns; educational seminars; annual tree, shrub, and native plant sales; stream health monitoring; invasive plant management; and much more.

Forestry is one of the central theme areas they work in.
The Forest and Wildlife Management Assistance Program of Alger and Marquette Counties promotes stewardship of forest resources on private lands. The program makes assistance available for wildlife habitat, timber production, tree planting, recreation, and forest health**,** as well as urban forestry and backyard wildlife**.** We provide on-site consultation, basic written information, and referrals to other service providers free of charge. Management suggestions are based on sound resource science and the landowner's goals. The Forester Matt Watkeys, can be reached matt.watkeys@mi.nacdnet.net.

The Assistance Program offers five basic types of service:

- On-Site Property Evaluations
- Information and Referral Services
- Presentations and Workshops
- Partnerships
- Cost Share Opportunities

A great project from the District includes the school forest in Burt Township – which is a Story in this Landscape. The article below demonstrates the collaboration between Conservation Districts and many other groups.

Partners in Planting: Alger CD, Consumers Energy, Michigan International Speedway and Superior Watershed Partnership and Alger Schools
Thanks to the generosity of corporate and non-profit partners, Alger Conservation District was able to help Superior Central and Burt Township students plant a total of nearly 2,000 trees in their school forests and public ski trails. Consumers Energy and Michigan International Speedway (MIS) provided 650 white pines to the two Alger schools, part of the 50,000 trees they donated to be planted across the state in their On Track to a Greener Michigan program. Superior Watershed partnership supplied funding for additional native plants and perennials for a 5-acre wildlife restoration in Superior Central's cross-country ski trail system.

With guidance from Alger CD staff, over 75 students and 12 summer interns from Northern Michigan University planted white pines and other species on May 20th, and on June 3rd returned to place tree shelters around the young trees to protect them from herbivores. A dozen Burt Township students, armed with shovels and planting bars, planted 150 white pines in their school forest in Grand Marais on May 28th.

"It's great to know that these students are looking to the future of our forests by planting trees," said Alger Conservation District Executive Director Teri Grout. "Years from now they can look at the mature white pines in their school forest and know that they gave those magnificent giants their start. We very much appreciate the students' efforts, and the generosity of Michigan International Speedway, Consumers Energy and our other partners in providing this opportunity."

"Michigan International Speedway (MIS) takes great pride in knowing that our green initiatives have made a significant, positive impact to the environment and sport of auto racing, and we continue to do different things to move forward with those initiatives," said MIS President Roger Curtis. "It's the right thing to do to protect our environment. Our brand at MIS is very much an environmentally friendly one."

Michigan International Speedway last year became the largest participant in Consumers Energy's Green Generation, matching 100 percent of its electricity use with renewable energy. Close to 20,000 homes and businesses in Michigan participate in Green Generation, contributing each month to purchase power from renewable sources, all made in Michigan.

Schoolcraft Conservation District

The Schoolcraft Conservation District is a unique local unit of government that was formed in 1965. The district is run by a 5-member board of local directors that are elected by county residents to 4-year terms.

The mission of the Schoolcraft Conservation District is to assist all county residents with information, education, and technical services in all aspects of natural resource and/or environmental issues, specializing in local assistance to non-industrial private landowners.

A unique project for the Schoolcraft Conservation District is their Central U.P. Groundwater Stewardship Program**.** The Central U.P. Groundwater Stewardship Program is voluntary, locally driven, and designed to address the concerns of individuals by maintaining a focus on the financial and technical constraints which drive real-world decisions. Technical assistance is free and confidential through the Groundwater Stewardship Program. Cost-share may also be available for those who need assistance and/or desire to implement environmentally sound practices. The groundwater program covers Alger, Delta, Dickinson, Marquette, Menominee, and Schoolcraft Counties. For more information and to learn more about the program and what cost-share practices are available please call the Delta Conservation District's Groundwater Technician, Holly Wendrick, at (906) 428-9469 x122

Chippewa/Luce/ Mackinac Conservation District

The Chippewa/East Mackinac Conservation District was established on May 23, 1949. In 2009 they celebrated 60 years of service to the landowners of Chippewa and Mackinac Counties. In July of 2012, the Chippewa/East Mackinac Conservation District merged with the Luce/West Mackinac Conservation District to form the Chippewa/Luce/Mackinac Conservation District. The District now includes all of Chippewa, Luce, and Mackinac Counties. The District has received a number planning and implementation grants dealing with watersheds, water quality, soil protection, invasive plants and insects, and farming enhancements.

This Conservation District also has a strong forestry assistance program. The Conservation District Forester will provide guidance to help landowners realize the full potential of their land. Guidance topics include advice concerning general forest management, timber harvesting, improving/creating wildlife habitat, food plots, tree and shrub planting, forest health/disease, and cost share programs.

The district will provide a no-cost consultation to help determine a landowner’s management goals and create an accurate landowner profile describing the property-type and project. The landowner will be provided with (at no-cost) a contact list of resource professionals who have expressed interest in helping them with their land.

EUUPEM

As discussed in the very beginning of this document, in 1992, a group composed of state and federal government agencies, a non-governmental organization, and industrial land holders formed to

coordinate management efforts in the eastern Upper Peninsula of Michigan (UP). The UP landscape, characterized by a variety of glacial landforms, encompasses 1.6 million ha. Members of the group represented organizations that manage two-thirds of this 1.6 million ha. The group's mission is to facilitate complementary management of public and private lands for all appropriate uses, using an ecological approach to sustain and enhance representative ecosystems, globally significant community and landscapes, and threatened and endangered species. The group has been very active and somewhat dormant depending on issues, threats and opportunities.

Past projects included:

- Land Type Associations (LTA's) classification for the eastern UP – this led to other projects on LTA's with Hiawatha
- Specific landowner outreach in Two Hearted including stakeholder meetings – this led to large deal which protected over 9 ha in the watershed.
- Field demo sites for forestry and fire in red pine – (Seney and DNR Muskrat Lakes).

While many of the larger land owners have changed – recent meetings and progress continues. The current Plan would address (and update) the following in the EUP:

- Threat Management
  - Beech bark disease issues – regeneration – replanting.
  - Climate change mitigation, disease issues
  - Fire mgmt. CWPP's, Wildfire plans,
- Efficiencies
  - Collaborative approach to FSC certification and improved spatial protected lands
  - Exploration of efficient timber operation and Stewardship contracting
  - Exploration of maintaining or increasing markets (especially value added) in the UP.
  - Lowland conifer mgmt.
- Collaborative Approaches
  - Identification of Strategic targeting of non-industrial private landowners in this landscape.
  - Better assessment of research and monitoring (permanent plots, deer enclosures, others)

Land Trusts

There are several non-profit lands trusts that own and management land within this report Landscape. Land Trusts play an important role in protecting unique natural or recreationally important lands across the landscape. They often provide a fill-in to gaps within public ownerships. Many land trust preserves are gems that provide unique opportunities to learn about the unique natural features of an area.

Michigan Nature Association (MNA)

Michigan Nature Association is the oldest land trust in Michigan, being started in 1952, and is dedicated to permanently protecting land that provides critical habitat for rare, threatened and endangered species,

and natural communities. The Michigan Nature Association has 172 sanctuaries state-wide and 7 sanctuaries in this report Landscape. The below 5 are open to the public.
1. Swamp Lakes Moose Refuge – Luce County:160 acres
2. Trout Lakes – Luce County: 80 acres
3. Two Hearted River – Luce County: 40 acres
4. Twin Waterfalls Plant Preserve – Alger County: 17.36 acres
5. Manistique Dune and Swale – Schoolcraft County: 29.12 acres

A map of these sites and more information can be found Here

Upper Peninsula Land Conservancy (UPLC):

While UPLC has no land in this report Landscape it is within their UP-wide service area. The UPLC has been working since 1999 to conserve and protect the land of Michigan's Upper Peninsula to ensure sustainable management for generations to come. As of 2017 the land trust had protected nearly 6,000 acres in the Upper Peninsula, with 10 dedicated Preserves, 24 experimental working forest reserves, and 19 conservation easements with private land owners and partnering organizations. Additional information about UPLC can be found Here.

The Nature Conservancy (TNC):

The Nature Conservancy, the largest nonprofit land conservancy in the United States, has the mission "Conserving the lands and waters on which all life depends." To accomplish their mission, they have an extensive planning process (Conservation by Design) supported by scientists and other resource professionals. They work to inform policies and practices in the following strategic areas: Agriculture, Forestry, Coasts, Native Fisheries, Watershed Connectivity, and Aquatic Invasive Species. The Preserves and Reserves in this Landscape were identified through an Ecoregional process of stakeholder meetings. The Nature Conservancy Ecoregional Plans can be found Here or at https://www.conservationgateway.org/ConservationPlanning/SettingPriorities/EcoregionalReports/Documents/Summdoc.PDF.

The priority for TNC in this Landscape has been the watersheds of the Fox and Two Hearted. One of their largest preserves in the state, McMahon Lake Preserve is within the central part of the Two Hearted Watershed. TNC also has a large 24,000 working forest reserve that manages timber under the State Commercial Forest Act (CFA) and certified under Forest Stewardship Council (FSC) guidelines.

