



**GREEN TIMBER**



# FOREST STEWARDSHIP PLAN

**LANDOWNER:** L'Anse Area Schools

**Address:** 201 N 4<sup>th</sup> Street  
L'Anse, MI 49946

**Phone:** (906) 524-6000

**Signature:**  
*Susan Tollefan*

**Date:** BOE approved 2-2023

**LEGAL DESCRIPTION**

Properties found in Baraga and L'Anse Townships, and within the L'Anse Village limits.  
See Section 2, page 16 for specific legal descriptions

~120 Acres

Green Timber Consulting Foresters, Inc. • 11511 US Highway 41, Pelkie, MI 49958  
(906) 353-8584 • info@greentimberforestry.com • GreenTimberForestry.com

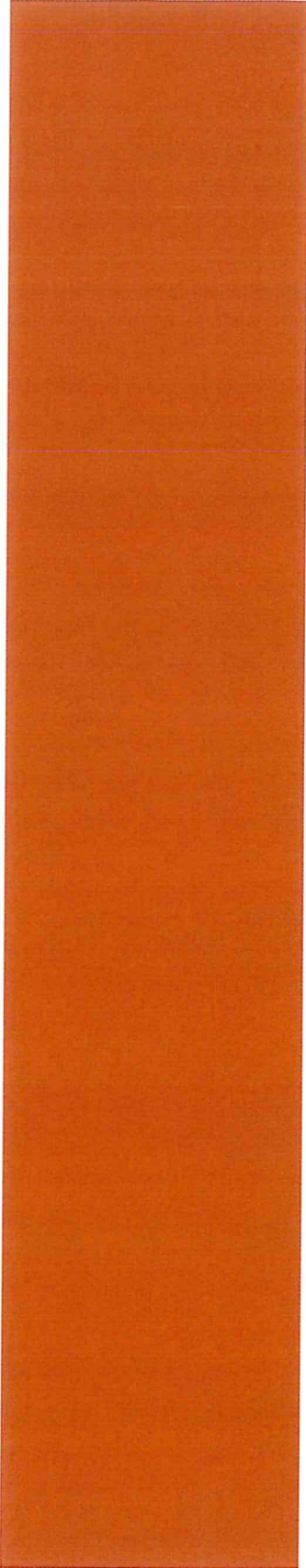
**PREPARED BY** **Elsa Schwartz, & Karl Ploeckelman**

**Signature of Plan Writer:** *Elsa Schwartz* *Karl Ploeckelman* July 22<sup>nd</sup>, 2022

**DNR APPROVAL**

**Printed Name:**

**Signature:**



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## **SECTION I: MAPS AND INTRODUCTION**

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## PROPERTY MAPS

- Locator Maps X2
- Stands Map
  - Village Property
  - Skanee Property
  - Pine Creek Property
- Activities Map
  - Village Property
  - Skanee Property
  - Pine Creek Property
- Soils Map
  - Village Property
  - Skanee Property
  - Pine Creek Property

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# L'Anse Schools Locator- Village & Skanee Road Property

T. 51 N. - R. 32 W.

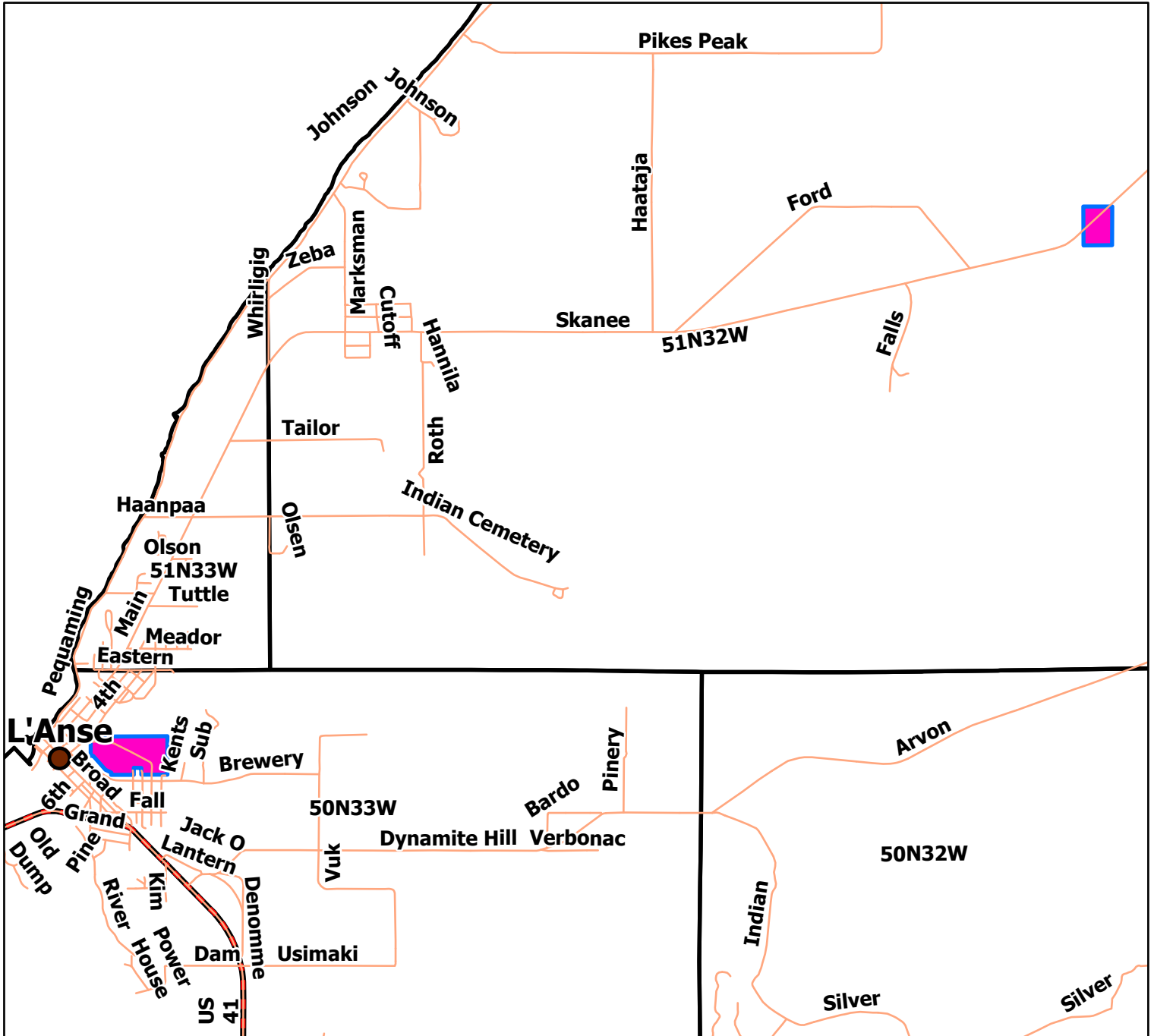
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T. 50 N. - R. 33 W.

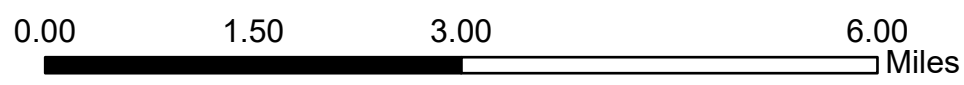
Portion of N1/2 SW1/4 Section 4

Baraga County, Michigan

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-  Towns
-  Boundary



# L'Anse Schools Locator- Village & Pine Creek Property

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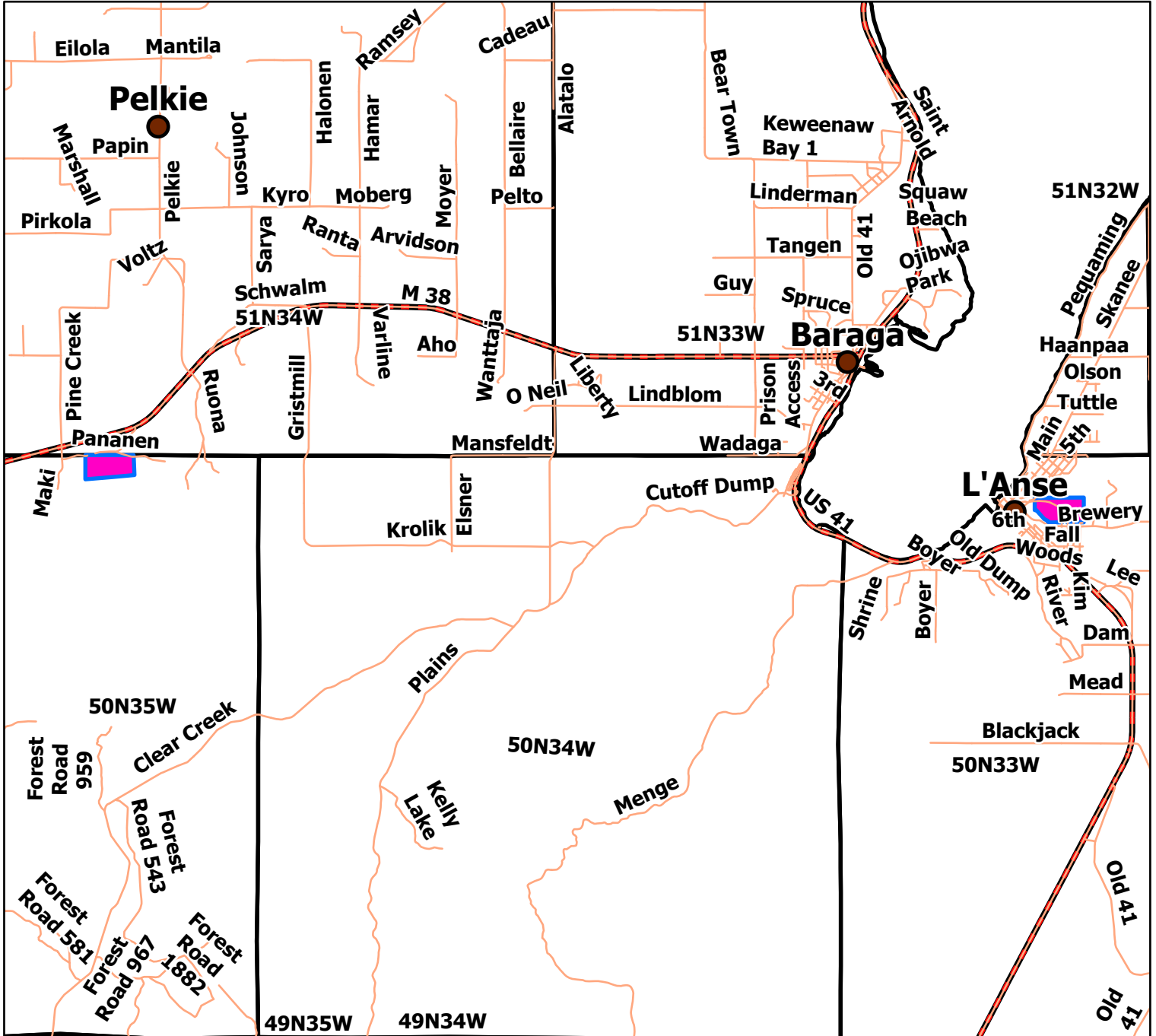
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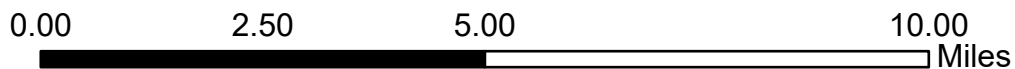
NE1/4 NE1/4 & NW1/4 NE1/4 Section 2

Baraga County, Michigan

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- Towns
- Boundary



# L'Anse Schools Property Stands- Village

T. 50 N. - R. 33 W.  
Portion of N1/2 SW1/4 Section 4  
Baraga County, Michigan

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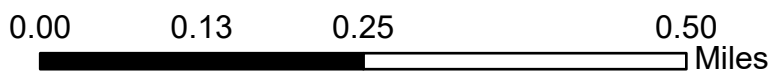
- Boundary
- Stands
- Trails
- Points of Interest

## Stand Type and Acres

Stand 1: M6 = 27.7 acres  
 Stand 2: Hm6 = 0.6 acres  
 Stand 3: Mf5 = 6.4 acres  
 Stand 11: Nonforest = 37.8 acres

## Points of Interest

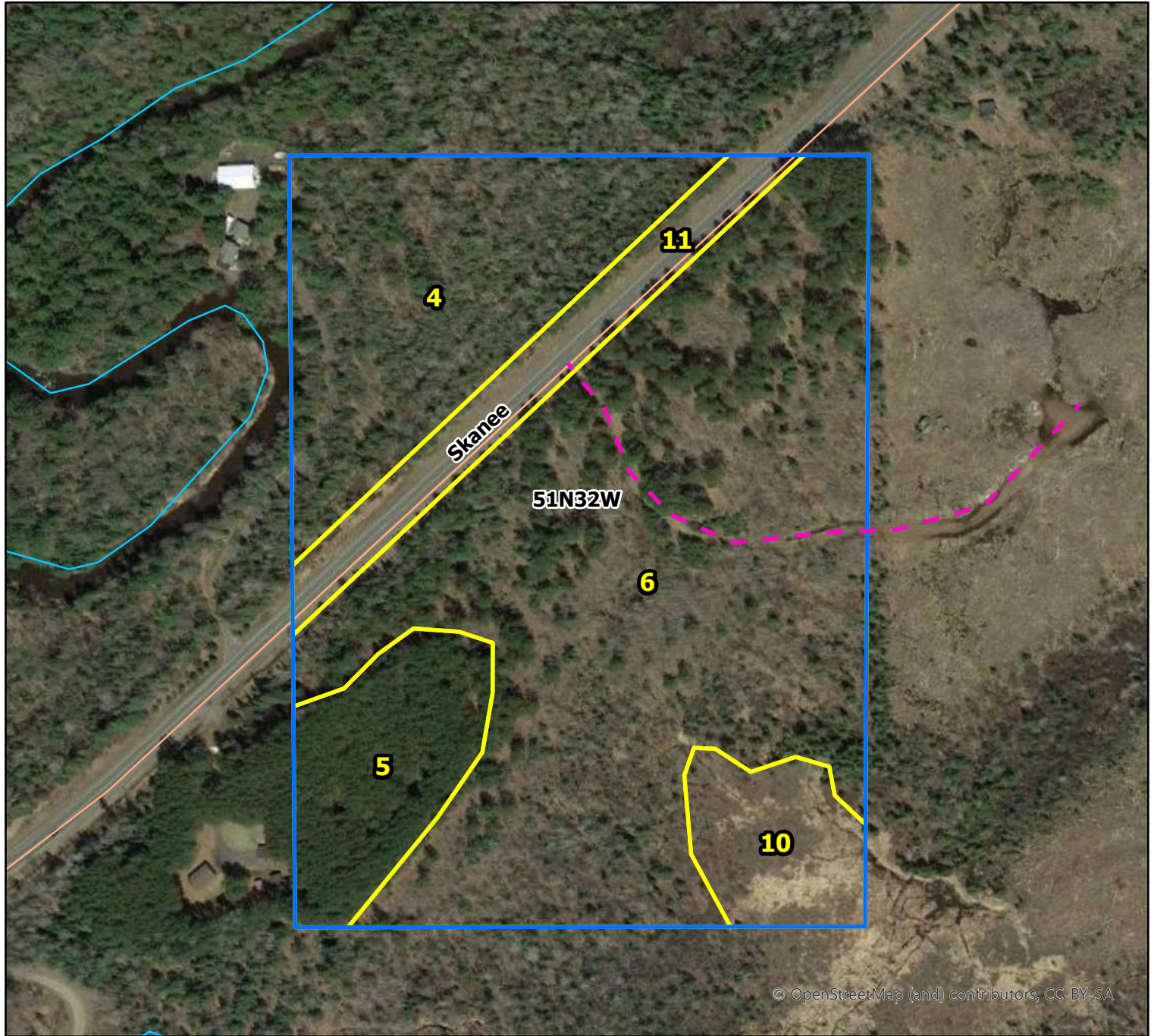
Point A: Outdoor Classroom  
 Point B: Potential site for future development




L'Anse Schools Property Stands - Skanee Road  
T. 51 N. - R. 32 W.  
E3/4 NE1/4 NW1/4 Section 24  
Baraga County, Michigan

-NOT A SURVEY MAP-  
This map was not prepared by a professional  
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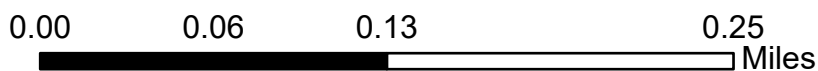


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-  Water Features
-  Boundary
-  Stands
-  Roads

### Stand Type and Acres

- Stand 4: Mf6 = 6.1 acres
- Stand 5: Rp6 = 2.7 acres
- Stand 6: Am5 = 17.2 acres
- Stand 10: XL = 1.8 acres
- Stand 11: Nonforest = 2.3 acres

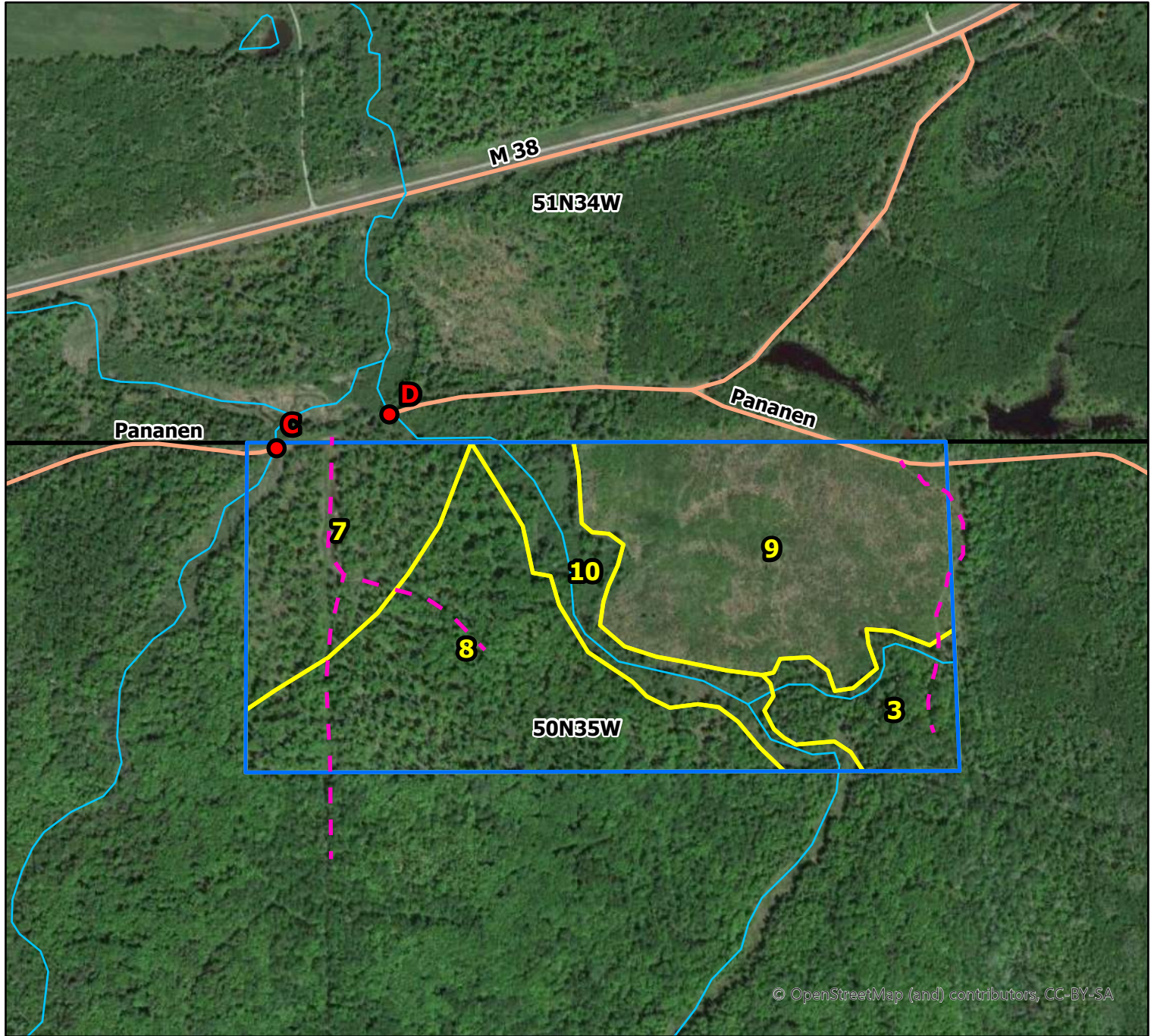


51N34W  
50N35W

L'Anse Schools Property Stands- Pine Creek  
T. 50 N. - R. 35 W.  
NE1/4 NE1/4 & NW1/4 NE1/4 Section 2  
Baraga County, Michigan

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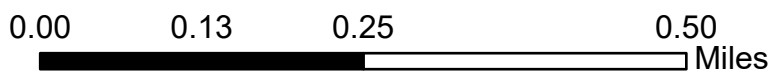
- Water Features
- Boundary
- Stands
- Roads
- Points of Interest

### Stand Type and Acres

Stand 3: Mf5 = 6.0 acres  
Stand 7: Ma5-3 = 12.1 acres  
Stand 8: M8 = 23.0 acres  
Stand 9: A3 = 23.4 acres  
Stand 10: XL = 6.8 acres

### Points of Interest

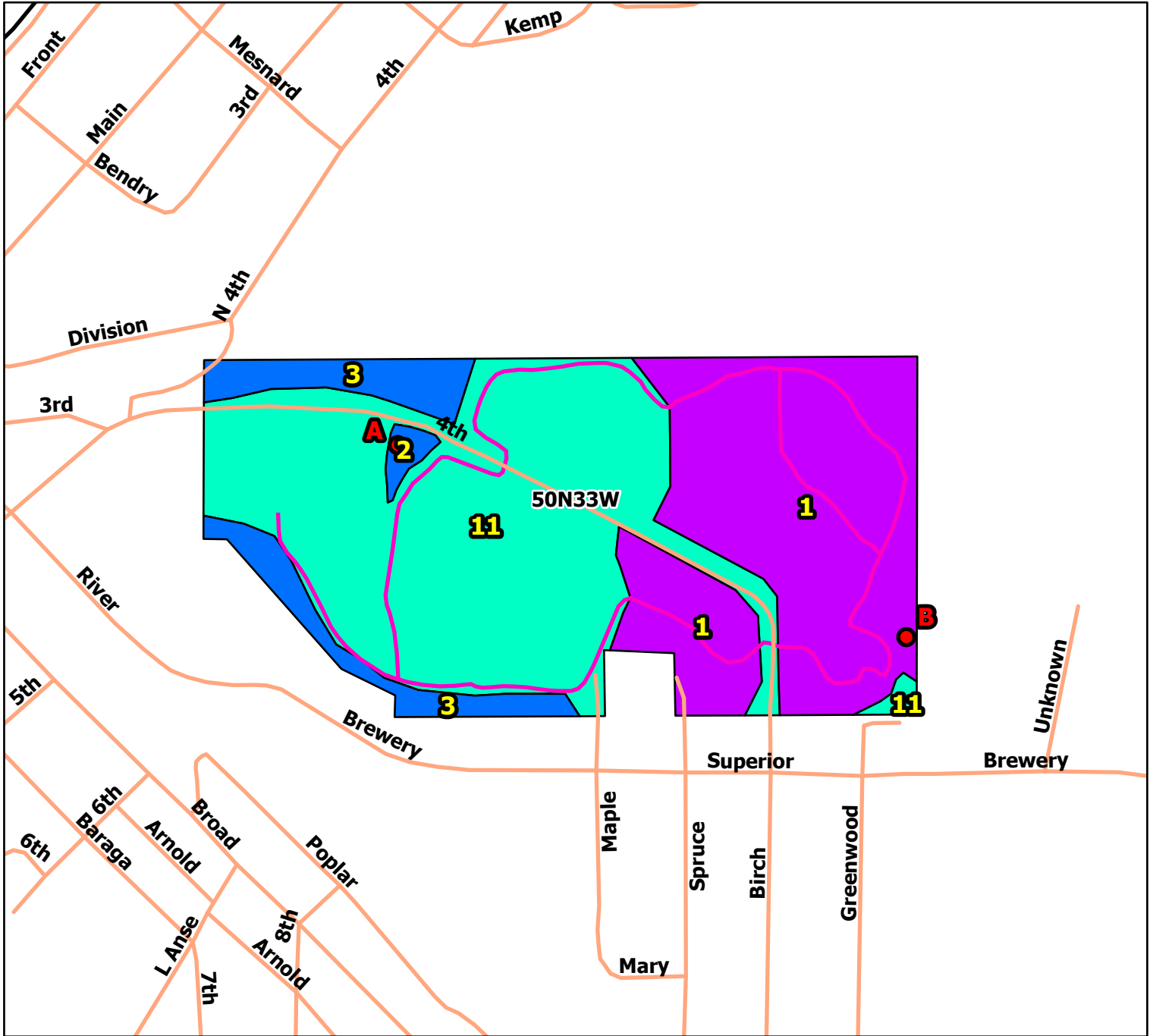
Point C: Removed temporary crossing  
Point D: Decayed bridge



L'Anse Schools Property Activities - Village  
T. 50 N. - R. 33 W.  
Portion of N1/2 SW1/4 Section 4  
Baraga County, Michigan

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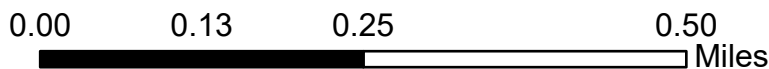
- Points of Interest
- Trails
- Roads

### Management

- No Active Forest Management
- Re-evaluate 2032, 2042
- Timber Stand Improvement 2022-42

### Points of Interest

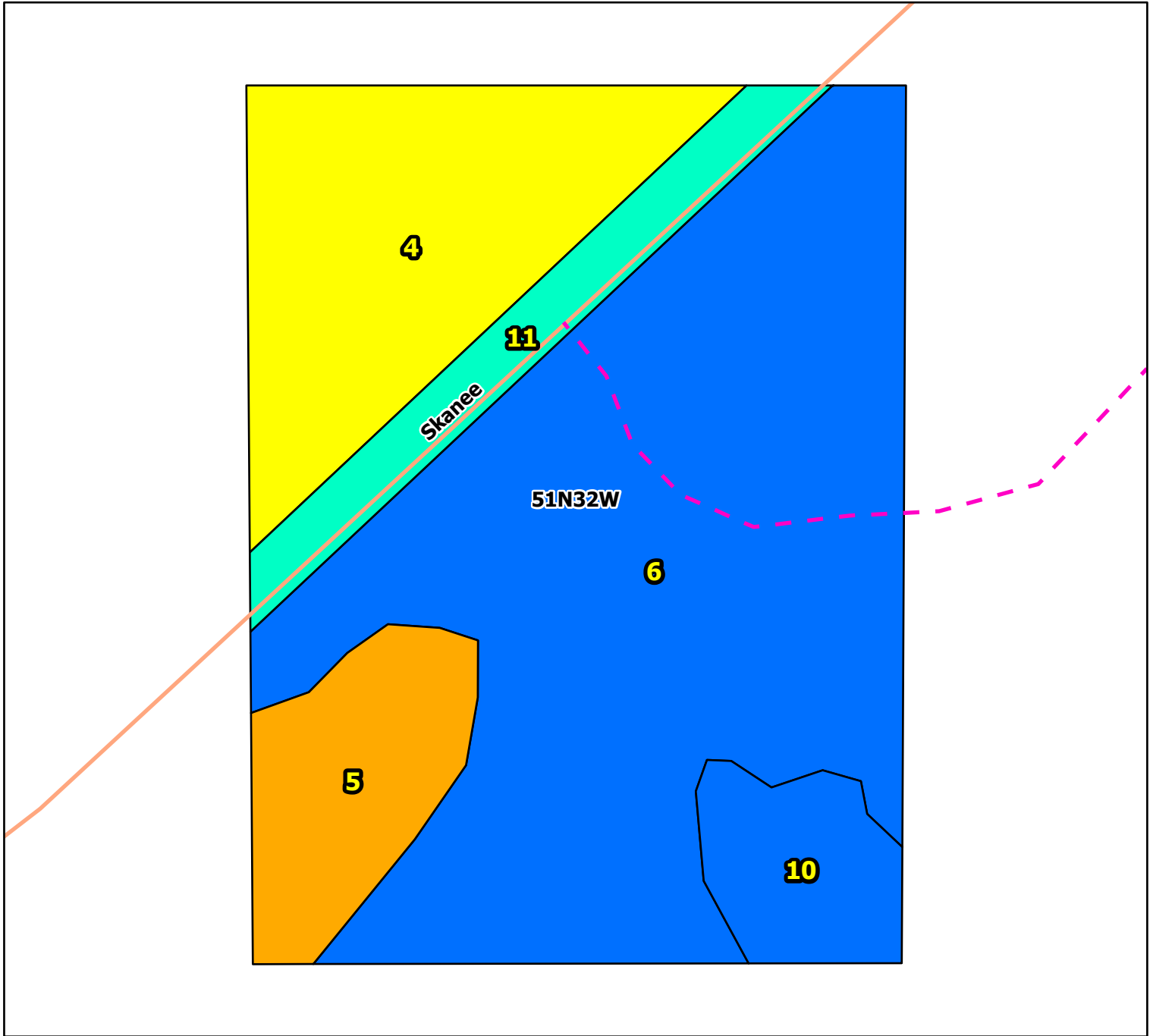
- Point A: Outdoor Classroom
- Point B: Potential site for future development