The list of Preserves includes:

- McMahon Lake – Luce County: 4,115 acres
- Swamp Lakes – Luce County: 630 acres
- Fox River Headwaters – Luce County: 40 acres
- two easements with private landowners

Watershed Restoration

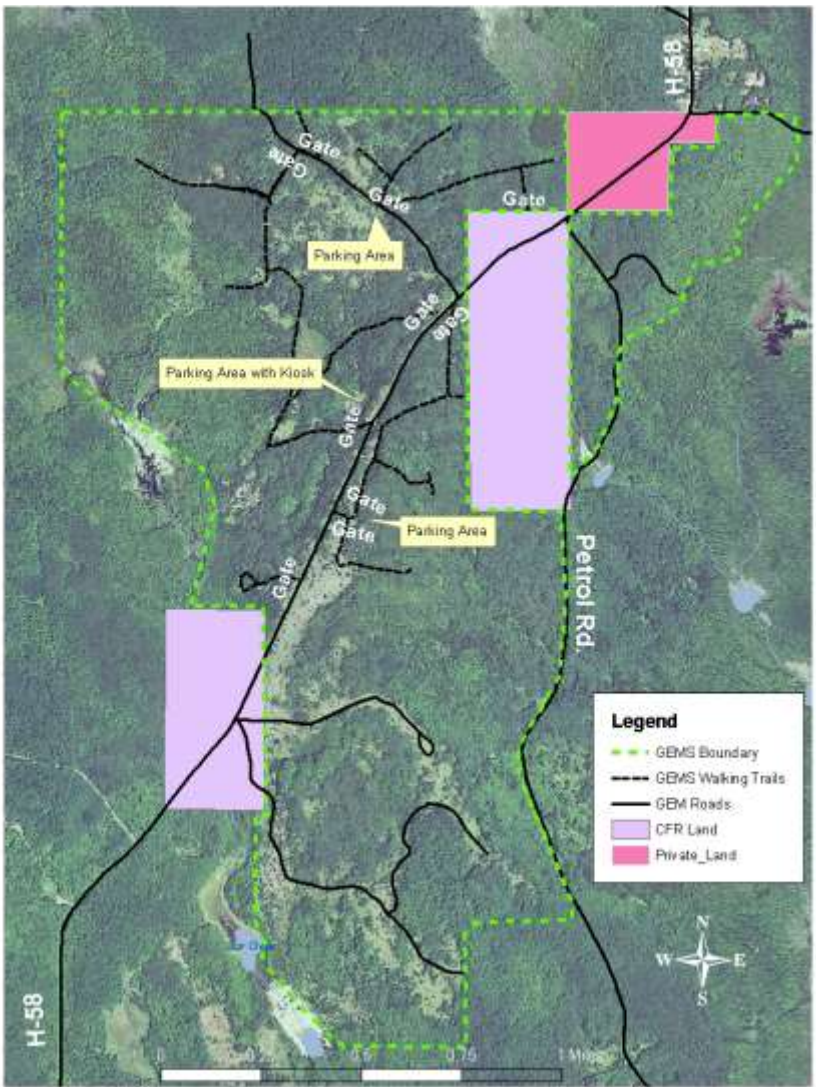
A major project of the Nature Conservancy was to perform a complete inventory of road stream crossings and sedimentation issues in the Two Hearted River Watershed. Repairing culverts, regrading roads and stabilizing river banks at 23 road crossings and man-made erosion sites along Michigan's Two Hearted River has naturalized river flow, reduced sediment by more than 625 tons, and connected 35 miles of river. This has improved habitat for fish and wildlife and increased recreational opportunities. The Conservancy used over one million dollars in federal and private grants to complete this work. The full story can be found Here or at http://www.healthylakes.org/successes/restoration-success-stories/restoring-connectivity-in-the-two-hearted-river-watershed/.

Besides land trusts there are several nonprofit organizations dedicated to providing wildlife habitat including: Audubon, Ducks Unlimited, National Wild Turkey Federation, Pheasants Forever, Ruffed Grouse Society, the Quality Deer Management Association and Trout Unlimited. Many of these organizations have programs to provide financial and technical assistance for enhancing wildlife.

Mid UP Ruffed Grouse Society

The Ruffed Grouse Society is dedicated to preserving and creating habitat for early succession birds such as ruffed grouse, woodcock, and snipe. Local chapters have annual fundraisers that fund things like education kiosks, tree planting, and other land restoration projects. In this report Landscape the Mid UP Ruffed Grouse Society has worked with the DNR to create new GEM - Grouse Enhanced Management areas in Eastern Alger County. Map 3.36 displays this DNR owned area. The land is specifically managed to enhance grouse habitat and to provide opportunities to view and hunt grouse.

Map 3.36 Map of Melstand GEM site. More information on this site found Here



Quality Deer Management Association

The Quality Deer Management Association offers Deer Steward courses and a Land Certification Program that was developed to recognize the accomplishments of landowners implementing the four cornerstones of Quality Deer Management. The program is a multi-level, voluntary process which will evaluate and certify properties against an established list of QDM standards. More information on Michigan Quality Deer management is found Here or at https://www.qdma.com/michigan/ There is one branch (local chapter) located in the UP.

UP White Tails Association

The purpose of the UP White Tails is to instruct the public on the practices of sound deer management. The organization became organized in 1988. To promote the purposes, the organizations does public awareness and education to better inform understanding environmental needs of deer population, to aid

and financially support research on the study of ecology, and its effects on the deer population, and to inform and cooperate with all individuals interested in conserving the habitat to ensure a bountiful deer population whether for the sport of deer hunting or otherwise in future years. There are 350 members in Schoolcraft and Alger Counties, the two counties within this report Landscape with local clubs.

Superior Watershed Partnership

The Superior Watershed Partnership and Land Trust is a 501(c)(3) nonprofit organization that implements science-based programs that achieves documented, measurable results. The Superior Watershed Partnership implements a variety of conservation and public education projects in the report Landscape including:

- Great Lakes habitat protection and restoration
- Community pollution prevention
- Climate change adaptation planning and implementation
- Invasive species removal and prevention
- Water Quality and Storm Water Management
- Native plant restoration
- Land Protection
- Youth programs and public education
- Alternative energy and energy conservation
- UP community assistance

The Superior Watershed Partnership wrote the watershed plan for the Two Hearted River Watershed and has implemented several sedimentation and erosion projects in the watershed. The plan can be found Here or at http://superiorwatersheds.org/projects/watersheds.

Michigan Shoreline Partnership

According to their Website, The Michigan Natural Shoreline Partnership (MNSP), a collaboration of state agencies, academia, nonprofit organizations and private industry, was formed in 2008 with the belief that a change was necessary in shoreline development practices in Michigan from high impacting methods that alter the natural riparian condition to practices that:

- Restore/Preserve the ecological function of the shoreline
- Effectively stabilize shoreline erosion
- Attract consumers as an option for lakefront use, to ensure the sustainable health of these resources.

Their mission is to promote natural shorelines through the use of green landscaping technologies and bioengineered erosion control for the protection of Michigan inland lakes. Their objectives include:

- Train contractors and landscape professionals about shoreline technologies and bioengineered erosion control.
- Educate property owners about natural shorelines and technologies that benefit lake ecosystems.
- Research, demonstrate, and develop natural shoreline technologies that benefit lake ecosystems.

- Encourage local and state policies that promote natural shoreline management.

A list of contractors that can assist landowners with shoreline landscape is found Here or at http://www.mishorelinepartnership.org/find-a-shoreline-contractor.html.

Trout Unlimited

Michigan Trout Unlimited (TU) is the coordination and representation for 20 local chapters of TU and over 8,000 individuals, devoted to the conservation, protection and restoration of Michigan's coldwater fish and their watersheds. Michigan is blessed with a vast wealth of wonderful and unique trout streams, over 11,000 inland lakes, and the largest sources of cold freshwater in North America - the Great Lakes. Michigan TU does whatever it takes to advocate for the prudent management of these resources, including on-the-ground stream improvements, angler and steward education, research, partnerships and collaboration with other conservation groups and governmental agencies, and policy development. Michigan is the birthplace of Trout Unlimited, and Michigan TU continues that proud heritage with its work today. The TU Chapter in Luce County – the Two Heart Chapter – has been active on several restoration projects within the watershed including stream bank stabilization and stairway building to avoid erosion.

Michigan Audubon

Michigan Audubon maintains a statewide network of bird sanctuaries. The network consists of 18 sanctuary properties that together total more than 3,500 acres. The habitats we protect and steward include: rivers, lakes, marshes, bogs, fens, grasslands, hardwoods and northern conifer forests. Each property plays a critical role in protecting Michigan native plants and animals, including both endangered and threatened species. Two sanctuaries are within this Landscape:

Riverbank Sanctuary is a 23-acre sanctuary on the shore of the Indian River just outside of Manistique. Mostly, it is pine forest but there are areas of black spruce swamp, wetlands along the river, and shrub swamp. Although this is found in a residential community, there is plenty of wilderness nearby and some wild species have been sighted here such as Common Loon, Pileated Woodpecker, Black Bear, and American Beaver.
Amenities: Parking. Maintained trail.

William Gillette Sleep Lake Sanctuary. This is a 240-acre prime sphagnum bog on the edge of a large glacial outwash containing a marsh. White Cedar, Osiers, Viburnums, Willow and Northern Bush Honeysuckle form dense growth. Labrador Tea, Bog Laurel, Sweet Gale and various bog orchids are abundant. The sanctuary and surrounding areas provide prime habitat for nesting Sandhill Cranes, Spruce Grouse, Solitary Vireos, Northern Parula Warblers, Boreal Chickadees, Sedge Wrens and Gray Jays.
Amenities: No Parking, No Trails. Both under consideration

3.2.3 Private Sector Natural Resource Professionals, collaborative plans

The state Forest Stewardship Program connects landowners with a forester or wildlife biologist to develop a Forest Stewardship Plan for their forest. Participation in the program is voluntary, and cost share is available throughout the year. Since 1991, almost 6,000 people in Michigan have used their Forest Stewardship Plan to help them to manage, protect and enjoy their forest. For this report Landscape the DNR lists 24 different companies that can write a plan for a landowner. To view the list Here or at http://www.michigan.gov/documents/dnr/FSP_PlanWriters_EUP_527313_7.pdf,

4. Landscape Stewardship Stories

An integral part of this report are the collection of stories that were interviewed and written within this Landscape. The 34 stories can be divided into the following themes. Under each theme are the individual stories. Each story is stand-alone although many reference each other and are related.

Stories on Forestry Practices

Watching the Seney Burn

Pining for Dry Forestland

Hand on Approach to Forest Management

Following The Plan – Ruth Dake

East Branch Sportsman's Club

By the Books – School Forest

Forest to Floor

Stories on Unique Features

Beaver Basin Wilderness

Kingston Plains

Untouched – Shingleton and Scott's RNA

Seiner's Point – Ecological Reference Area

Simmons Woods

What is a Natural Area – Deer Park

Strangmoor bog – National Natural Landmark

The Inland Buffer Zone – NPS

Canada Yew

Stories on Recreation/Trails

A National GEM – North Country Trail

Ironjaw Semi-Primitive Area

Fox River Pathway

Stories on Tools

Trail Cameras

Conservation Easements

Creating a Legacy

Accessing the Health of your Forest

Dedication to Conservation – MNA

Portable Bridges

Sound meters – Soundscape Ecology

Stories on Challenges

Losing A Dominant Tree Species

Stories on Opportunities

Volunteering in the Hiawatha

Northern Great Lakes Forest Project

Forest Legacy Success

Successful Transformation of the Two Hearted River Watershed

Cusino Wildlife Research Station

The First Female Field Biologist

EUPPEM

5. Develop a Personal Story: Resources and Services for Landowners

A variety of programs and informational resources are offered by non-profit conservation organizations, state and federal resource agencies to help a landowner take the next steps toward meeting their own land stewardship goals.

5.1 Land Conservation Options

5.1.1 Purchase or Donation of land

If property is within a priority area or of unique value a land trust may purchase the property from a willing seller landowner. The price is determined by an appraisal. Note, land trusts by law are not allowed to pay more than appraised value for a property due to their non-profit status. An above appraised value sale is a "private benefit" to an individual and violates the non-profit status of the land trust. The landowner may decide to take a tax deduction and donate the land to a land trust. This is another way a landowner can conserve their land. In either case, purchase or donation, the landowner would have an understanding of what the property would be used for going forward – nature preserve, open space, forest reserve etc.

5.1.2 Conservation easement

Conservation easements are one of the most important tools for conserving private land. Landowners continue to enjoy ownership of their land while preserving its beauty and natural characteristics for future generations. Conservation easements are negotiable documents that match owners' property-use needs with long term benefits to their community. A landowner determines what future goals they want for the property and decide such factors as allowable development, ability to split the property, and forestry and grazing activities. Each easement is custom to the property and the easement does not grant public use of the property – it remains in private ownership. The more restrictive the easement the more the landowner may be able to deduct from federal and state tax programs. An excellent summary of conservation easement benefits to landowners and woodlot owners is found Here provided by the Leelanau Conservancy. Section 3.2.2 discussed land trust information for the report Landscape covered in this plan. Below are the multiple option a landowner has in working with a land trust.

5.1.3 Bargain Sales

A bargain sale occurs when a landowner agrees to sell land for an amount less than the full fair market value as determined by an appraiser. The difference between the fair market value and the contract price is deemed to be a charitable donation and tax deductible when the purchaser is a charitable entity, such as a land trust.

5.1.4 Remainder Interest Trust or Reserved Life Estate

Through a remainder interest trust or life estate, the landowner can place an easement on their land and restrict it today, as well as make a commitment that at the end of a specified time period or upon the landowners' death the entire property will be owned by the land trust or other remainder beneficiary. As

with bargain sales and donations of easements, significant tax benefits may be realized by the landowner through these transactions.

5.1.5 Bequest, Living Trust, or Charitable Trust

These estate planning devices can all be used to ensure that a land trust receives a valuable interest either during life or at the death of a landowner. These "valuable interests" may include full title to land, partial interests in land, stocks, or cash.

5.1.6 Gifts Conservation Buyer Land

A gift of Conservation Buyer land allows landowners to donate property to a land trust with the agreement that the land trust can resell the property subject to a restrictive conservation easement. This arrangement ensures that a property gets permanent protection while at the same time allowing the land trust to raise funds to support other land protection projects.

5.1.7 Installment Gifts or Sales of Land

Through Installment giving or selling of land, a landowner can maximize tax benefits by spreading out the time period over which such transactions occur.

5.2 Forestry Options

5.2.1 Forest Stewardship Program

The Forest Stewardship Program was created by the USFS in 1991 to encourage long-term stewardship of family forest land by providing professional planning and technical assistance to private landowners. Ultimately, the purpose of the program is to enhance and sustain the long-term productivity of forest resources and produce healthy and resilient forest landscapes. As part of the process, landowners work with a certified Forest Stewardship Plan Writer to develop a custom plan that describes your personal land stewardship goals, unique forest resources and suggested management activities.

There are many benefits to developing a Forest Stewardship Plan, including enhanced access to USDA conservation programs, forest certification programs and forest product and ecosystem service markets. For example, you can use your Forest Stewardship Plan to prepare for a timber sale, improve wildlife habitat, or to enroll in other programs that require a forest management plan. Participation in the Forest Stewardship Program is voluntary and landowners can obtain information and cost-share assistance throughout the year.

Administration of the Forest Stewardship Program varies by state. In Michigan, the program is administered by the Michigan DNR, who trains and certifies 130 professional foresters and 15 wildlife biologists in the private sector to write simple yet comprehensive Forest Stewardship Plans. Since 1991, almost 5,000 Michigan landowners have used their Forest Stewardship Plan to help them to protect, manage, and enjoy their forest.

Visit www.michigan.gov/foreststewardship to connect with a certified plan writer and take your next step toward managing your land to meet your stewardship goals. More information about the program can also be found at http://www.fs.fed.us/spf/coop/programs/loa/fsp.shtml/. See Table 5.1 for information about this report Landscape.