L'Anse Schools Property Activities - Skanee Road  
T. 51 N. - R. 32 W.  
E3/4 NE1/4 NW1/4 Section 24  
Baraga County, Michigan

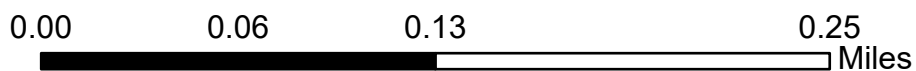
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### Management

- Roads
- Thinning 2023-28
- No Active Forest Management
- - - Access Roads
- Modified Clearcut 2023-28
- Re-evaluate 2032, 2042

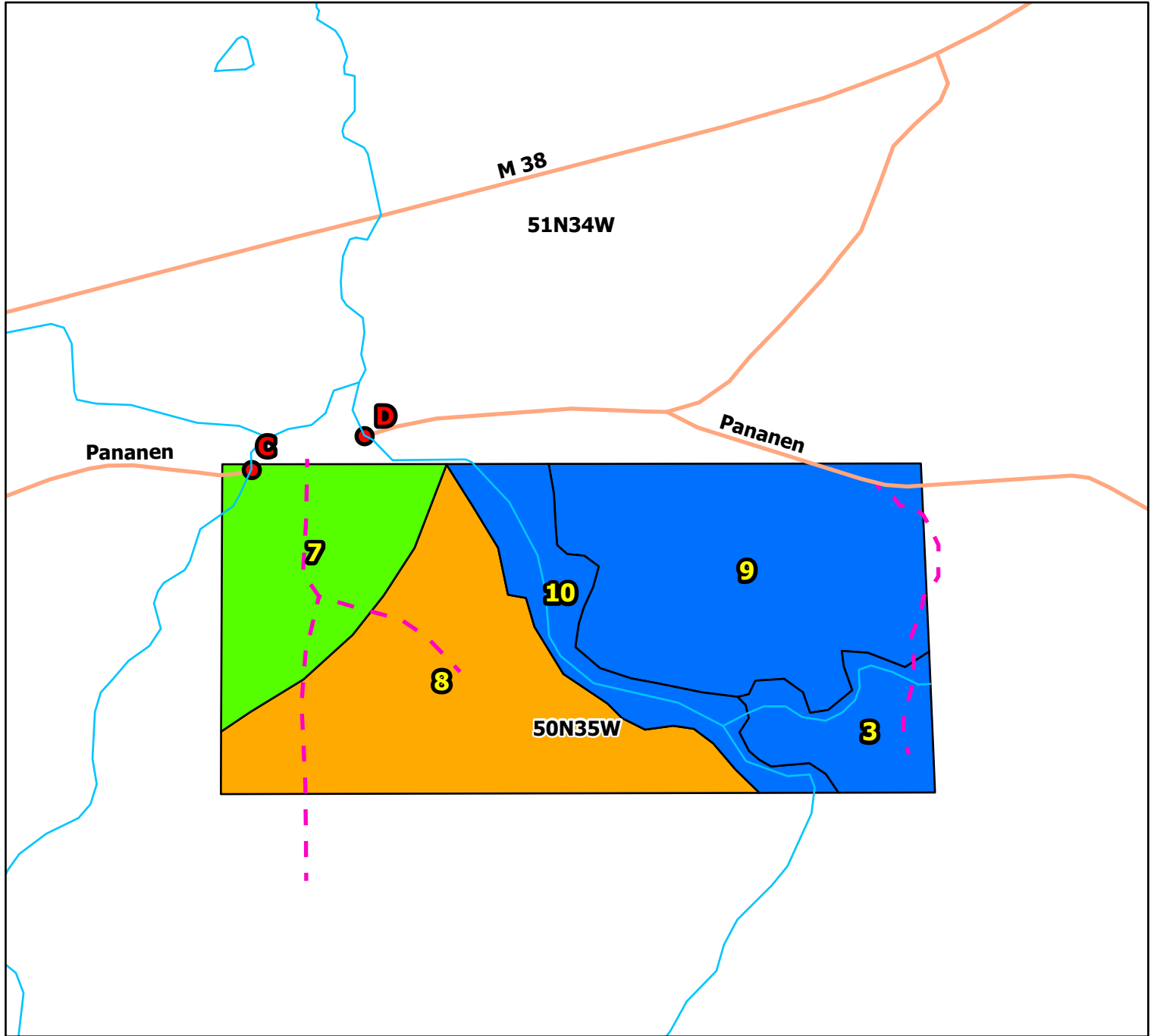


51N34W  
50N35W

L'Anse Schools Property Activities - Pine Creek  
T. 50 N. - R. 35 W.  
NE1/4 NE1/4 & NW1/4 NE1/4 Section 2  
Baraga County, Michigan

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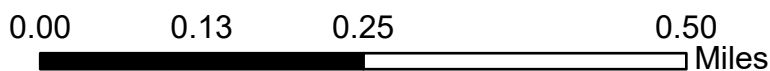
### Management

### Points of Interest

- Roads
- - - Access Roads
- Points of Interest

- Individual Tree Selection / Patch Clearcut 2037-42
- Individual Tree Selection 2037-42
- Re-evaluate 2032, 2042

- Point C: Removed temporary crossing
- Point D: Decayed bridge








L'Anse Schools Property Soils - Village  
T. 50 N. - R. 33 W.  
Portion of N1/2 SW1/4 Section 4  
Baraga County, Michigan

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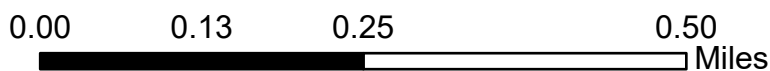


-  Water Features
-  Boundary
-  Soils

### Soil Type

27B: Munising loamy sand, 1 to 8 percent slopes

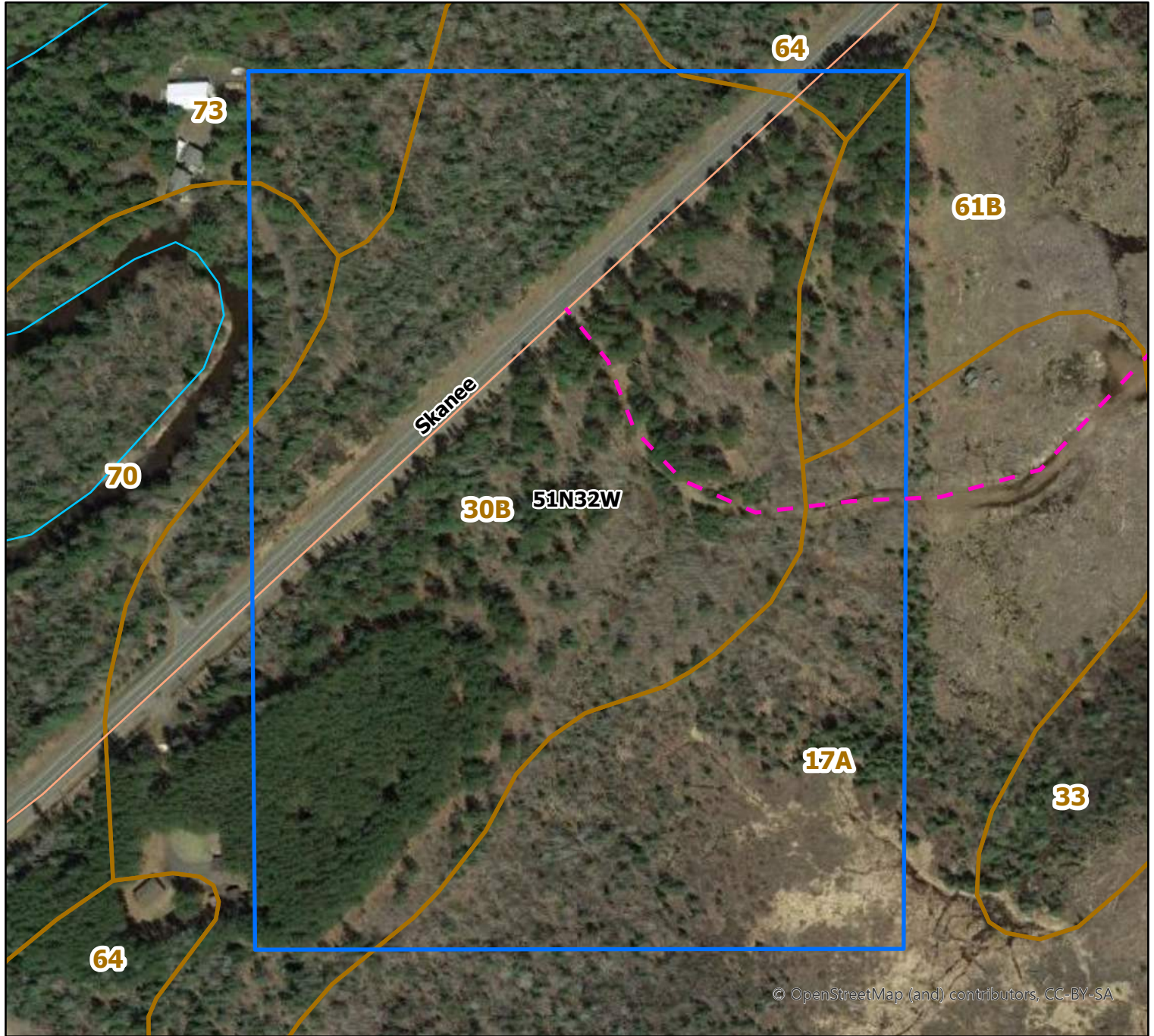
69F: Tokiahok-Frohling loamy sands, 35 to 60 percent slopes



L'Anse Schools Property Soils - Skanee Road  
T. 51 N. - R. 32 W.  
E3/4 NE1/4 NW1/4 Section 24  
Baraga County, Michigan

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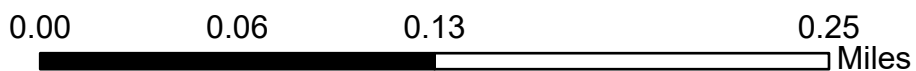
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-  Water Features
-  Boundary
-  Roads
-  Soils

### Soil Type

- 17A: Au Gres sand, 0 to 3 percent slopes
- 30B: Kalkaska sand, 0 to 6 percent slopes
- 61B: Ishpeming loamy sand, rocky, 1 to 8 percent slopes
- 64: Pits, sand and gravel
- 70: Winterfield fine sandy loam
- 73: Arnheim mucky silt loam

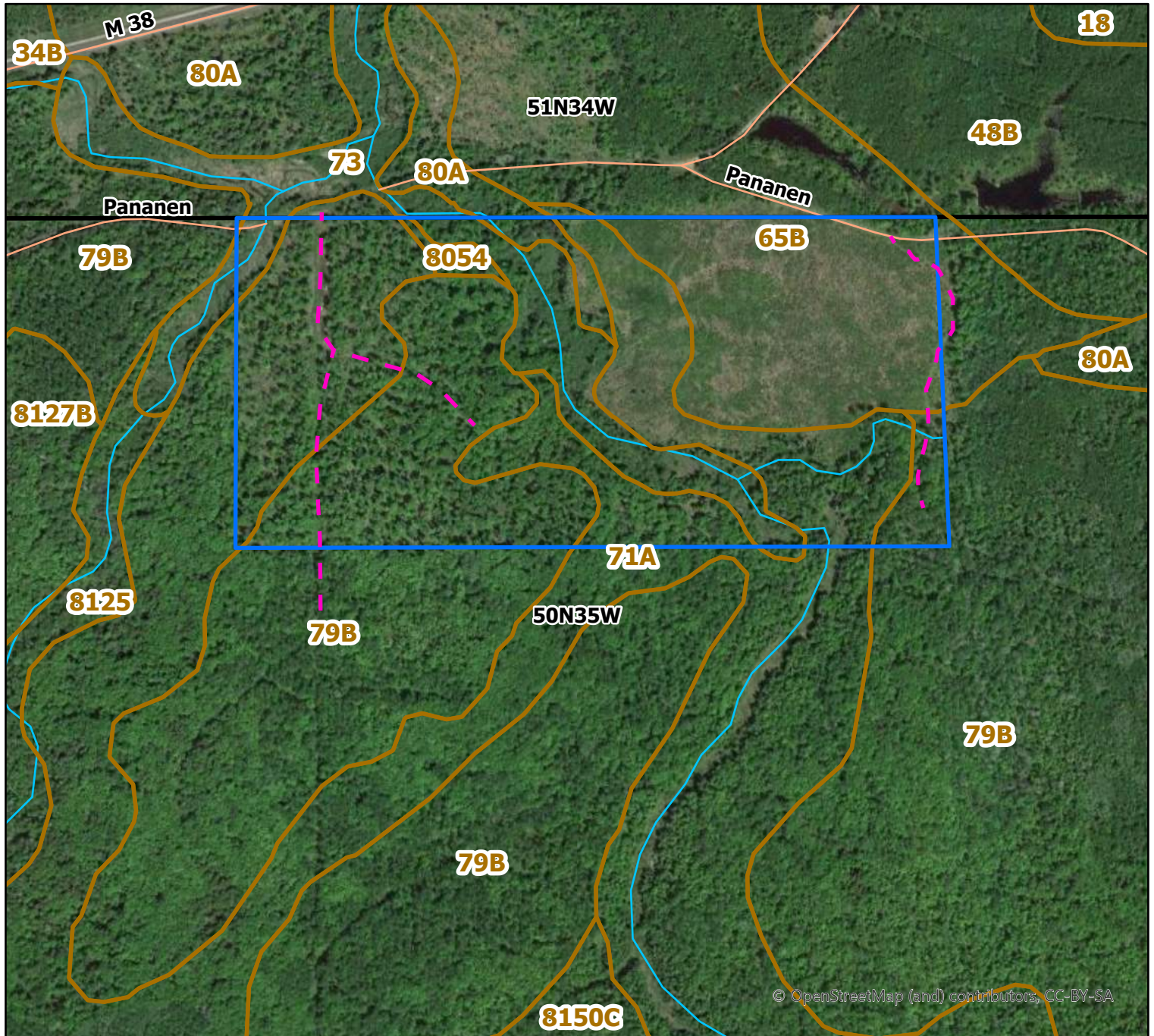


51N34W  
50N35W

L'Anse Schools Property Soils - Pine Creek  
T. 50 N. - R. 35 W.  
NE1/4 NE1/4 & NW1/4 NE1/4 Section 2  
Baraga County, Michigan

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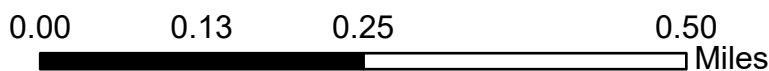
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- Water Features
- Boundary
- Roads
- Soils

### Soil Type

- 65B: Ocqueoc fine sand, 0 to 8 percent slopes
- 71A: Pelkie loamy very fine sand, 1 to 6 percent slopes
- 73: Arnheim mucky silt loam
- 79B: Nunica silt loam, 1 to 6 percent slopes
- 8054: Bowstring-Arnheim complex, 0 to 1 percent slopes, frequently flooded



## INTRODUCTION

This forest management plan has been prepared for the landowner L'Anse Area Schools in order to describe the current conditions of the forest and related natural resources on their property and to prescribe management activities for a period of 20 years, commencing at the date listed on the front cover of this plan.

After 20 years this plan will be considered expired and the property should again be visited by a forester in order to assess the conditions of the forest and to make recommendations for future management based on the conditions observed at that time. When the assessment of forest conditions occurs, this forest management plan should also undergo an update or complete revision; this decision should be made by the landowner with the advice of their forester. The property should undergo a brief inspection by a forester in approximately 10 years to determine if any significant changes have occurred on the property that may impact the recommendations set forth in this plan. This plan will describe:

- Goals and objectives of the landowner.
- All features and conditions observed on the land with a focus on those that relate to forest management.
- Recommended management options to fit the landowner's goals while managing the land sustainably and in accordance with current science.

This plan provides a wealth of information about the current condition of the property. At-a-glance information about forest types, management recommendations, harvest dates and soil types can be found on the maps included in Section I of this Forest Management Plan; a summary of the recommended management activities is provided in the "Recommended Treatment Schedule" which is located immediately after the narrative stand descriptions. More detailed descriptions of the forest conditions and explanations of the management recommendations are found in Section III of this plan. Photos are included to illustrate certain conditions and features that were observed on the property.

Terminology that is commonly used in forest management plans, but may be unfamiliar to the reader is defined in the Glossary in Section IV.

## LANDOWNER GOALS AND OBJECTIVES

The L'Anse Area Schools acquired their properties through private donations. They are primarily interested in managing their property for the continuation and enhancement of educational and recreational opportunities for students and the general public. They would like to maintain the current trail system in place, and are interested in increasing opportunities for student learning and involvement in the woods. They are interested in managing the more remotely located properties for sustainable timber production, increasing timber quality, productivity, forest health, and wildlife habitat. Having a forest management plan written under the compliances of the Forest Stewardship Program and the American Tree Farm System will help enable the landowner to meet these goals and objectives.

The landowner also desires guidance on specific landscape trees around the school buildings and facilities. They would like to select and plant landscape trees that will be successful, but also minimize future maintenance costs. While this forest management plan mainly focuses on the forested areas of the school owned property, some recommendations and thoughts will be provided for these situations as able.

## SUSTAINABILITY AND MULTIPLE USES

In many situations, management recommendations can be tailored to achieve multiple long-term goals while enhancing the current benefits the landowner obtains from the property; for instance, logging roads can be designed to facilitate a harvest now and meet the long-term needs of a landowner for accessing and using his or her property. Conducting sustainable forest management that considers both the current conditions of the land and the desired future outcomes will help to ensure that the future owners and users of the land will have equal opportunities to benefit from the forest. This principle, known as sustainable forest management, considers current conditions of the forest and applies scientific principles of forestry to ensure that the forest is able to provide "the greatest good [for] the greatest number in the long run," as stated by Gifford Pinchot, one of the founders of modern American forestry.

Management actions conducted on one parcel of land can affect natural processes on adjacent parcels. One example of this is when a poorly-built stream crossing washes out and clogs a neighbor's streambed with sediment, thereby degrading trout habitat. Likewise, the ecosystems found in a particular area can influence the outcomes of forest management. Attempting to establish a maple syrup operation on dry, sandy soils is simply not going to be a successful endeavor. Therefore, it is important for land management options to consider the types of ecosystems present on a given piece of land and on the adjacent properties. Natural occurrences such as windstorms, soil types and topography are not subject to property lines laid out by humans. Forest management that is based on natural disturbances and considers the range of factors that impact tree growth is a key component of broad-scale "landscape management." It is difficult to coordinate landscape management activities across a number of small parcels of land under different ownerships. Conducting sustainable forest management that considers the influence of ecosystems and mimics natural disturbances is one step towards landscape management. The recommendations made in this management plan have been developed to ensure sustainable forest use.

According to another pioneer in American conservation, Aldo Leopold, "... To keep every cog and wheel is the first rule of intelligent tinkering." This was an early reflection on what is today referred to as "ecological integrity." In short, ecological integrity consists of the ability of a natural system to continue to carry out its typical functions. In order for a system to continue to function, it is important that it retains its original components. Those components may include parts that we cannot see, as well as those that do not have a perceived or measurable "value." One example is deer populations. It was once thought that extirpating wolves and other predators would result in plentiful deer populations, and that there would be no disadvantages to this. Eventually it was realized that even with hunting used as a management tool, predators are still needed to cull out the weakest members of the herd. High deer populations can have negative impacts on forest vegetation and the diversity of tree species. Obviously, there are numerous factors at play in the current size of the deer herd, including winter intensity, feeding by humans, parasites, diseases, and hunting pressure. The interactions between wolves, deer and vegetation are a basic representation of dynamic natural systems. Historically, the focus of wildlife management was on increased populations of game species. Likewise, forest management at times becomes preoccupied with managing for the most valuable timber species, losing touch with the importance of other facets of the forest. Although we may not yet know or understand every interaction within the natural systems we manage, it is important to "keep every cog and wheel" so that these systems may continue to carry out their natural functions. Some species have been lost, so the systems of today may not behave in the ways in which they once did, but there is a degree of resilience to systems whereby other organisms may be able to take over a function. This resilience can be tested when invasive species are introduced that outcompete native species and their populations explode due to a lack of natural controls.

### **THIRD-PARTY CERTIFICATION OF SUSTAINABLE FORESTRY**

It's common in today's marketplace to see paper products and lumber stamped with a logo that indicates that the product has been produced "from responsible sources." The two most common logos are trademarks of the Forest Stewardship Council (FSC) and the Sustainable Forestry Initiative (SFI). These two organizations oversee the development and enforcement of standards of sustainability. The standards developed by SFI and FSC are intended to be globally-relevant and address such factors as diversity, protection of endangered species, protection of water resources, and even the rights of workers and indigenous peoples. Forest management certification was developed by the forestry community as a response to public concern about the loss of natural forests, especially in tropical areas. To attain certification, landowners and producers must adhere to the requirements set forth in the standards of sustainability for the program or programs from which they seek certification. They must also submit to periodic inspection by independent third parties who are familiar with the standards of sustainability, industry standards, and the science of forestry.

Another certification body, which may not always be thought of as such, is the American Tree Farm System (ATFS). The ATFS is a certification system that is unique to the American marketplace and is tailored to meet the unique needs and objectives of family forest owners. Wood produced in accordance with the ATFS standards can also be marketed as certified by SFI. Like the SFI and FSC programs, entities seeking ATFS certification must meet the standards developed by the American Forest Foundation. These standards may be viewed online at <https://tinyurl.com/5xuh29pf> or provided to the landowner upon request of Green Timber.

One of the key requirements of all three certification systems is the development of a forest management plan that meets a specific set of criteria. This plan has been written to meet the requirements of the ATFS. Through membership in the Green Timber Tree Farm Group (GTTFG) forest landowners can attain third-party certification of forest management at no cost to them. Members of the GTTFG sign a Memorandum of Understanding and agree to abide by the standards of ATFS and the requirements of the GTTFG. Because the certification of the group is impacted by the actions of all members, it is imperative that members abide by the requirements of the group. In the current marketplace, there is no financial benefit to third-party certification for small private landowners, however members of the GTTFG receive an annual newsletter, the right to display the familiar diamond-shaped Tree Farm sign, and other benefits from the staff of Green Timber. During times when forest products markets are particularly tight, third-party certification can make the difference between a harvest selling and not selling. More information about the GTTFG can be found online at <https://greentimberforestry.com/management/green-timber-tree-farm-group>.

## PROGRAMS FOR PRIVATE LANDOWNERS

Governments at both the Federal and State levels have long realized the contributions of private forestland to economic stability and growth, and even to national defense in times of war. More recently, additional benefits have been identified, including wildlife habitat, clean water, and carbon sequestration. In Michigan, "private individuals and families own 9.1 million acres or 45 percent of the forests throughout the state. All together the 400,000 family forest owners in Michigan are the largest group of forest owners and forest land area in our state. The average family forest in Michigan is 23 acres." (Source: Michigan Tree Farm Committee, 2019).

To encourage the continued management of forestland for the production of forest products, and minimize the loss of forestland to other uses, Michigan provides landowners with the option to enroll in one of two property tax reduction programs. These programs, Commercial Forest ([www.michigan.gov/commercialforest](http://www.michigan.gov/commercialforest)) and Qualified Forest ([www.michigan.gov/qfp](http://www.michigan.gov/qfp)), require a landowner to manage his or her property for timber production in accordance with a professionally-written forest management plan. Each program has unique requirements, but the overarching objective is to mandate that steps are taken to ensure continued forest growth at suitable levels, depending on the forest types present on a given piece of land.

In addition to the property tax incentive programs, landowners in Michigan have the option to pursue funding from one of at least two sources to help pay for the cost of a professionally-written plan. The rationale for these programs is the principle that landowners who are educated about their forest are more likely to make proper management decisions, which in turn ensures long-term sustainability of private forest land. In Michigan, landowners are able to get funding from the Natural Resources Conservation Service (NRCS) (<https://tinyurl.com/y45drzt8>) or from the Michigan Forest Stewardship Program ([www.michigan.gov/foreststewardship](http://www.michigan.gov/foreststewardship)). Ultimately, both of these programs are funded by the Federal Government; NRCS funding is administered directly by that agency and Forest Stewardship funding is administered by the Michigan DNR through a grant from the United States Forest Service. In addition to funding for forest management plans, the NRCS also provides funding to implement certain practices on privately-owned forest land. Green Timber Consulting Foresters or your local NRCS District Conservationist can provide more information about these opportunities. There are also a range of grant programs available from the Michigan DNR for wildlife habitat enhancements on private lands ([www.michigan.gov/dnr-grants](http://www.michigan.gov/dnr-grants)).

### *Forest Stewardship Plans*

The total cost of this forest management plan is being provided to the landowner by the Michigan Forest Stewardship Program. This is a program administered by the Michigan DNR and funded by the United States Forest Service to encourage private landowners to develop comprehensive forest management plans. The rationale behind this program is that landowners who are educated and informed about their property will make better management decisions, and well-managed forestland provides a range of benefits to all people. The Forest Stewardship Program is funded through federal appropriations to the Michigan DNR. Once this plan is completed and approved by Michigan DNR staff, the landowner's obligations to the Forest Stewardship Program will be fulfilled.

The Forest Stewardship funding provided by the Michigan DNR for this plan is an exceptionally higher amount than most stewardship plans due to the property's use. Properties used for education and outreach to the public, such as this one, are offered a higher funding option to offset more of the planning costs. This is likely the case for a variety of reasons including: general higher costs and lower revenues associated with these kinds of properties, more incentive to stay educated and practice good stewardship, and these properties benefit the public more than other privately owned parcels.