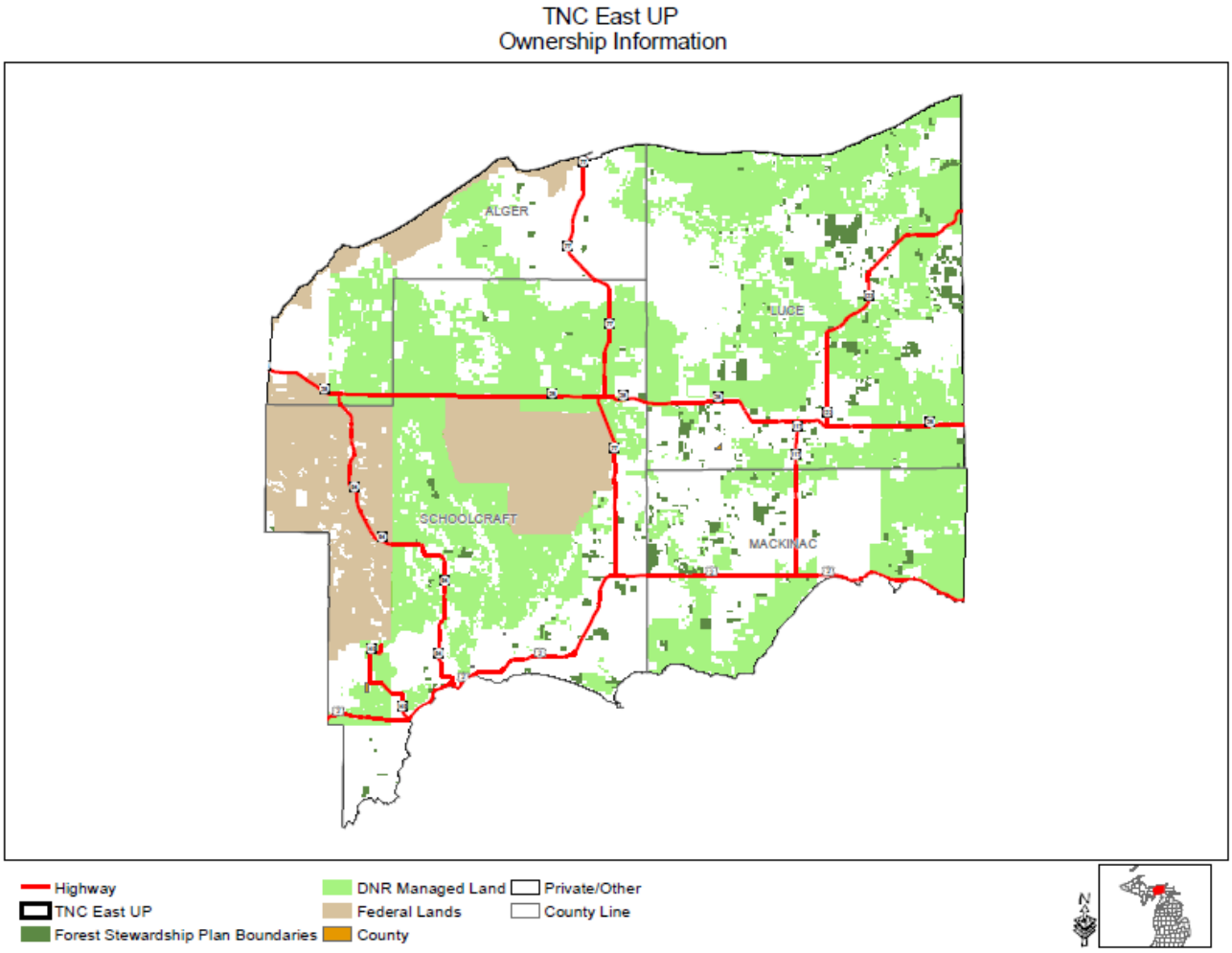
Table 5.1 Data on Eastern UP Forest Stewardship Plans

Landscape	Total Acres in Landscape	Total Square Miles in Landscape	# of FSP Plans per Landscape	FSP Plans per Landscape (Acres)	DNR Managed Land (Acres)
TNC East UP	1,916,241	2,994	390	61,948	47,422

Michigan DNR *2016

See Map 5.1 for a geography location of these plans.

Map 5.1 Forest Stewardship Plans in Report Landscape – Dark Green are FSP plans



5.2.2 American Tree Farm System

The American Tree Farm System is a certification program of the American Forest Foundation that acknowledges land management practices meeting certain Standards of Sustainability. As part of this program, a network of more than 82,000 family forest owners sustainably managing 24 million acres of forestland across the country. The American Tree Farm System is recognized by the Program for the Endorsement of Forest Certification, which is an international forest certification system. Landowners following the Standards of Sustainability can feel proud to be recognized as ambassadors for sustainable woodland stewardship.

The eight Standards of Sustainability that must be met in order to gain recognition as a certified tree farm under the American Tree Farm System program are listed below. An approved Forest Stewardship Plan completed through the Forest Stewardship Program or a qualifying NRCS incentives programs can be written to also serve as a qualifying forest management plan under the American Tree Farm System. There is no additional cost to be enrolled in the American Tree Farm System certification program. For more information, please visit Here or www.treefarmsystem.org.

Tree Farmers perform the following:

- **Commitment to Practicing Sustainable Forestry**: Landowner demonstrates commitment to forest health and sustainability by developing a forest management plan and implementing sustainable practices.
- **Compliance with Laws**: Forest-management activities comply with all relevant federal, state, and local laws, regulations, and ordinances.
- **Reforestation and Afforestation**: Landowner completes timely restocking of desired species of trees on harvested sites and nonstocked areas where tree growing is consistent with land-use practices and the landowner's objectives.
- **Air, Water and Soil Protection**: Forest-management practices maintain or enhance the environment and ecosystems, including air, water, soil, and site quality.
- **Fish, Wildlife and Biodiversity**: Forest-management activities contribute to the conservation of biodiversity.
- **Forest Aesthetics**: Forest-management activities recognize the value of forest aesthetics.
- **Protect Special Sites**: Special sites are managed in ways that recognize their unique historical, archaeological, cultural, geological, biological, or ecological characteristics.
- **Forest Product Harvests and Other Activities**: Forest product harvests and other management activities are conducted in accordance with the landowner's objectives and consider other forest values.

5.2.3 Qualified Forest Program

The purpose of the Qualified Forest Program, administered by Michigan Department of Agriculture, is to encourage landowners to actively manage their privately-owned forests for commercial harvest, wildlife habitat enhancement, and improvement of other non-forest resources. In exchange for managing

their forests in a sustainable fashion, enrolled landowners will receive an exemption from the local school operating millage. In order to qualify for the program, landowners must have between 20 and 640 acres, have an approved forest management plan, and must comply with the prescriptions included in that plan. See www.michigan.gov/qfp for more information or to begin the enrollment process. The application deadline in order to receive tax benefits the following year is September 1.

5.2.4 Commercial Forest Program

The Commercial Forest Act gives property tax breaks for forest owners in Michigan that voluntarily enroll in the Commercial Forest Program. Under this program, landowners pay a specific rate of $1.25 per acre for property taxes and the State of Michigan pays counties another $1.25 per acre. Landowners must have at least 40 acres of contiguous forest, an appropriate forest management plan, and conduct commercial harvests as prescribed in their plan. Land that is included under the Commercial Forest Program must be open to the public for non-motorized recreational use. More information about this program, which is administered by the MDNR, is available online at www.michigan.gov/commercialforest. The application deadline in order to receive tax benefits the following year is April 1.

5.2.5 Environmental Quality Incentives Program

The Environmental Quality Incentives Program (EQIP) is a voluntary conservation program administered by the USDA Natural Resources Conservation Service. It supports production agriculture and environmental quality as compatible goals. Through EQIP, farmers, ranchers, private forest land owners and federally-recognized American Indian tribes may receive financial and technical assistance to implement structural and land management conservation practices on eligible agricultural land.

Program priorities aim to address resource concerns including soil erosion, soil quality, water quality degradation, plant productivity, habitat fragmentation, invasive plants, and forest health. Conservation practices related to forestry may include forest trails and landings, stream crossings, riparian forest buffers, forest stand improvement, tree and shrub establishment, brush management, early succession habitat, wetland wildlife habitat, and upland wildlife habitat. EQIP activities are carried out according to a site specific conservation plan developed in conjunction with the producer. Forest Stewardship Plans are accepted by the NRCS when applying for EQIP funding. All conservation practices are installed according to NRCS technical standards.

Contact your local District Conservationist or forester for information and enrollment forms for EQIP or other USDA-NRCS assistance programs. For more information, please visit Here or https://www.nrcs.usda.gov/wps/portal/nrcs/detail/mi/programs/financial/eqip/?cid=nrcs141p2_024538.

5.2.6 Best Management Practices (BMP's) for Forest Health, Water Quality and Wildlife

Best Management Practices (BMPs) are guidelines published by the State of Michigan to protect Michigan's water resources from non-point source pollution and erosion while working on forest land. BMPs are now called "Sustainable Soil and Water Quality Practices on Forest Land" and the document

is online Here or at http://www.michigan.gov/dnr/0,4570,7-153-30301_34240---,00.html. BMPs include proper location and construction of logging roads, the use of riparian management zones, installation of culverts and other stream crossings, proper use of pesticides and other chemicals, and site preparation for planting. BMPs also include the proper seasonal timing of activities to minimize the spread of insects or disease. Any forest management activities should minimize soil erosion near wetlands and surface water. Tree Farm certification requires compliance with best management practices.

5.2.7 Forest Economics

Landowner should be aware of capital gains tax for forestry**.** Profits from timber sales are taxed as capital gains, rather than ordinary income, if you own the timber for more than twelve months. Expenses, including the cost of a management plan or a consulting forester's fees for a timber sale, can be deducted from profits. There are many great tax related resources available Here or at www.TimberTax.org, including the most recent edition of the annual "Tax Tips for Forest Landowners.".

5.2.8 Other Financial Assistance Programs

The Natural Resources Conservation Service (NRCS) administers several programs such as the Environmental Quality Incentives Program (EQIP) or Conservation Stewardship Program (CSP) that may provide financial assistance to forest owners to implement "conservation practices" to address "resource concerns" on their land. Landowners must have an approved forest management plan prior to enrolling. Forest Stewardship Plans are accepted by the NRCS when applying for EQIP funding, although they do not require the same level of detail as NRCS conservation activity plans. Work with your NRCS District Conservationist and forester to fill out supplemental "Job Sheets." Link Here or at www.mi.nrcs.usda.gov/technical/forestry.html for info.