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## **SECTION II: THE LANDOWNER AND THE LAND**

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## GENERAL PROPERTY DESCRIPTION

### LOCATION

This property consists of three separate parcels, located in the L'Anse and Baraga Townships, within Baraga County, Michigan. In this management plan they shall be referred to by the name of their approximate location; the Village, Skanee, and Pine Creek properties. The Village property is located directly within the community of L'Anse. The Skanee property is located approximately eight miles northeast of the community of L'Anse. The Pine Creek property is located approximately eight miles west of the community of Baraga. The access route to the various properties are depicted on the Locator Map for each individual parcel, included in Section I of this management plan. There was minimal corner evidence across the properties, only on the Skanee and the Pine Creek properties was evidence found of section corner markers. There was minimal evidence of any marked property boundary lines across any of the three properties. Foresters often use existing survey evidence to delineate timber harvest boundaries in the field. The boundaries of a timber harvest generally are very close to the true property boundaries however a forester is not qualified to set a legal property corner or boundary. Michigan Statutes mandate that a registered professional surveyor must set all legal property corners and boundaries. More information about surveyors in Michigan is available online at <http://www.misps.org/>. The legal description of the three properties are:

<b>Village Property</b>	<b>Skanee Property</b>	<b>Pine Creek Property</b>
T. 50 N – R. 33 W Portion of N ½ SW ¼ of Section 4 L'Anse Township, Baraga County, Michigan 28 acres	T. 51 N – R. 32 W Portion of NE ¼ NW ¼ of Section 24 L'Anse Township, Baraga County, Michigan 30 acres	T. 50 N – R. 35 W 62-acre portion of N ½ of Section 2 Baraga Township, Baraga County, Michigan 62 acres

### BRIEF DESCRIPTION

The three properties within the L'Anse Schools ownership are primarily dominated by northern hardwoods forest cover types, with some conifer. The soil conditions vary across the properties, but the primary soil type consists of a loamy sand. All three properties are relatively flat, with some rolling terrain, but generally the sandier sites are found on areas of higher ground, with wetter, mucky soils on lower ground. These soil conditions support most tree species that are tolerant of both drier and wetter conditions.

The Village property is located directly within the town of L'Anse, and includes the most of the school buildings and facilities. This property also contains some forested areas surrounding the school, specifically on the east side of the parcel close to the sports activity fields. The forested areas on the Village property sees the most use, being in town and with convenient access for students, staff, and the local community.

This property contains a couple hiking trails within the forested area, one main summer trail that was developed in the last 10 years, and one interpretive trail that doesn't appear to see much summer use. This interpretive trail likely sees more winter use via snowshoe trails. If future harvesting or other significant forest management activities within this property ever take place, extra care and precautions will be necessary to minimize the negative visual impacts that timber harvesting can sometimes bring.

The other properties, the Skanee and Pine Creek properties, are remotely located and surrounded by other forested properties. These remote parcels have not been developed in any way for school use, and generally are not used by the school for any particular educational related purpose. Instead, these parcels are primarily used for sustainable timber production, and likely see some public foot traffic for hunting. Any harvesting that occurs on these properties should not have any negative impacts on the neighboring parcels.

## LAND HISTORY AND PAST LAND USE

Humans have utilized this land and its resources for many years. There is little debate that early humans interacted with, and in many cases, modified vegetation however there is much speculation regarding the extent of human influence on the land prior to European settlement in this region. Foresters, climate scientists and others have utilized information gathered during initial government land surveys to develop a "snapshot" landscape scale map of prevailing forest cover across Michigan at the time the surveys were completed in the late 1800s.

Prior to European settlement, four different forest cover types were seen to dominate across the three different properties. Late 1800s survey records indicate that the Village property was once dominated by hemlock and yellow birch, with occasional components of sugar maple. These three species are similar in the fact that they are all relatively slow-growing and shade-tolerant species. Due to the fact that these species are somewhat slow-growing, they are often outcompeted in full light conditions by early successional species such as aspen and white birch. However, when a dominant canopy is maintained, the understory becomes shaded. This shading eliminates competition from faster growing, early successional species. Once shade-tolerant species become the dominant species, they are able to continuously regenerate in the absence of a catastrophic disturbance removing a large proportion of the dominant canopy. The persistence of this cover type on the landscape without human disturbance indicates that this area was historically subjected to low to moderate frequency, low intensity disturbance. This form of disturbance typically only removes single or small patches of dominant individuals. Two commonly observed disturbance types that exhibit these characteristics are windthrow and natural single-tree mortality.

Windthrow is the process of single or multiple trees being tipped over by high winds. In large tracts of contiguous hardwoods, this typically only occurs in the tallest, large-crowned, and typically most mature individuals in the stand as the "average," individuals shelter each other. However, the tallest individuals remain exposed to the wind above the majority of the surrounding canopy. The tallest individuals then catch the high winds, their crown acting as a sail. The winds are then able to push the tree over. This motion exhumes the root network of the tree and surrounding soil, creating bare mineral soil and microtopography in the stand, which is required by some tree species seeds to germinate.

The absence of the mature tree's crown in the canopy creates an influx of sunlight to the forest floor and advanced regeneration that has been persisting in the shaded conditions. The same effect is observed when mature individuals die from natural mortality. This influx of light allows the regeneration to grow, where it will eventually fill the canopy gap and maintain shade-tolerant species dominance in the stand.

The Skanee property was also historically dominated by hemlock and yellow birch, with portions being dominated by a low conifer swamp. Species found in the low conifer swamp cover type commonly include black spruce, northern white-cedar, and occasionally balsam fir and tamarack. These four species exhibit similar growth characteristics: being moisture-tolerant species that are somewhat shade tolerant, but regenerate best in full-light conditions. Additionally, these four species, except for cedar, are short-lived species. The dominance of short-lived, shade-intolerant species at this site in the absence of significant human disturbance suggests that this area was historically subject to moderate-intensity, stand-replacing events. Such events include wildfire, pest and disease outbreak, and severe windthrow events.

Fir, spruce, and tamarack are all species that become highly vulnerable to forest pests and disease as they age. Forest pests such as spruce budworm and eastern larch beetle are capable of causing mass mortality of these species in a given area over two or three growing seasons. In the event of such a pest or disease outbreak, fuel loads will rapidly accrue in the effected stand, making it much more susceptible to wildfire. When an ignition source (most commonly lightning in natural ignition) ignites an area with high fuel loads under the right conditions, a wildfire can start. If a burning stand has enough fuel ladders, a small ground fire can rapidly spread to the canopy of a forest, where high winds will rapidly increase the fire's temperature and rate of spread. Such canopy fires often have the capability to remove the entire dominant canopy of forests, leaving full-light conditions required by certain tree species seeds to germinate. Black spruce in particular requires high temperatures to release seeds from its serotinous cones, and the presence of black spruce in this area historically is another indicator of potential wildfire in the past. However, broad-scale windthrow and mortality created by severe pest and disease outbreaks can also remove a dominant canopy on their own, so it's difficult to say with much certainty which one of these three historical disturbances was most prevalent in this area.

The Pine Creek property was historically dominated by two different forest cover types: cedar and hemlock, and hemlock and sugar maple cover type. The cedar and hemlock cover type is very similar to the cedar swamp cover type that was described above for the Skanee property. Considering how hemlock is also a dominate species along with the cedar in this cover type, it suggests that the soils are drier and not as saturated with water, to be able to sustain the hemlocks. The persistence of this cover type on the landscape without human disturbance indicates that this area was historically subjected to low to moderate frequency, low intensity disturbance. This form of disturbance typically only removes single or small patches of dominant individuals. Two commonly observed disturbance types that exhibit these characteristics are windthrow and natural single-tree mortality. The hemlock and sugar maple historic cover type is similar to the hemlock and yellow birch cover type described above for the Village property, the only difference being a greater presence of sugar maple with less of a presence of yellow birch.

Following European settlement, the forests of Upper Michigan were logged in three phases during the late 19<sup>th</sup> and early 20<sup>th</sup> centuries. The first phase consisted of a focused effort to only harvest the highly sought-after white pines because lumber from these trees was in high demand at the time. When the seemingly endless supply of pines dwindled, many people left Upper Michigan for the western and southern forests. Those who stayed found opportunities in the hemlock and hardwood forests that remained, transitioning to production of hardwood lumber, railroad ties, mine timbers, charcoal for the manufacturing of iron, and chemical wood for industrial processes. This second phase of logging had the biggest impact on most of the landscape because it cleared the forests that remained after the pines were “cherry picked” out. These new uses created markets for species that were once considered useless, in addition to utilizing a higher percentage of the volume in each tree when compared with the past pine logging. In many parts of the Upper Peninsula wildfires broke out, burning the large amounts of slash and debris that remained following the first two phases of logging. As the fires subsided, the forests began to naturally regenerate with a diverse mixture of tree species. The tree species composition and quality of the forests that regenerated were largely determined by the available seed source and soil conditions. Aspen was one of the most common species in this regenerating forest and once again, markets and utilization adapted to the change in forest composition, leading to today’s highly mechanized pulp and paper industry, new products like fiberboard, and the advent of selective cutting. More detailed information about historical forest succession and early human impacts on the forests of Upper Michigan can be found at <https://www.nrs.fs.fed.us/gla/reports/history.PDF>.

The Village and the Pine Creek properties have been actively managed in the past. The Skanee property has not had any recent harvesting activity. On the Village property, evidence of old cut stumps suggest that the forest experienced a light thinning around 20 years ago, maybe around the year 2000. The thinning would have removed some of the low quality trees and opened up the canopy, improving the health and productivity of the stand. Around 2012, additional trees were removed from the stand, creating space for the establishment of the hiking trail system which is currently in place.

The Pine Creek property was last harvested by two different logging companies about two years apart. The first harvest was an aspen clearcut on the east side of the parcel, which occurred around 2013. This first logging company did not pursue a stream crossing, then leaving the west half of the parcel unharvested. The west half of the property was then harvested around 2015, by a different company where a hardwood thinning was implemented. Areas of lower quality trees with aspen clones was more aggressively thinned, removing the poorer quality stems and the aspen. The areas of higher ground with better quality stems were thinned more lightly. Overall, both harvests appear to have been well conducted, resulting in a healthier forest with enough canopy space to promote further tree growth. Discussions with school staff implied that Byron Sailor, a retired forester, helped set up and conduct both harvesting efforts.

There are no known archaeological or historical sites on the property. If any evidence of such a site is ever located on the property, immediate steps should be taken to protect the site or sites. If a timber harvest or other activity is occurring, it should be temporarily halted until the State Historical Preservation Office (SHPO) can be contacted to determine the nature of the site. The SHPO can then provide recommendations on how to properly protect and, if necessary, document the site. If a landowner does not wish to notify the SHPO of such a site, it is still recommended that activity that may damage above-ground historical resources be avoided and that soil disturbance is minimized so that buried items are protected. Contact information for the SHPO is available online at <https://www.miplace.org/historic-preservation/about-shpo/contact-shpo/>.

## CURRENT LAND USE

The forested areas of the Village property are currently being used mainly for recreational and educational opportunities for both the students and the public. The hiking trails which run through the main forested area are heavily utilized by teachers and other members of the public who like to walk the trails during a quick lunch break or during after school hours. The trails are also used year-round by students for different school activities, including the summer reading program that is put on by Friends of the Library. Interpretative signs illustrating different tree species or habitats have been placed over the years by students for various different projects. These interpretive signs appear not to be placed along the main summer hiking trail, but instead along what is likely a trail system that is mainly used as a snowshoe path during winter months. There are also bat houses that were made by students placed along the summer trails.



Figure 1: Image of a student's interpretative sign along a walking trail on Village property.

The Village property also contains the most important part of the school system, the school facilities themselves. This primarily includes the school buildings, but also parking lots, playgrounds, maintenance buildings, sport activity fields, and other aspects that facilitate the day-to-day operations of a K-12 school. These areas obviously see the most use and activity from students and staff.



The Skanee and Pine Creek properties are open to the public, but receive less usage as compared to the Village property. Due to the remote location of the Skanee and Pine Creek properties being outside of town and in a greater forested landscape, these properties offer greater potential to display and educate students on the more industrial aspects of forest management. Aspects such as forest inventory, harvesting, and monitoring forest growth and succession is easier to see on these remote properties versus the Village property. The school also utilizes the facilities and professional educational capacity of the Alberta Ford Forestry Center to help convey these lessons. These remote properties may receive some usage by the public for hunting purposes as well. Due to lower recreational use, the school is interested in managing these remote properties for sustainable timber production and maximization of growth overtime. Aesthetics of these remote properties is a secondary objective.



Figure 2: Representative image of the summer walking trail through the Village property's forest.

Allowing hunting on school forest land is always a sensitive topic due to the inherent risk of operating firearms, and the potential liability issues surrounding this topic. If this liability is cause of concern, it is recommended that the superintendent and school board discuss and make appropriate decisions and recommendations. Consultation of a lawyer to help understand the exact laws and potential liability concerning school forest properties may be necessary. It is recommended that no hunting is allowed on the Village property due to the increased recreation and school related traffic this parcel sees. From a local forestry standpoint, there is little to no concern with allowing hunting on the remote parcels that the school owns. The parcels contain no development, and are entirely natural. There is no risk of damage to facilities by allowing hunting and public traffic on these parcels. Additionally, there seems to be little to no public traffic on the remote parcels, further limiting most risk of accidental hunting accidents. Compared to any other parcel of land open to public hunting, risk is the same. If the school would for some reason still like to restrict or limit the use of any of their forested parcels for hunting purposes, they could employ any of the following strategies:

- Post signage discouraging land use for hunting
- Block roads and trails with gates or earthen berms to minimize vehicle traffic. This in conjunction with signage would be most beneficial.
- Monitor plat books and online public access maps (such as OnX Hunt maps) to ensure these sources aren't showing the school forest land as open to public access and hunting.

## CURRENT LAND CONDITIONS

### WATER AND WETLANDS

There are no large water bodies located on any of the three properties. On the Pine Creek property there are two small drainages that run through the property, separating the aspen stand from the rest of the hardwoods. These streams combine with Pine Creek just north of the property, which then continue to flow north and east until they connect to the Sturgeon River. This property is located in the Sturgeon River Watershed, meaning that any water which flows through the property and the surrounding areas eventually will flow into the Sturgeon River, and eventually Lake Superior. While there are no drainages located directly on the Skanee property, the Silver River does flow right along the northwestern boundary of the property. Any water running off of the Skanee property eventually flows into the Silver River, which then flows into Lake Superior in the Huron Bay. The Village property is located within the Little Silver Creek-Frontal Keweenaw Bay Watershed, meaning that any water flowing through this property will eventually flow into Lake Superior in the Keweenaw Bay. With any timber harvests that occur on any of these properties, particular consideration should be given to minimizing soil compaction and rutting in order to prevent the potential for erosion which can lead to long-term losses in soil productivity and water quality of the described water features.