Some of the recommended activities in this plan have potential for financial assistance. NRCS forestry "conservation practices" include forest trails and landings, stream crossings, riparian forest buffers, stream habitat improvement, forest stand improvement, tree and shrub establishment, brush management, early succession habitat, wetland wildlife habitat, and upland wildlife habitat. NRCS conservation practices address "resource concerns" (environmental problems) like soil erosion, soil quality, water quality degradation, plant productivity, habitat fragmentation, invasive plants, forest health, etc. Contact your local NRCS Service Center to apply for financial assistance Here or at www.nrcs.usda.gov/wps/portal/nrcs/main/mi/contact/local).

5.3 Wildlife Information

5.3.1 Wildlife Management

A plan should address what wildlife is desired and how it is to be managed. Wildlife benefit from having appropriate habitat, plentiful food sources, and adequate water supply. Existing natural areas can be managed by inventorying communities present to see if adequate resources are available to support target species. If the desired habitat is not present, the landowner can consider creating the plant

community that benefits the target species. Restoration activities can range from planting a few trees, shrubs, grasses, or forbs to large-scale conversions to forest, prairie, or other.

Basic steps to improve wildlife habitat are:
1. Determine the species of wildlife that live in your area.
2. Select the species you want to attract and learn about their habitat and food requirements.
3. Inventory the habitat available and habitat needs on your land and that of adjacent landowners.
4. Design projects to improve wildlife habitat.

The size of your property, the vegetative types and their location, the types of wildlife you want to attract, and the habitat and land management practices on adjoining land determine what can be done to encourage wildlife use in your area. Trees, shrubs, grasses, wildflowers, and perennial and annual flower gardens all provide food and cover for wildlife. Rock piles, brush piles, decaying logs and compost piles are also valuable cover components. They supply cover for chipmunks, rabbits, weasels, salamanders, toads, snakes, snails and beneficial insects.

5.3.2 Creating Habitat

Trees and shrubs that provide food and cover for backyard wildlife are sought by many birds and mammals. The heavy cover of dense conifers, such as spruce and cedar, attract winter songbirds like cardinals and provide shelter for gamebirds such as ruffed grouse. Trees and shrubs that provide food in the form of seeds and fruit for birds and mammals are highly desirable. Plants which supply fruit (soft mast) that last into the winter include crabapples, mountain ash, American high-bush cranberry, nannyberry, arrowwood viburnum, staghorn sumac, and wild grape. Plants that furnish fruit during spring, summer and early fall include serviceberry, mulberry, elderberry, raspberries, cherries and dogwoods. Conifers such as tamarack, white spruce, blue spruce, hemlock and white cedar, which hold their seeds in a semi-loose cone, may attract crossbills, finches, evening grosbeaks, chickadees and red squirrels. Trees such as oak, walnut, hickory, hazelnut, or beech that provide hard mast (nuts) attract large seed-eating birds, small mammals and deer. Standing dead trees (snags) are very attractive to many wildlife species and can furnish cavity nest sites for many songbirds, squirrels or bats, as well as provide insect larvae for woodpeckers, nuthatches and flickers.

Converting mowed areas to grass meadow provides nest sites, food and cover for wildlife. Tall, native prairie grass such as switchgrass, big bluestem and Indian grass provide a lush variety of cover 4-7 feet tall and provide nest sites and winter cover for quail, pheasants, songbirds such as cardinals and blue jays, rabbits and deer. Prairie grasses, mixed with prairie wildflowers such as gray-headed coneflower, woodland sunflower, and aster are an attractive way to provide wildlife habitat. Another option to mowed grass is a perennial wildflower garden. These areas are also called songbird or butterfly gardens. Many wildflower mixtures that provide colorful flowers from late April until the October frosts are commercially available. These wildflower mixtures can include a variety of species such as coreopsis, black-eyed Susan, phlox, blazing star, yarrow, and bee balm. Most wildlife prefers native plants, so

control of invasive species can improve habitat. The ability to identify plants is important. Methods of invasive plant control include: mechanical, chemical, fire, grazing, and competition from noninvasive species.

Prescribed burning requires understanding of fuel, weather conditions, strategies for controlling the area and intensity of the burn and a host of other factors. The risk of out-of-control fire strongly suggest that landowners may want to hire professionals, particularly for complex burns.

A variety of programs and informational resources are offered by state and federal resource agencies and nonprofit conservation organizations to help you take the next steps toward meeting your own land stewardship goals. See Sections 5.2 through 5.6 for more information.

5.3.3 Enjoyment

Landowners purchase forests and spend many hours every year working in their woods for a variety of reasons. For some landowners, forests are an economic investment to secure future income. For others, owning a forest is an ethical choice to improve the world by slowing urban sprawl or providing environmental services such as clean air and water. But for many landowners, the primary motive for owning forest land is the enjoyment that they receive by spending time in their woods. Forest owners do a lot of activities in their woods because it is just plain fun! So as you work with your forester to navigate these programs and choose the best ones for you and your property, don't forget that most family forest owners in Michigan own their forest because they simply enjoy being out in their own woods. Good forest management should not only improve the ecology and economics of your forest, but also your enjoyment of your land.

Appendix 1. General Forestry Information and Related Programs

Glossary of Common Forestry Terms

The following glossary is adapted from www.dnr.state.md.us/forests/gloss.html.

Agroforestry - a land-use system that combines both agriculture and forestry in one location.

Alley Cropping - widely spaced rows of trees with annual crops growing in between the rows.

Basal Area (Tree) - cross sectional area of a tree at 4.5 feet off ground in units of square feet (ft^2).

Basal Area (Forest) - basal area of all trees per acre summed up, in units of ft^2/acre; measure of density.

Biomass – harvesting and using whole trees or parts of trees for energy production

Board Foot – a measure of volume 1 foot by 1 foot by 1 inch or 144 cubic inches of wood.

Bolt – 8-foot-long log

Browse - parts of woody plants, including twigs, shoots, and leaves, eaten by forest animals.

Carbon Cycle – the biogeochemical cycle to exchange carbon between the biosphere and atmosphere by means of photosynthesis, respiration and combustion.

Clear-cut - the harvest of all the trees in an area to reproduce trees that require full sunlight.

Cord - a unit of wood cut for fuel that is equal to a stack 4 x 4 by 8 feet or 128 cubic feet

Cordwood - small diameter or low quality wood suitable for firewood, pulp, or chips.

Crop Tree - a young tree of a desirable species with certain desired characteristics.

Crown - the uppermost branches and foliage of a tree.

Cruise - a forest survey used to obtain inventory information and develop a management plan.

Cull - a saw timber size tree that has no timber value as a result of poor shape or damage.

Diameter at Breast Height (DBH) - diameter of a tree trunk taken at 4 1/2 feet off the ground.

Diameter-Limit Sale - a timber sale in which all trees over a specified DBH may be cut. Diameter-limit sales often result in high grading and is a very poor forestry practice.

Endangered Species – a species in danger of extinction.

Even-Aged Stand - stand with age difference between oldest and youngest trees is minimal (<10 years).

Forestland – land at least one acre in size that is at least 10 percent stocked with trees.

Forest Farming - cultivating high value specialty crops in the shade of natural forests.

Forest Stand Improvement (FSI) - any practice that increases the health, composition, value or rate of growth in a stand. Also called Timber Stand Improvement when focused on timber**.**

Group Selection - harvesting groups of trees to open the canopy and encourage uneven aged stands.

Habitat - the ecosystem in which a plant or animal lives and obtains food and water.

Hardwoods - a general term encompassing broadleaf, deciduous trees.

High Grading - to remove all good quality trees from a stand and leave only inferior trees.

Intolerance - characteristic of certain tree species that does not permit them to survive in the shade.

Landing - cleared area where logs are processed, piled, and loaded for transport to a sawmill.

Log Rule - a method for calculating wood volume in a tree or log by using its diameter and length. Scribner, Doyle and the International 1/4-inch rule are common log rules.

Lump-Sum Sale - a timber sale in which an agreed-on price for marked standing trees is set before the wood is removed (as opposed to a mill tally or unit sale).

Mast - nuts and seeds such as acorns, beechnuts, and chestnuts that serve as food for wildlife.

Over-mature - trees that have declined in growth rate because of old age and loss of vigor.

Overstocked - trees are so closely spaced that they do not reach full growth potential.

Pole Timber - trees 4 to 10 inches DBH.

Pre-Commercial Operations - cutting to remove wood too small to be sold.

Prescribed Fire – an intentional and controlled fire used as a management tool used to reduce hazardous fuels or unwanted understory plants (invasive, undesirable species, etc.).

Pulpwood - wood suitable for use in paper manufacturing.

Range - cattle grazing in natural landscapes.

Regeneration - the process by which a forest is reseeded and renewed.

Riparian Forest Buffers - strips of land along stream banks where trees, shrubs and other vegetation are planted and managed to capture erosion from agricultural fields.

Salvage Cut - the removal of dead, damaged, or diseased trees to recover value.

Sapling - a tree at least 4 1/2 feet tall and between 1 inch and 4 inches in diameter.

Sawlog - log large enough to be sawed economically, usually >10” diameter and 16’ long.

Sawtimber stand - a stand of trees whose average DBH is greater than 11 inches.

Sealed-Bid Sale - a timber sale in which buyers submit secret bids.

Seed-Tree Harvest - felling all trees except for a few desirable trees that provide seed for the next forest.

Selection Harvest – harvesting single trees or groups at regular intervals to maintain uneven-aged forest.

Shelterwood Harvest – harvesting all mature trees in two or more cuts, leaving trees to protect seedlings.

Silvopasture - growing trees and improved forages to provide suitable pasture for grazing livestock.

Silviculture - the art and science of growing forest trees.

Site Index - measure of quality of a site based on the height of a dominate tree species at 50 years old.

Site Preparation - treatment of an area prior to reestablishment of a forest stand.

Skidder - a rubber-tired machine with a cable winch or grapple to drag logs out of the forest.

Slash - branches and other woody material left on a site after logging.

Snag - a dead tree that is still standing and provide food and cover for a variety of wildlife species.

Softwood - any gymnosperm tree including pines, hemlocks, larches, spruces, firs, and junipers.

Species of Special Concern – not threatened or endangered yet, but has low or declining populations.

Stand - a group of forest trees of sufficiently uniform species composition, age, and condition to be considered a homogeneous unit for management purposes.

Stand Density - the quantity of trees per unit area, evaluated in basal area, crown cover or stocking.

Stocking - the number and density of trees in a forest stand. Classified as under-, over-, or well-stocked.

Stumpage Price - the price paid for standing forest trees and paid prior to harvest.

Succession - the replacement of one plant community by another over time in the absence of disturbance.

Sustained Yield - ideal forest management where growth equals or exceeds removals and mortality.

Thinning - partial cut in an immature, overstocked stand of trees to increase the stand's value and growth.

Threatened Species - a species whose population is so small that it may become endangered.

Timberland - forest capable of producing 20 ft^3 of timber per acre per year.

Tolerance – the capacity of a tree species to grow in shade

Under-stocked - trees so widely spaced, that even with full growth, crown closure will not occur.

Understory - the level of forest vegetation beneath the canopy.

Uneven-Aged Stand - three or more age classes of trees represented in a single stand.

Unit Sale - a timber sale in which the buyer makes regular payments based on mill tally and receipts.

Veneer Log - a high-quality log of a desirable species suitable for conversion to veneer.

Well-Stocked – stands where growing space is effectively occupied but there is still room for growth.

Windbreaks - rows of trees to provide shelter for crops, animals or farm buildings.

Federal and State Laws Related to Forest Management

- USA - Federal Insecticide, Fungicide, and Rodenticide Act, 1947
- USA - National Historic Preservation Act, 1966
- USA - Clean Water Act, 1948 and 1972
- USA - Endangered Species Act, 1973
- MI - Michigan Pesticide Control Act, Public Act 171 of 1976
- MI - Natural Resources and Environmental Protection Act, Public Act 451 of 1994
- MI - Right to Forest Act, Public Act 676 of 2002

Forest Management Plans

A written plan is the foundation for good forest management and accomplishing your unique goals for your forest. There are two programs in Michigan that offer financial assistance to help pay for a portion of the total cost of developing a forest management plan. Plan writers are allowed to set their own prices, so interview several foresters before hiring one to develop a forest management plan with you.

The Forest Stewardship Program (FSP) encourages long-term stewardship of family forest land by connecting landowners with professional foresters to develop a Forest Stewardship Plan that helps landowners *manage, protect, and enjoy their forests*. The DNR has trained and certified 150 private sector foresters and 20 wildlife biologists, and there are at least several foresters available in every county. Funding from the U.S. Forest Service (USFS) helps lower the total cost, and this partial cost share is made available through grants to the Plan Writer to minimize payment hassles for landowners. The cost share is $225 per plan plus $0.50 per acre up to $2,500 per landowner. Landowners can easily enroll in the program any time of the year by completing an easy two-page form with their Plan Writer. A DNR Service Forester reviews the plan for meeting USFS standards for a simple yet comprehensive Forest Stewardship Plan. More information about the Forest Stewardship Program is available online at www.Michigan.gov/ForestStewardship. Since 1990, more than 5,700 landowners in Michigan have used their Forest Stewardship Plan to help them *manage, protect, and enjoy* over 900,000 acres of forest land.

The Natural Resources Conservation Service (NRCS) also administers a financial assistance program to develop a forest management plan. The financial assistance from the NRCS is much higher than the Forest Stewardship Program, but the landowner must apply at their local NRCS office for a contract with the NRCS for a "conservation activity plan" (CAP 106). Applications for funding are accepted year round, but there is usually a "sign-up cutoff date" in the winter, and contracts are usually funded in the summer. After getting a contract, the landowner then hires one of 50 Technical Service Providers (professional foresters certified by the NRCS) to write the plan. The NRCS District Conservationist in each county reviews the forest management plan to verify that it meets program guidelines. The Michigan NRCS has more information about forestry and financial assistance programs on its website.

Fees, plan quality, and plan contents can vary widely so please call at least three professional foresters to ask about prices and the contents of their plans. Feel free to ask for references and an example plan to read one of their previous forest management plans before you hire them. Consulting foresters frequently travel several counties away from their office, so do not feel obligated to hire the closest forester. Very low prices or very high prices are not always accurate indicators of plan quality. You do not have to use either of these two financial assistance programs to develop a forest management plan, but they are helpful to ensure consistent quality of the plan and also to lower your costs.

Best Management Practices

Best Management Practices (BMPs) are guidelines published by the State of Michigan to protect Michigan's water resources from non-point source pollution and erosion while working on forest land. BMPs are now called "Sustainable Soil and Water Quality Practices on Forest Land" and the document is online at www.Michigan.gov/PrivateForestLand. BMPs include proper location and construction of logging roads, the use of riparian management zones, installation of culverts and other stream crossings, proper use of pesticides and other chemicals, and site preparation for planting. BMPs also include the proper seasonal timing of activities to minimize the spread of insects or disease. Any forest management activities should minimize soil erosion near wetlands and surface water. Tree Farm certification requires compliance with best management practices.

Forest Health

The DNR publishes the annual "Forest Health Highlights" that has information about the forest insect and disease problems in Michigan. See www.Michigan.gov/ForestHealth for a pdf of the most recent edition. To report an unusual insect or disease in your forest, please email several photos to DNR-FRD-Forest-Health@Michigan.gov.

DNR Forest Health - www.Michigan.gov/ForestHealth
DNR Invasive Species Info - www.Michigan.gov/InvasiveSpecies
MDARD Exotic Forest Pests – www.Michigan.gov/ExoticPests
USFS Forest Health - http://fhm.fs.fed.us/

Wildlife Habitat

The DNR Wildlife Division has an excellent publication on managing wildlife habitat at www.michigandnr.com/publications/pdfs/huntingwildlifehabitat/Landowners_Guide/index.htm.

DNR Wildlife Division – www.Michigan.gov/Wildlife

Michigan United Conservation Clubs - https://mucc.org

Quality Deer Management Association – www.qdma.com

Audubon Society - www.MichiganAudubon.org

Foresters for the Birds – http://vt.audubon.org/foresters-birds

Ruffed Grouse Society - www.RuffedGrouseSociety.org

National Wild Turkey Federation - www.nwtf.org

Michigan Trout Unlimited – www.MichiganTU.org

US Fish and Wildlife Service - www.fws.gov/partners

Forest Economics

Capital Gains Tax Information. Profits from timber sales are taxed as capital gains, rather than ordinary income, if you own the timber for more than twelve months. Expenses, including the cost of a management plan or a consulting forester's fees for a timber sale, can be deducted from profits. There are many great tax related resources available on www.TimberTax.org, including the most recent edition of the annual "Tax Tips for Forest Landowners."

American Tree Farm System

A free inspection from one of the 138 Tree Farm Inspecting Foresters is required to enroll. This Forest Stewardship Plan complies with the Farm System's eight Standards of Sustainability listed below. See www.TreeFarmSystem.org for information about the Tree Farm program, forest certification, and the full Standards of Sustainability.

1. **Commitment to Practicing Sustainable Forestry.** Forest owner demonstrates commitment to forest vitality by developing and implementing a sustainable forest management plan.
2. **Compliance with Laws.** Forest management activities comply with all relevant federal, state and local laws, regulations and ordinances.
3. **Reforestation and Afforestation.** Forest owner completes timely restocking of desired species of trees on harvested sites and non-stocked areas where tree growing is consistent with land use practices and the forest owner's management objectives.
4. **Air, Water, and Soil Protection.** Forest management practices maintain or enhance the environment and ecosystems, including air, water, soil and site quality.
5. **Fish, Wildlife and Biodiversity.** Forest management activities contribute to the conservation of biodiversity.
6. **Forest Aesthetics.** Forest management plans and management activities recognize the value of forest aesthetics.
7. **Protect Special Sites.** Special sites are managed in ways that recognize their unique historical, archeological, cultural, geological, biological or ecological characteristics.
8. **Forest Product Harvests and Other Activities.** Forest product harvests and other management activities are conducted in accordance with the management plan and consider other forest values.