It is important that any timber harvesting or other equipment operation on this property considers the potential impacts it may have on water and soil quality. Soil erosion and poor timber harvesting practices can introduce a range of contaminants, including soil particles, leaves and other organic debris, lubricants, fuels, and other chemicals, into surface water and groundwater. Once these contaminants enter water, they can be very difficult to remove. Soil eventually settles out of the water however it can then alter the bed of the lake or river in which it settles, thereby degrading habitat for aquatic insects and fish in larger streams. Man-made contaminants, especially pesticides, fuels and lubricants can have a more drastic impact, especially in large quantities. These materials also do not settle out of the water. For these reasons it is important that loggers are instructed to use care when fueling, lubricating or conducting any other maintenance on their machines.

Forests play many critical roles in the water cycle. During summer rainstorms, forest canopies intercept rainfall, helping to reduce the velocity of the water before it hits the soil, thereby reducing erosion which helps to keep streams, rivers, and lakes clean. Some of the water intercepted by the canopy never reaches the ground as it evaporates back into the atmosphere following the rainstorm. This helps to reduce the amount of runoff. The water that does reach the soil is often reabsorbed by the trees and is either utilized by the trees to conduct photosynthesis or is returned to the atmosphere in a process known as transpiration. The shade of forest canopies, particularly in conifer-dominated forests, helps to slow the rate at which snow melts in the spring. This in turn helps to mitigate water fluctuations in rivers downstream. The great cutover of the late 19<sup>th</sup> and early 20<sup>th</sup> centuries removed forest canopies over large parts of the watersheds of many major river systems. As a result, communities downstream began to experience catastrophic flooding as the snow rapidly melted. Dams were built partly for flood control to address these problems. Trees in wetlands act as pumps helping to keep the area from becoming excessively wet. The loss of trees in a wetland can result in what is known as "swamping."

This is a rise in the water table that makes an area unsuitable for tree growth and is often followed by the invasion of species like tag alder and cattails. It is important that timber harvesting in wetland areas consider the possibility of rising water tables and maintain enough trees on a site to keep “pumping” water into the atmosphere. If a water table rises too much, it can drown out the trees that are left behind.

In accordance with Tree Farm, it is required that management activities that are implemented on this ownership adhere to the guidelines found in the “Sustainable Soil and Water Quality Practices on Forest Land” manual, also known as Michigan’s “Best Management Practices (BMPs).” This manual can be found on the Michigan DNR website at <https://tinyurl.com/y8myllnv>. Pertinent BMP information will be included in the sections of this plan where they apply.

## WILDLIFE

The L'Anse Schools place a high value on wildlife and preserving wildlife habitat. People that use walk on the trails on the Village property enjoy seeing the deer and other wildlife that pass through the forest. As a school project, the students built bat houses and set them up across different points of the hiking path to enhance the bat habitat. Enhancing deer and grouse habitat is also of interest for the Skanee and Pine Creek properties, for those who may use these properties for hunting if that activity is deemed acceptable and allowed.

There are a few passive things that can be done to benefit wildlife on this property. The first is ensuring that some large dead or hollow trees are retained on the property following a timber harvest. Retention of large cull trees, which are live trees with little to no economic value, as well as standing dead “snags” in a forest provides quality habitat for many species of wildlife. These “wildlife trees,” or “den trees,” are low in timber value but they still provide a range of benefits to wildlife. Raptors use these trees as nesting locations, or to perch in and hunt from. Animals such as porcupines, bats, and owls use cavities in these trees as dens. Insect larvae feed on decaying wood and many are eaten by woodpeckers. Those insects that reach maturity are a source of food for songbirds, bats, reptiles, and amphibians. Once the trees die and fall over, other animals use the down logs, known as coarse woody debris, for various purposes. Raccoons, foxes and numerous small mammals use down logs as dens. Grouse may use the logs as drumming logs during their mating season. Coarse woody debris retains moisture and provides a crucial refuge for salamanders and other amphibians during hot summer days. When coarse woody debris has decayed to a point where it is no longer usable by most wildlife, it becomes a part of the soil. Snags and coarse woody debris can also harbor disease and insects that may grow to a large enough population to detrimentally affect the live trees on the property, however during the field inspection, no serious concerns were noted. Proper forest management must consider the balance of providing enough snags and coarse woody debris to retain the value of the property for wildlife without posing a threat to the health of the forest. The wildlife trees retained on the property should be carefully selected to ensure that they are not harboring any serious diseases or pests that may negatively impact the overall health of the forest. Generally speaking, larger wildlife trees are more beneficial because they take longer to decay and have the capacity to support larger wildlife.



Figure 3: Image of student bat house on the Village property

An additional step to potentially benefit wildlife in the short term is by taking care when walking in the woods during the spring months. Many species of birds construct nests on the ground or in low-growing shrubs and these nests could be easily damaged by a footstep or other traffic. Also, the survival strategy of a newborn fawn is to remain absolutely still when it is in danger, so it could be possible to injure a fawn if one does not walk with care.

Fields and other openings in the forest create edge habitat. Edge habitat occurs at the transition between two distinctly different cover types, most often the transition between forests and clearings. In addition to the herbaceous plants which provide a source of forage for many species, the trees growing along the edge of the forest form very dense crowns that extend low on the tree trunk. These dense, extensive crowns provide extra nesting habitat and produce high quantities of seed. Birds of prey including bald eagles and hawks also take advantage of these open areas for the easy hunting such areas provide. The Skanee property for example, offers a source of edge habitat, between the aspen cover type and the lowland brush, in the southeast corner of the property.

The following tables provide a sampling of some of the wildlife that may be observed on and near the property.

**The various forest types are used by migrating and non-migrating birds such as:**

Black-capped Chickadee	Kingfishers	Warblers
Blue Jay	Nuthatches	Wild Turkeys
Flickers	Ruffed Grouse	Woodcock
Finches	Sparrows	Woodpeckers
Grosbeaks	Thrushes	Wrens

**The northern white cedar, mature pine and mature hardwoods found on the property and in the area offer ideal perching, hunting and nesting opportunities for owls and other raptors such as:**

Bald Eagle	Great Horned Owl	Red-Tailed Hawk
Barred Owl	Northern Goshawk	Rough-Legged Hawk
Broad-Winged Hawk	Red Shouldered Hawk	Saw-Whet Owl

**The wetlands and streams found on and near the property offer good habitat for wildlife species that require large amounts of lowland brush and water to survive. Some of the animals that may be found in these areas of the property are:**

Beaver	Frogs	Otter
Bitterns	Hérons	Turtles
Fish	Muskrat	Various Waterfowl

**There are many terrestrial animals that exist on the property. The vegetation provides a variety of food sources and rotten, hollow trees offer den opportunities. Some examples of the animals that benefit from the habitat of this property and the surrounding area are:**

Black Bear	Mink	Salamander
Bobcat	Pine Marten	Snakes
Chipmunks	Porcupine	Toads
Coyote	Rabbit	Weasel
Fisher	Raccoon	White-tailed Deer
Fox	Red Squirrel	Wolf

## FOREST HEALTH

Forest health is a broad term and may have different meanings to individual landowners as well as forest managers. In this section, specific information is given about threats to forest health and the resilience of the forests growing on this property. Special emphasis is given to “pest” problems in the form of both native and non-native insects and diseases, such as fungi, that are most relevant to this property and location.

Overall the forested properties are in good health. There is some damage and mortality from the emerald ash borer on ash species, but ash makes up a relatively small component of the hardwoods and therefore is not greatly impacting the overall forest health. There is some maple dieback seen in the maple trees on the Village property but the extent of the dieback appears to be minimal at this time. There is also a moderate infection of cankers on the maples on the Skanee property.

It is important to recognize that insects and fungi are a natural part of all forests. The forests in this region have evolved over thousands of years in concert with a particular suite of organisms. In an unmanaged forest, these organisms serve to rid the forest of less vigorous trees and those that are stressed by other factors such as physical damage caused by wind or fire. The death of these weaker trees frees up growing space, nutrients and water for the most vigorous trees; dead fallen trees are recycled into the soil. Given favorable conditions, it is possible for native organisms to reach such high populations that they are capable of damaging and even killing perfectly healthy trees. In a catastrophic outbreak the damaging agent eventually runs out of habitat, essentially “eating itself out of house and home” at which time its population returns to normal levels allowing the forest to redevelop, usually in a younger state. In other cases, conditions may change, becoming unfavorable for the damaging agent, or predators arrive and bring its population back in check.

As a general rule, younger trees and those that are growing vigorously are the most resilient to damage caused by insects and diseases. Trees do not “heal” damage, rather they rely on their ability to compartmentalize, or “seal off” damage caused by fire, insects, fungus and wind. Rapidly sealing off a wound minimizes the chances that insects or diseases can enter the tree through the wound. Young trees and vigorously growing older trees are the most capable of compartmentalizing damage and growing new wood over the damaged areas; slow growing trees are less able to fend off subsequent attacks. Additionally, certain species are better at surviving damage. White birch, balsam fir and aspen are naturally very short-lived trees with wood that is very susceptible to decay, as a result physical damage to these trees is typically more likely to lead to major problems than equivalent damage to a white pine, cedar or sugar maple.

Forest health does not necessarily equate to timber quality. A large, vigorously-growing white pine may have many large branches that are undesirable for the production of quality timber. Conversely, when a stand is selectively harvested, trees with dieback or physical damage may still be capable of yielding quality sawlogs if they are harvested in a timely manner, before the disease or decay has had a chance to progress. Maintaining a healthy forest involves periodic observation; this can be as simple as a landowner noting an unusual condition and contacting a forester to assess it. Annual monitoring is not always necessary unless a particular severe insect or disease is threatening the forest on the property.

## Emerald Ash Borer

Ash trees make up a minor proportion of the stocking on this ownership. All species of ash trees<sup>1</sup> are susceptible to damage and death caused by an insect known as the emerald ash borer (EAB), which is an insect native to Southeast Asia that is believed to have entered the U.S. through shipping materials. Once an ash tree is infected, it can be killed by EAB in a matter of a few years. Populations of ash trees in Lower Michigan are being decimated by EAB; in the Upper Peninsula EAB has been documented, however its impacts are minimal thus far. The adult stage of EAB, shown in Figure 4, is virtually harmless to trees, however the juvenile stage of the insect (larva) feeds on the living tissues of the tree just under the bark; this cuts off movement of water, nutrients and energy throughout the tree. Over a period of just a few years, the presence of these larvae will cause enough damage to completely kill the tree. There are a few things to watch for that may be indicative of an EAB infestation. The most obvious signs are death of ash branches progressing from the top downward towards the trunk. As the top branches of the tree are killed, the tree will produce epicormic branches, or suckers, low on the stem in an attempt to continue producing energy. As the top branches die, the bark will begin to slough off and S-shaped tunnels will be seen on the exposed wood. These symptoms would generally be observed in multiple trees; the death of a single ash tree is not necessarily indicative of EAB, it may be a result of some other factor. Ash trees are found as a minor component across this entire ownership; the loss of this species will not drastically change the forest, however the loss of a species is still a concern due to the change in diversity.



Figure 4: Adult Emerald Ash Borer

## Eutypella and Maple Borer

Sugar maple is one of the most common tree species observed in the canopy of the forests across this ownership. Sugar maple is impacted by two factors, one fungus and one insect; both native and therefore are not significant concerns. Neither is common on the property however by being aware of the fungus and insect, the landowner will be less likely to be alarmed if either one is noticed impacting the maple trees on the property. The first of these is the Eutypella canker, which is caused by a fungus and is sometimes known as “cobra heads” because of the resemblance to a cobra, as shown in Figure 5. The spores of this fungus enter a tree’s cambium through a wound in the bark.

The fungus causes death of the cambium; this dead area expands each year, using energy and nutrients from the tree. The fungus itself is not capable of killing trees, however the canker can girdle a tree over a span of several years, leading to death. Additionally, the canker causes a major weak spot in the trunk of the tree that makes it highly susceptible to wind breakage.



Figure 5: Eutypella canker on a sugar maple on a similar property

<sup>1</sup>Species of mountain ash, including American mountain ash and European mountain ash are not impacted by EAB as they are not “true” ash species.

Trees with *Eutypella* should be cut during commercial harvests. If cankers are bucked out of the tree to improve log grades, the exposed face of the canker should be left facing downward into the soil to minimize spore dispersal as spores can travel in excess of 75 feet if wind conditions are favorable. Limiting harvest damage can also help to prevent spores from infecting other trees.

The sugar maple borer is a native beetle that causes damage to the trunks of sugar maple trees; the larvae of this insect spend most of their lives living within the trunk or larger branches of sugar maple trees. During the first year the larvae burrows into the tree and feeds on the sapwood, or outermost layers of wood; this is where it also spends its first winter. During the second year, the insect burrows deeper into the trunk of the tree where it overwinters for the second year before emerging to mate in early to mid summer. This activity degrades the quality of lumber and other solid wood products, in addition to opening the tree up to infection by fungi and other diseases. There is little that can be done to completely exclude the sugar maple borer from a stand; instead it is important to remove trees with signs of damage during commercial timber harvests in order to free up space for trees that have not been damaged. Figure 6 shows a sugar maple with a sugar maple borer scar.



Figure 6: location of an old sugar maple borer scar

### Top Dieback

Top dieback, also sometimes known as sugar maple decline, is a problem that seems to occur at varying frequencies through time and impacts different areas more severely than others. Top dieback has been a concern to forest managers throughout central and western Upper Michigan for the past five to ten years although it has been observed at other times in the past. The exact cause of top dieback of maple is generally unclear, however it seems to be associated with stresses caused by common environmental factors, the most significant of these is drought or water stress. Some studies have indicated that top dieback could be a result of earthworms being spread across the landscape, which is likely true in many areas, but is probably not the reason for the dieback across the forest on the village property.