Qualified Forest Program

The Qualified Forest (QF) program reduces property taxes by up to 18 mills for landowners with parcels between 20 and 640 acres and who comply with their forest management plan to optimize their forest

resources. Landowners do not have to allow the public on their land to hunt or fish, so this program is more attractive to family forest owners who own land for their own recreation. There is a $50 application fee and an annual fee equivalent to 2 mills to help fund the operation of the program. The MDARD administers the Qualified Forest program and more information is available at www.michigan.gov/qfp, including the minimum requirements for a QF forest management plan and a list of about 190 "Qualified Foresters" who can write plans for the Qualified Forest program. Rich Harlow is the program administrator, and the phone number for the Qualified Forest program is 517-284-5630.

Commercial Forest Program

The Commercial Forest (CF) program provides a specific property tax of $1.25 per acre for landowners that have at least 40 acres of forest and are engaged in sustainable timber production in support of Michigan's forest products industry. Participating landowners must make their land open to the public for foot access for hunting and fishing, so this program is usually more attractive to corporate forest owners who own large forests in the Upper Peninsula. The application fee is $1 per acre with a minimum fee of $200 and a maximum fee of $1,000. The DNR administers the Commercial Forest program and more information is available at www.michigan.gov/commercialforest, including the application forms and the required components of a CF forest management plan. Any of the 225 Registered Foresters in Michigan can write a forest management plan for the Commercial Forest program. Shirley Businski is the program administrator for the Commercial Forest program, and her phone number is 517-284-5849.

While it is not required to use a financial assistance program for developing a plan for these two tax programs, many landowners benefit from using either the FSP or NRCS programs to develop their forest management plan and then enroll in the separate Commercial Forest or Qualified Forest programs. Participating in a financial assistance program may hinder the schedule for developing a forest management plan in time for the application deadlines of the Commercial Forest program (April 1) or the Qualified Forest (September 1) program and delay entry into the tax program for an entire year.

Financial Assistance Programs

The Natural Resources Conservation Service (NRCS) administers several programs such as the Environmental Quality Incentives Program (EQIP) or Conservation Stewardship Program (CSP) that may provide financial assistance to forest owners to implement "conservation practices" to address "resource concerns" on their land. Landowners must have an approved forest management plan prior to enrolling. Forest Stewardship Plans are accepted by the NRCS when applying for EQIP funding, although they do not require the same level of detail as NRCS conservation activity plans. Work with your NRCS District Conservationist and forester to fill out supplemental "Job Sheets." See www.mi.nrcs.usda.gov/technical/forestry.html for info.

Some of the recommended activities in this plan have potential for financial assistance. NRCS forestry "conservation practices" include forest trails and landings, stream crossings, riparian forest buffers, stream habitat improvement, forest stand improvement, tree and shrub establishment, brush management, early succession habitat, wetland wildlife habitat, and upland wildlife habitat. NRCS conservation practices address "resource concerns" (environmental problems) like soil erosion, soil quality, water quality degradation, plant productivity, habitat fragmentation, invasive plants, forest health, etc. Contact your local NRCS Service Center to apply for financial assistance (see www.nrcs.usda.gov/wps/portal/nrcs/main/mi/contact/local).

Timber Sales

One of the primary benefits of investing in a forest management plan is that it helps you prepare for a timber sale. A well-planned timber sale should have both economic benefits for you and ecological benefits for your forest. A forest management plan will help you to determine what trees to sell, and more importantly, what trees to keep so that you can improve your forest when you harvest your timber. All timber sales should be conducted to accomplish your stated goals for your forest, whether those are improving wildlife habitat, increasing access for recreation, removing diseased trees, modifying the species composition, improving "crop trees" for future harvest, or just generating some current income.

Timber sales can be a long and complicated process so it is often a good investment to hire a consulting forester to help you administer your timber sale. A consulting forester will help you decide what trees to sell and market the sale to multiple buyers to get the best price for your trees. Your forester will also ensure that the loggers follow "Best Management Practices" to protect your soil and water resources. Consulting foresters also provide customized timber sale contracts which are often more detailed than the typical contract that a timber buyer provides. Foresters can also help you reduce the taxes on the profits of your sale by calculating your "basis" and "depletion" for capital gains. Consulting foresters may charge hourly rates, set fees, or a percentage of the sale price for their services in administering your sale.

Most timber sales in Michigan are either a "lump sum" sale where the buyer pays in full for the marked trees before the harvest begins or a "mill tally" sale where the buyer pays an agreed price for a unit of wood (cords, boardfeet, tons, etc.) when it is cut and delivered to the sawmill. Most selection harvests in hardwoods forests (oak, maple, beech, cherry, etc.) are sold in a lump sum sale. If you are thinning a pine plantation or clearcutting an aspen stand, those types of large volume harvests are often sold in a mill tally sale. Mill tally sales require a higher level of trust and usually some extra oversight.

Whether you hire a consulting forester or not, be sure that you have a clearly written contract that describes exactly what will occur and when it will occur during your timber sale. The seasonal timing of the harvest is important to protect your soil and to reduce the potential to spread diseases like oak wilt. A detailed contract will protect both the seller (you, the landowner) and the buyer (logger or sawmill) in a

timber harvest. It is the landowner's responsibility to know the location of their property corners and property lines so investing in a survey conducted by a licensed land surveyor can be a good investment.

There are many excellent loggers in Michigan so be sure that you are working with a "Qualified Logging Professional." Look for loggers that have been trained by the Michigan Sustainable Forestry Initiative or are members of the Michigan Association of Timbermen or are certified as a Master Logger.

Forestry Programs and other Resources for Private Forest Landowners

General Forestry Information

- Forestry Assistance Program – MACD/MDARD/DNR - www.michigan.gov/mifap
- MSU Extension – MSU - http://msue.anr.msu.edu/topic/info/forestry
- Michigan Forest Association - MFA – www.michiganforests.org

Forest Management Plans

- Forest Stewardship Program – DNR/USFS - www.Michigan.gov/ForestStewardship
- Conservation Activity Plans – NRCS - www.nrcs.usda.gov

Property Tax Incentives

- Qualified Forest Program – MDARD - www.Michigan.gov/qfp
- Commercial Forest Program – DNR - www.Michigan.gov/CommercialForest

Financial Assistance

- Environmental Quality Incentives Program – NRCS - www.nrcs.usda.gov
- Conservation Stewardship Program – NRCS - www.nrcs.usda.gov

Forest Certification

- American Tree Farm System – AFF - www.TreeFarmSystem.org
- Forest Stewardship Council – FSC – www.us.fsc.org

Working Forest Easements

- Forest Legacy Program – DNR/USFS - www.Michigan.gov/PrivateForestLand
- Thirty Michigan Land Conservancies - www.heartofthelakes.org
- Healthy Forest Reserve Program - NRCS - www.nrcs.usda.gov
- Farmland and Open Space Preservation – MDARD - www.Michigan.gov/Farmland

Wildlife Habitat

- Landowner Incentive Program – DNR - www.Michigan.gov/dnrlip
- Hunter Access Program – DNR - www.Michigan.gov/hap
- Partners for Fish and Wildlife – USFWS - www.fws.gov/midwest/partners/getinvolved.html
- Trout Unlimited - www.michigantu.org
- Ruffed Grouse Society - www.ruffedgrousesociety.org
- Quality Deer Management Association - www.qdma.com
- Michigan United Conservation Clubs - www.mucc.org
- Many other game advocacy groups ….

Professional Foresters to Help Private Forest Landowners

Consulting Foresters
Consulting foresters are independent businesses that work directly for the landowner, their only client.

Consulting foresters administer timber sales, write Forest Stewardship Plans, manage wildlife habitat, plant trees, and offer other services for forest landowners.

There are about 125 consulting foresters in Michigan.

Association of Consulting Foresters - www.acf-foresters.org
Forest Stewardship Plan Writers – www.Michigan.gov/ForestStewardship

Industry Foresters
Industry foresters work for local forest products companies to buy timber from private landowners or to manage forest land owned by their company.

Industry foresters buy timber from private landowners and write forest management plans.

There are about 100 industry foresters in Michigan.

Michigan Association of Timbermen - www.timbermen.org
Michigan Forest Products Council - www.michiganforest.com
Great Lakes Timber Professionals Association - http://gltpa.org

Government Foresters
Government foresters, funded by your tax dollars, provide general forestry information to landowners.

Government foresters hold workshops, field days, write articles, and provide information to landowners.

There are ~35 government foresters who help private landowners (and another 200 working on public land).