As previously stated, top dieback is commonly associated with drought or water stress. When a tree is not able to effectively transport the necessary amounts of water up to the foliage, the tree aborts branches and foliage in an effort to reduce the demand for water. This normally starts at the very top of the tree and works downward overtime. If the drought period is short, trees will rebound and grow new branches back into that lost canopy space. If moisture stress continues, trees will continuously reduce their canopy size until they can no longer support themselves, succumb entirely, and die. There are different causes that can result in top dieback conditions, and the following paragraphs discuss some of the more common ones associated with recent timber harvesting or other human activity.



Trees that are retained in previous harvest operations generally have small crowns that were accustomed to competing for sunlight, and were maybe growing in somewhat shaded conditions. Timber harvesting opens these residual trees to more sunlight than they were previously accustomed too. The increased sunlight falling on the leaves of the trees increases the heat experienced and transpiration rates. Transpiration is effectively the tree "sweating" from its leaves and keeping it cool. Increased transpiration requires more water, but without adequate time to bolster the existing rooting capacity, the trees instead have to abort certain branches to maintain enough water for their remaining branch structure.

Another potential change after timber harvesting could be the available water capacity for roots to pull from the soil. Increased amounts of sunlight penetration to the soil level can increase evaporation, and essentially dry out the soil sooner than normal during periods of drought. Also, soil compaction from construction and equipment operation on roads and skid trails can also limit rooting capacity and water retention. Roots require space and air to grow through the soil, and soil conditions that are compacted or saturated from rutting don't allow for conducive root development. Less roots results in trees that have less water collection capacity, and therefore are not able to support the canopy and water demands that they once did, or need to in the newly created canopy conditions. Compacted soils also hold less water, resulting in a lower available water capacity for tree roots to pull from.

While implementing future forest management, care must be taken to not overharvest the hardwood stands or overly compact the soil within the stand. Overharvesting allows more sunlight to reach the forest floor which may increase the potential for top dieback to develop by drying the soils, thereby leading to mortality of the fine tree roots. As this root death progresses, the tree loses some of its ability to absorb water and nutrients. If conditions conducive to dieback persist, the death of branches progresses downward through the crowns of the trees, affecting larger branches. Over time the progression of dieback significantly impacts a tree's ability to capture energy from sunlight which makes it more susceptible to damage from insects and fungi. For more information on top dieback of maple, see the "History of Sugar Maple Decline" document found in the Appendix of this plan. Top dieback can be found within the property, but only time will tell how each tree is able to cope with it. When timber harvests occur on this property, trees that exhibit advanced signs of top dieback should be prioritized for removal as they are at the highest risk of disease and death. As new trees grow in these affected areas, they will be able to adapt to the growing conditions present, and grow rooting and canopy systems accordingly to support overall tree health.

During the property inspection, no invasive plant species were found established within the forested areas of the property. An additional search of the Midwest Invasive Species Information Network (MISIN) however did find records of invasive species established on the Village property, Japanese barberry and Bell's Honeysuckle. Teachers at the school have also noticed the presence of the invasive Spotted Knapweed and Tansey occupying the open areas of the property, such as around the sport activity fields.

## **Japanese Barberry**

Japanese barberry is an exotic, invasive shrub that was originally introduced as a landscaping plant in urban settings. With a high ornamental value from the flowers, vibrant red fruit, and its ability to respond to pruning, it was widely used by landscapers. Japanese barberry is a shrub like plant that commonly grows to about two to three feet tall, but can grow up to six feet in height. It has small oval shaped leaves and the stems are significantly spiny. These spines make hand pulling difficult, and prevent predation from animals such as deer and cattle, giving the barberry a competitive advantage over native plants. Barberry produces small creamy yellow flowers in May and the small red fruit that is produced matures in mid-summer and can hang from the plant into the winter months. Creeping roots, and branches that readily root when they touch the ground, can produce single large organisms. These plants also spread when birds, rabbits, and other wildlife eat the fruit and spread the seeds to new locations. The root system of the barberry plant is shallow and fibrous and can withstand a variety of soil conditions; although, they do not tolerate extreme wet or extreme dry conditions very well.

Control of Japanese barberry includes a variety of strategies. Small plants can be hand pulled or dug out by the roots for successful mortality and eradication. This is commonly done in the spring when the plants are first leafing out. They generally produce leaves earlier than native plants which can make them easily identifiable. This is also a good time to hand pull because they are somewhat vulnerable after spending a great deal of their energy reserves to produce the leaves for that growing season. For larger plants, a combination of cutting and chemical treatment may be necessary due to large root systems. Cutting in the spring and summer can slow the growth of the plants but may not prevent flowering and seed production, and more than likely won't kill the plant. Chemical treatment is most effective in the mid-summer to fall because the plants are transporting resources and energy produced from the leaves down to the roots. Treating the plants during this process will transport the chemicals down into the root systems, more effectively killing that plant and preventing re-sprouting.

## **Bell's Honeysuckle**

Interestingly enough, Bell's honeysuckle is actually a hybrid between two invasive honeysuckle species: Morrow's honeysuckle and Tartarian honeysuckle. Morrow's honeysuckle is native to Japan and Tartarian honeysuckle is native to Eurasia. The most conspicuous characteristic of Bell's honeysuckle is perhaps its height, as this invasive is capable of growing twenty feet tall. Like many invasive plants, Bell's honeysuckle also leaves out well before native plants and holds its leaves longer in the fall than its native competitors. This is one characteristic that allows Bell's honeysuckle to rapidly outcompete native plants, allowing it to create monocultures which significantly limit the amount of natural tree regeneration and abundance of ephemeral plants at a given site. Control methods for Bell's honeysuckle include prescribed burns, herbicide treatments, and manual rooting if the established plants are still relatively young. One of the key aspects to understand about Bell's honeysuckle is that it can readily grow new stems from root suckers. Therefore, control methods must be implemented very thoroughly for three to five years in a row in order to eradicate Bell's honeysuckle from a given site. More information on Bell's honeysuckle can be found in the Appendix of this forest management plan.

## **Common Tansy**

Common tansy is a small perennial flower that is native to Eurasia. This plant is most easily identified by its clusters of small yellow flowers. Tansy typically grows three to four feet tall, but will occasionally reach six feet in height. In many ways, tansy is a textbook invasive plant, persisting in recently disturbed and high-trafficked sites with abundant light. This plant has two primary vectors of spread: through rhizomes and through the dispersal of its small and light seeds by wind, water, or by being inadvertently moved by humans on muddy boots or vehicles. Like many invasive plants, tansy has the capability to outcompete native vegetation and create monocultures that decrease habitat quality and overall ecosystem health. Control efforts for common tansy may include hand pulling in smaller patches, repeated mowing in the growing season, or herbicide treatments. If mowing methods are used, patches of tansy will need to be mowed regularly throughout the growing season in order to prevent the shoots from reaching maturity and dispersing seeds. Regardless of the treatment method, the site will need to be revisited and retreated for multiple growing seasons in a row to ensure that the plant does not regenerate through previously-dispersed seeds which are capable of persisting in the seed bank. Common Tansy has little effect on forest management, and will mainly be found growing in open, unmaintained grassy areas.

## **Spotted Knapweed**

Spotted knapweed, is an invasive plant that is thought to have been transported to the United States in alfalfa seed brought from Europe for farming. It is now present in many states and its wide range of site tolerance allows it to spread quite rapidly. It is particularly adapted to colonize disturbed sites such as recently used logging roads or the edges of plowed fields. Knapweed has the ability to displace native plants that are more desirable to wildlife; knapweed itself is not suitable as a food source for wildlife, however bees and insects do benefit from the nectar and pollen. Once knapweed has become established on a site and native plants become less common, the potential for soil erosion increases because knapweed has a taproot. Plants with taproots are less effective at stabilizing soil than plants with fibrous roots, such as native grasses. The most effective way to remove knapweed on a small scale is to pull it by hand in July or earlier, before it has had a chance to go to seed. On larger scales, success has been experienced by conducting prescribed burns for three years in a row, however this can be quite cost prohibitive and may not be a suitable option for all areas. If handling knapweed, gloves and long sleeves should be worn as some plants in the knapweed family are known to produce chemicals that can cause mild skin irritation.

## **Japanese Knotweed**

Like many invasive species, Japanese knotweed was introduced to the United States in the late 1800s as an ornamental in gardens. After its introduction to gardens, it was quickly noticed that the plant was capable of growing in a variety of conditions, and had an extensive fibrous root network. These two characteristics are highly sought after while selecting plant species for erosion control. Hence, Japanese knotweed quickly gained popularity for stabilizing soils as the United States rapidly developed new areas. However, by the 1930s, the negative consequences of Japanese knotweed became more apparent. In the 1930s, people began to realize that Japanese knotweed began to grow in monocultures that would exceed fifteen feet in height, containing individuals that would develop dense woody stems that closely resemble bamboo. These cohorts of Japanese

knotweed began to degrade environmental and aesthetic qualities of urban and forested areas and even limit access to areas due to the dense growth of these woody bamboo-like stems. Japanese knotweed is typically found in recently-disturbed areas such as road right-of-ways and abandoned homesteads in addition to lowland areas such as river banks. Japanese Knotweed generally spreads through underground root rhizomes, but can also be spread through fragments of root and stem material. The ability for the species to root and spread through cut fragments makes control of this invasive very difficult, as any mowing or cutting efforts can actually assist in the spread. Japanese Knotweed can also hybridize with Giant Knotweed, at which point the species can start to reproduce and spread via seed as well. Control efforts for this invasive can include manual pulling if the stems are small enough to do so, but herbicide is generally necessary due to the plant's ability to resprout from fragments. In larger cohorts, herbicide application is necessary. Destruction of any live removed plant material is necessary to limit further spread at landscape dump sites. More information related to species identification, characteristics, and control methods can be found in the appendix of this plan. This species has been identified in the southeast corner of the western portion of Stand 1.

Invasive plants are often brought to areas as seeds on muddy boots, logging equipment, or other vehicles. Plants like honeysuckle and barberry may be introduced purposefully for landscaping purposes, and then spread naturally into the surrounding landscape. Additionally, invasives like knapweed and tansy may be spread by the transport of minerals, such as those that are hauled in for fill during construction or development projects. These species often establish at recently-disturbed sites with bare mineral soil and full light conditions, such as the access roads found on the property. These areas could serve as entry points for a variety of invasive species as individuals drive and walk down these roads in order to access the property. Therefore, the landowner and community should regularly monitor these areas among others for the establishment of invasive plants. The landowner can use the Midwest Invasive Species Information Network ([www.misin.msu.edu](http://www.misin.msu.edu)), which provides an excellent resource to track and report occurrences of invasive species, and to look up the property location to see if any other invasives have been reported in the vicinity of the property.

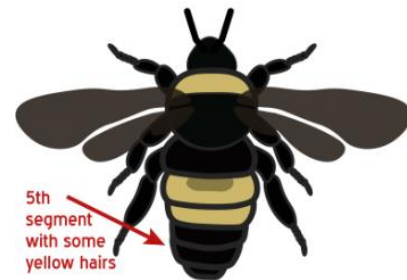
If discovered early, invasive plants are often able to be eradicated at a site at a low cost to the landowner. However, if these plants are allowed to persist for multiple growing seasons, eradication often becomes impossible and containment becomes expensive on an annual basis. Therefore, it is in the best interest of the landowner to monitor for these species and take immediate steps to remove them if necessary.

Based on the geographic location of the property and the ecosystems present there is not a high risk of wildfire. Therefore, it is not necessary to conduct specific forest management aimed at reducing the risk of wildfire. However, precautions should be taken to minimize the risk of accidental fires during dry periods when leaf litter and other organic material are extremely dry. Things to consider include parking vehicles with hot exhaust systems on clear areas and not in tall dry grass, the operation of small engines, and outdoor fires. The Michigan DNR provides daily assessments of fire danger throughout snow-free periods of the year. Fire danger can be viewed online by visiting <https://tinyurl.com/y29x9g6f> and clicking on the link "Daily Fire Danger - Fire Danger Rating" near the top of the page. Information about burning permits can be found online at <https://tinyurl.com/y2vkhsmv>.

## RARE, ENDANGERED, AND THREATENED SPECIES

During the property inspection, no threatened or endangered plant or animal species were noted. A search of the Michigan Natural Features Inventory (MNFI) indicates that four threatened species may make use of these properties. On the Village property the threatened Yellow-banded Bumblebee and the Northern Bluebell may make use of the property. The Showy Orchis may make use of the Skanee property, and the threatened Eastern Box Turtle may make use of the Pine Creek property.

**Yellow-Banded Bumblebee** (*Bombus terricola*) is considered to be rare, although the exact status is uncertain. Not much is stated of its preferred habitat or food sources, except that it is most commonly found in and around wooded areas. It is said that the bee was formerly common and widespread across much of the eastern US and Canadian Provinces, but has vanished from all but isolated patches of its native range along with other North American bumblebees. Habitat loss from urbanization and agriculture use, spread of pathogens from commercial bumblebees, and widespread use of neonicotinoids are all blamed for much of the drastic population decline of the yellow banded bumblebee. Management strategies to favor this insect include scaling back the use of herbicides and pesticides, conservation of healthy habitat, and promoting native wildflower reestablishment. These management strategies largely pertain to agriculture settings, but also may pertain to aspects of forest management on this property.



Source: UW Madison



Source: <https://www.ontario.ca/page/yellow-banded-bumble-bee>

Figure7: Images of the Yellow Banded Bumblebee.

The **northern bluebell** (*Mertensia paniculata*) is neither threatened or endangered, but a species of special concern. The northern bluebell is a delicate herb with a very small blue flower that is no larger than a finger nail and blooms on a similar timeline to the calypso orchid in may through July. The northern bluebell has been identified in the western half of the upper peninsula, and in counties along the coast of Lake Superior as far east as Alger County. Although northern bluebell favors moist sites, it is associated with plant species that are slightly less moisture-tolerant than vegetation that is associated with calypso orchid. Plants that are associated with northern bluebell include wild leeks, speckled alder, ironwood, trillium, and thimbleberry.