Conservation Districts – 20 foresters in the Forestry Assistance Program – www.Michigan.gov/mifap
MSU Extension – 5 educators statewide - http://msue.anr.msu.edu/topic/info/forestry
DNR – 5 foresters statewide – www.Michigan.gov/PrivateForestLand
USFS - www.fs.fed.us/spf

Credentials and Programs
"Registered Foresters" are recognized by the State of Michigan – www.Michigan.gov/Foresters

"Certified Foresters" are certified by the Society of American Foresters - www.safnet.org
"ACF Foresters" are members of the Association of Consulting Foresters - www.acf-foresters.org

"Forest Stewardship Plan Writers" write Forest Stewardship Plans – www.Michigan.gov/ForestStewardship
"Technical Service Providers" write plans for the Environmental Quality Incentives Program - www.nrcs.usda.gov
"Qualified Foresters" write plans for the Qualified Forest Program – www.Michigan.gov/qfp

"Qualified Logging Professionals" are loggers trained by the Sustainable Forestry Initiative - http://sfimi.org
"Master Loggers" are trained, audited and certified by other professional loggers - www.mimlc.com
"Timber Buyers" may or may not be foresters or loggers, and they buy timber from landowners to sell to sawmills.

Internet Resources for Forest Landowners

DNR Forest Resources Division – www.Michigan.gov/Forestry

DNR Forest Stewardship Program – www.Michigan.gov/ForestStewardship

DNR Private Forest Land – www.Michigan.gov/PrivateForestLand

DNR Urban and Community Forestry - www.michigan.gov/ucf

Qualified Forest Program - www.Michigan.gov/qfp

Commercial Forest Program – www.Michigan.gov/CommercialForest

NRCS Financial Assistance – www.nrcs.usda.gov/wps/portal/nrcs/main/mi/technical/landuse/forestry

Forest Stewardship Plan Writers - www.Michigan.gov/ForestStewardship

NRCS Technical Service Providers - www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/technical/tsp/

Michigan Forest Association Foresters List - www.michiganforests.com/forester.htm

Michigan Society of American Foresters - http://michigansaf.org

Association of Consulting Foresters – www.acf-foresters.org

Conservation District Foresters – www.michigan.gov/mifap

Michigan Association of Conservation Districts - http://macd.org

Tree Sales - http://michigan.gov/documents/dnr/DirectoryOfMichiganSeedlingNurseries-IC4175_258828_7.pdf?20141113140132

DNR Hunting Access Program - www.michigan.gov/hap

DNR Wildlife Landowner Incentive Program - www.michigan.gov/dnrlip

DNR Wildlife - www.michigandnr.com/publications/pdfs/huntingwildlifehabitat/Landowners_Guide/index.htm

Michigan United Conservation Clubs – www.mucc.org

Quality Deer Management Association – www.qdma.com

National Wild Turkey Federation - www.nwtf.org

Foresters for the Birds - http://vt.audubon.org/foresters-birds

DNR Forest Health - www.Michigan.gov/ForestHealth

MDARD Forest Pests – www.Michigan.gov/ExoticPests

USFS National Forest Health - http://fhm.fs.fed.us

DNR Invasive Species – www.Michigan.gov/InvasiveSpecies

Midwest Invasive Species Network - www.misin.msu.edu

MSU Diagnostics Laboratory - www.pestid.msu.edu

Michigan Association of Timbermen - www.timbermen.org

Michigan Sustainable Forestry Initiative - http://sfimi.org

Michigan Master Loggers - www.mimlc.com

Michigan Forest Products Council - www.michiganforest.com

Forestry Taxes - www.timbertax.org

Sample Timber Sale Contract - www.nhdfl.org/library/pdf/Forest%20Protection/timbersaleagreement.pdf

Project Learning Tree - www.michiganplt.org

Project WILD - www.michigan.gov/michiganprojectwild

Michigan Environmental Education Curriculum Support – www.michigan.gov/meecs

Michigan Forest Pathways - http://miforestpathways.net

Michigan Forest Association - www.michiganforests.com

American Tree Farm System - www.treefarmsystem.org

My Land Plan - http://mylandplan.org

National Woodland Owners Association - www.woodlandowners.org

Ties to the Land (succession planning to pass forest to next generation) - http://tiestotheland.org

Conservation Easements – http://landtrust.org/Links/linksTABLE.htm

MTU School of Forest Resources & Environmental Science - www.mtu.edu/forest

MSU Department of Forestry – www.for.msu.edu

MSU Extension Forestry - http://msue.anr.msu.edu/topic/info/forestry

MSU Soil Testing Laboratory - www.spnl.msu.edu

USDA Soil Web Survey - http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm

USFS Private Woodland Owners - http://na.fs.fed.us/pubs/misc/flg

USFS Ecosystem Services - www.fs.fed.us/ecosystemservices/index.shtml

USFS State and Private Forestry - www.fs.fed.us/spf

Great Books for a Forest Landowner's Library

1. Woodland Stewardship: A Practical Guide for Midwestern Landowners. 2nd Edition, 2009. This book, written by a team of educators and foresters from Minnesota, Wisconsin, and Michigan is an excellent manual on how to manage your forest for a wide variety of goals. It is only $16 and is available at www.bookstores.umn.edu. A free pdf of the entire book is online at http://woodlandstewardship.org.

2. Owning and Managing Forest: A Guide to Legal, Financial, and Practical Matters. Revised, 2005. This book is written by Thomas McEvoy, an Extension Professor at the University of Vermont. It contains excellent advice on the legal and financial issues of owning and managing a family forest. Cost: $33

3. A Landowner's Guide to Managing Your Woods. 2011. This book is authored by a landowner, forester, and logger to give a balanced view of forest management and how to maintain a small forest for long-term health, biodiversity, and high-quality timber production. Cost: $15

4. Michigan Trees: A Guide to the Trees of the Great Lakes Region. Revised, 2004. This book is the classic text on tree identification in Michigan authored by two professors at Univ MI. It has drawings instead of photos, but the book has more complete information than the ID books with prettier photos. Cost: $15

5. Michigan Forest Communities: A Field Guide and Reference. 2004. This book, authored by Dr. Don Dickmann at MSU, describes 23 forest communities in Michigan. The book is available from MSU Extension for $15, or a free pdf is at http://web2.msue.msu.edu/bulletins/Bulletin/PDF/E3000.pdf.

6. Positive Impact Forestry: A Sustainable Approach to Managing Woodlands. 2004. This book is written by Thomas McEvoy, an Extension Professor at the University of Vermont. It is a great introduction to silviculture, the science and art of growing and managing forests. Cost: $33

7. Managing Michigan's Wildlife: A Landowner's Guide. 2001. This book, edited by two biologists for the Michigan Department of Natural Resources, is the classic text in Michigan for landowners on wildlife habitat and managing forests for preferred game species. This book about wildlife habitat management is only available at www.michigandnr.com/publications/pdfs/huntingwildlifehabitat/Landowners_Guide/index.htm.

8. Estate Planning for Forest Landowners: What Will Become of Your Timberland? 2009. Nothing is more dreadful than death and taxes, but this book helps landowners prepare for both. To ease your pain, it is free at http://www.srs.fs.usda.gov/pubs/gtr/gtr_srs112.pdf. See also www.timbertax.org for related resources about taxes related to owning forest land and harvesting timber.

9. Trees Are the Answer. Revised, 2010. This book is written by Dr. Patrick Moore, one of the founders of Greenpeace. His perspective on forestry will appeal to both tree huggers and loggers. Cost: $16

10. A Sand County Almanac. 1949. This book by Aldo Leopold is one of the foundations for environmental ethics that continues to inform forest stewardship of both private and public lands. This book will help you to articulate your own ethical approach to managing your forest. Cost: $10.

11. Last Child in the Woods. 2008. This book by Richard Louv is a strong argument that our nation's children are suffering from "nature deficit disorder." This book will give you great ideas about how you can bring school groups, scout groups, church groups, or even your own children out into your forest to experience and enjoy nature. Cost: $10.

12. The Forests of Michigan. Revised in 2016. This book by two MSU forestry professors is an interesting history of Michigan's forests over the last few centuries. The new edition is available at the University of Michigan press for $50.

Appendix 2: Michigan Laws Related to Forestry

This is an incomplete list of Michigan laws related to forestry:

- Natural Resources and Environmental Protection Act, Public Act 451 of 1994
- Right to Forest Act, Public Act 676 of 2002
- Commercial Forest Act, Parts 511 and 512 of Public Act 451, 1994, as amended
- Qualified Forest Program, Public Acts 42 and 45 of 2013

Federal and State Laws Related to Forest Management

- USA - Federal Insecticide, Fungicide, and Rodenticide Act, 1947
- USA - National Historic Preservation Act, 1966
- USA - Clean Water Act, 1948 and 1972
- USA - Endangered Species Act, 1973
- MI - Michigan Pesticide Control Act, Public Act 171 of 1976
- MI - Natural Resources and Environmental Protection Act, Public Act 451 of 1994
- MI - Right to Forest Act, Public Act 676 of 2002

Appendix 3: Trail Camera Pictures from Luce County, MI

Moose – McMahon Lake Preserve – Two Hearted Reserve

Bear – North Branch Two Hearted – Two Hearted Reserve

Bears – North Branch Two Hearted – Two Hearted Reserve

Bear – North Branch Two Hearted – Two Hearted Reserve

Sandhill Cranes – North Branch Two Hearted – Two Hearted Reserve

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