The **Showy Orchis** (*Galearis spectabilis*) is a small orchid that is found growing under deciduous forest canopies with nutrient-rich soil. This plant is often found growing upon sandy clay or rich loam soils, such as the lowland soil found in the southern portion of the property. This plant typically flowers from the first week of May to the last week of June. This orchid has gradually declined as forest canopies have been removed, areas have been developed, and natural hydrology regimes have been altered. In order to protect this species at this site, an effort should be made to maintain a dense forest canopy in the lowland forested areas of this property. More information on the showy orchis is available in the Appendix of this forest management plan

The primary part of Michigan where the **eastern box turtle** (*Terrapene carolina carolina*) is found is the western half of the Lower Peninsula, however this species could be found in rare cases in the Upper Peninsula of Michigan. The eastern box turtle is a small land turtle with a high domed shell and ranges from 4.6 to 7.8 inches in length. It is brown or black with a highly variable pattern of yellow or orange markings on its shell. Box turtles can be seen anytime between April and October and are best seen during egg laying in June and July. This turtle is Michigan's only truly terrestrial (land) turtle. It typically occurs in forested habitats with sandy soils that are near a source of water such as a stream, pond, lake, marsh or swamp. On this ownership the most likely place that it could be found is in or in close proximity to Stand 10 on the Pine Creek property, along the streams. More information about this species can be found in the Appendix of this forest management plan.

It is possible that other threatened or endangered species may use the property. If any such species are encountered on the property, it may be necessary to alter the management prescribed in this plan. The changes will depend on the type of species found, and the degree to which they make use of the property. More information about the MNFI is available online at <https://mnfi.anr.msu.edu/>.

## FORESTS OF RECOGNIZED IMPORTANCE

Forests of Recognized Importance (FORI) are defined by the American Tree Farm System as "globally, regionally, and nationally significant large landscape areas of exceptional ecological, social, cultural, or biological values." FORI occur at the landscape level, not the individual stand or ownership level. In Michigan, FORI on private forest land mostly consist of critical wildlife habitat (such as habitat used by endangered species), rare forest types, corridors of unique rivers, and Great Lakes coastlines. The Michigan Tree Farm Committee has defined important wildlife habitat as any forest that provides habitat required by state and federally listed threatened or endangered species. Rare forest types include primarily old growth forests but may include other exceptional forest communities. Corridors of unique rivers include the portions of those rivers designated as "Natural Rivers" or "Wild and Scenic Rivers." The Natural River and Wild and Scenic River designations created prohibitions on dam building and other development supported by the Federal Government on sections of river.

These designations do not explicitly prevent development, nor do they give the Federal Government control over private property. That being said, owners of property along Wild and Scenic Rivers and Natural Rivers are encouraged to manage the land in a fashion that preserves the aesthetic values of the river. The Great Lakes coastlines include all those properties located within one mile of a Great Lake shoreline. Additionally, the Green Timber Tree Farm Group has identified all properties located within one-half mile of the shoreline of the Portage Waterway as FORI. This distinction applies to Portage Lake, the Portage Lake Canal extending from McLain State Park to South Entry, and Torch Lake, but does not include tributaries of any of these water bodies. The Portage Waterway has great economic and cultural significance to the inhabitants of the Copper Country as it was a vital transportation link during the days of copper mining and has become a recreational and aesthetic asset to the area and its residents.

Being that the Village property is within a mile of the Lake Superior shoreline, this property is considered to be within a FORI. The Skanee and Pine Creek properties are not considered to be within a FORI.

When management is implemented on a property known to be within a FORI it is vital that it is done in a fashion that protects the ecological integrity of the property. Whether a property falls within a

FORI or not, it is extremely important that all Best Management Practices are followed when conducting a timber sale or establishing or maintaining roads, trails, and stream crossings. Strictly adhering to the Best Management Practices guidelines will drastically reduce or eliminate the potential for runoff and sedimentation to enter and degrade the waterway. More information on Best Management Practices can be found in the "Sustainable Soil and Water Quality Practices on Forest Land" manual. This manual can be found on the Michigan DNR website at <https://tinyurl.com/y8myllnv>.

## SOILS

The word "soil" is defined as "the product of the *parent material*, influenced by *climate* and *biota*, in a *landform*, over *time*." Each of the five terms listed in italics exerts a specific influence over how a soil forms. These five factors interact in diverse ways resulting in the broad diversity of soils found across the planet, and even on one particular parcel of land. Each factor influencing soil formation is briefly described below.

**Parent Material:** Parent material is the source of the mineral components of soil. It is typically unweathered rock but can also be recently deposited beach sand, or rocks and gravel deposited by glaciers. Parent material provides the majority of the nutrients used by plants; it also plays a major role in the soil texture.

**Climate:** The climate relates to temperatures, rainfall, wind and other weather phenomena that work to erode the parent material and make it more usable for plant growth. Climate also impacts the types of plants and animals that use soil in an area, which directly impact soil formation.

**Biota:** Biota are the particular groups of plants and animals that occupy an area. Plants impact soil formation by using particular nutrients, and root growth causes fractures in rock to expand and eventually split. Animals can impact soil formation by mixing and aeration. Insects and earthworms often have a more significant impact on soil formation than larger wildlife like deer and moose.

**Landform:** Landform affects how soil accumulates and how parent material erodes. Little if any soil will form on steep rock outcrops, while a great deal of sediment and organic matter can gather in low-lying areas, forming soils that are often very high in nutrients, but which may also contain excess amounts of water.

**Time:** Time is crucial to the development of soils. The longer a soil is allowed to develop, the stronger the impacts of the other four factors can become. A soil that has existed for thousands or tens of thousands of years may have a finer texture and more nutrients available for plant growth than a soil that began to form a few hundred years ago.

Soil maps are labeled with **mapping unit symbols**. A mapping unit symbol is a number and letter combination that refers to a unique soil type, found across the landscape on a particular slope class. The number indicates a unique soil series, determined by factors such as texture, color, moisture and acidity. The letter in the mapping unit symbol corresponds to the slope of the soil. An area listed as "A" slope is generally flat or very gently sloping, while an area listed as "F" slope is extremely steep. The letters from B to E indicate intervals along the gradient from mostly flat to extremely steep. These areas are mapped separately and given unique mapping unit symbols to allow considerations to be made for the slopes. In forest management, the slope of the landscape can impact the safety of timber harvesting operations in an area and increase the potential for erosion following a timber harvest. Soil descriptions also provide information about drainage characteristics and available water capacity. Drainage is a measure of how rapidly excess water moves through the soil and can range from excessively drained to very poorly drained. If a soil is poorly drained, excess water is retained for a longer period of time; this can result in stagnant conditions where oxygen, necessary for root growth, is limited. Available water capacity is essentially a measure of the water available for plant growth after all excess water has drained out following a precipitation event. It can be visualized by considering the soil as a sponge, which has become saturated in a bowl of water. When the sponge is removed from the bowl, excess water drains out. At a certain point, no more water drips out of the sponge, however it is still possible to extract water from the sponge by wringing it out.

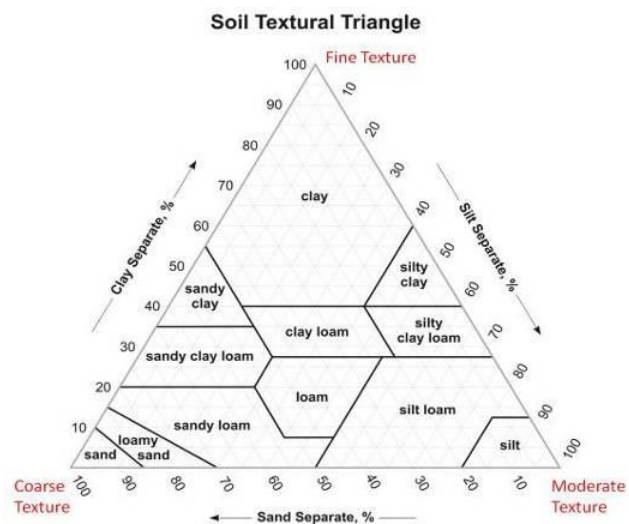


The water that can be wrung out of the sponge may be thought of as its available water capacity. Moderate available water capacity is usually tolerable for the growth of most upland trees and other forest plants except during times of extreme droughts. During droughts, trees and other plants are often unable to obtain adequate amounts of water for proper growth; it is during these times that they can be at an increased risk of attack by insects and diseases. Maintaining at least partial forest cover and preventing soil compaction can help to preserve a soil's ability to retain water, thereby protecting against unnecessary drought stresses. Keeping partial forest cover helps to keep the soil cooler, which limits evaporation; preventing compaction maintains the structure of the small spaces between soil particles, which are crucial in the retention of water. Available water capacity ranges from very low to very high. A soil with very low available water capacity can limit plant growth by causing moisture stress, which can also make plants more susceptible to insect damage or disease.

Figure 8 shows the chart used to determine the specific texture of a soil, with modifiers such as "fine" reflecting the specific size of particles within the soil. The texture of a soil is one of its most important characteristics for a number of reasons. Texture impacts how rapidly water moves downward through the soil, the amount of water held in the soil following precipitation and the length of time for which it is held there, the availability of nutrients and the stability of trees in high winds, as well as many other characteristics. The three primary soil textures are sand, silt and clay, with sand being the coarsest and clay being the finest. The size of soil particles impacts how closely together they occupy the space of the soil. Smaller soil particles are able to pack together more tightly. The tightly packed soil particles of a silt or clay

give it a higher surface area per unit of mass than a comparable volume of sand. This extra surface area means that silt and clay are able to retain more water than sand. Nutrients needed for plant growth are dissolved in the water that occupies this space in the soil. On the other end of the spectrum, when a soil becomes packed too densely together, for instance after being compacted by improper logging operations, its ability to retain small pockets of oxygen in the "pore spaces" between soil particles is decreased. This limits root growth because roots require oxygen to conduct respiration. Sandy soils are less susceptible to compaction than clays or silts.

The soils we see today have formed over the span of approximately 10,000 years since the last glaciers retreated from what is now Upper Michigan. Following the retreat of the glaciers, upland areas consisted of little more than exposed bedrock, deposits of sand, rock and gravel, and scattered large boulders. Many low-lying areas consisted of small lakes and ponds. Over time this material has been weathered down both physically and chemically into varying soil types, and material has been eroded by wind and water to fill some low-lying areas. Other low-lying areas have undergone the process of wetland soil development.



**Figure 8: USDA Soil Textural Triangle.**

Source: [http://soils.usda.gov/education/resources/lessons/texture/textural\\_tri\\_hi.jpg](http://soils.usda.gov/education/resources/lessons/texture/textural_tri_hi.jpg)

According to Web Soil Survey, a service of the Natural Resource Conservation Service (NRCS) there are thirteen unique soil types found across the three different properties. The soils found on this property, arranged from most common to least common within each individual property, are:

### **The Village Property**

- 27B Munising loamy sand, one to eight percent slopes
- 69F Tokiahok-Frohling loamy sands, 35 to 60 percent slopes

### **The Skanee Property**

- 30B Kalkaska sand, zero to six percent slopes
- 17A Au Gres sand, zero to three percent slopes
- 61B Ishpeming loamy sand, rocky, one to eight percent slopes
- 73 Arnheim mucky silt loam
- 70 Winterfield fine sandy loam
- 64 Pits, sand and gravel

### **The Pine Creek Property**

- 71A Pelkie loamy very fine sand, one to six percent slopes
- 79B Nunica silt loam, one to six percent slopes
- 65B Ocqueoc fine sand, zero to eight percent slopes
- 73 Arnheim mucky silt loam
- 80A Bowers silt loam, zero to three percent slopes
- 8054 Bowstring-Arnheim complex, zero to one percent slopes, frequently flooded

The distribution of these soil types across the property is depicted on the Soils Map, which is included in Section I of this plan.

The **Munising loamy sand, one to eight percent slopes (27B)** is found on the Village property, and comprises about 38 percent of the entire property acreage. The soil texture mainly consists of a loamy sand which is considered to be moderately well drained. However, plant root growth is limited within this soil type due to a restrictive feature which occurs 15-25 inches below the soil surface. The water table is also at a rather shallow depth of 12 inches from the surface, due to the restrictive layer. While the soils may be well-drained during the drier periods of the year, the soils may become more saturated with water during the wetter periods of the year. The shallower root structure also may increase the risk of windthrow damage. It is likely that sustainable heavy equipment operation will be able to occur within this map unit during dry periods of the summer. However, if severe precipitation events occur, heavy equipment operation may need to be forgone for a period of time in order to allow the soil to dry out and regain its structural integrity before proceeding.

The **Pelkie loamy very fine sand, one to six percent slopes (71A)** is found on the Pine Creek property, and comprises about 15 percent of the entire property acreage. The soil texture consists of a very fine sand that is moderately well drained. The loamy texture within the very fine sand gives the soils a greater water holding capacity, compared to sandy soils. These soil conditions are suitable for tree species that are tolerant of drier conditions for most of the year, but also that are tolerant of wet conditions when the soils may be saturated for a short period of time. This soil type does not present any major equipment limitations that may inhibit logging operations.

The **Kalkaska sand, zero to six percent slopes (30B)** is found on the Skanee property, and comprises about 11 percent of the entire property acreage. The soil texture mainly consists of sand, and is considered to be somewhat excessively drained. The sand component within this soil type creates much drier conditions compared to the 71A soil mapping unit described above. Tree species that are most suitable for growing on this soil type are species that are more highly tolerant of drought conditions, such as pine, and are ill suited for tree species that require more saturated soils. The sandy soil allows for equipment operation during the summer months without too much damage to the soil structure.

The **Tokiahok-Frohling loamy sands, 35 to 60 percent slopes (69F)** is the other primary soil type found on the Village property, and comprises about three and a half percent of the entire property acreage. This soil type is primarily found within Stand 2 of the property, along the narrow strips of forested acreage to the north and south of the western side of the property. This soil type consists of a loamy fine sand, with a restrictive layer at a depth of 20-39 inches. There is significant slope within this soil type, which may pose limitations to any harvesting operations.

The rest of the soils listed for the Skanee property comprise about nine percent of the total property acreage. The most significant of these soils is the **Au Gres sand, zero to three percent slopes (17A)**, which is found in the southeastern portion of the parcel, containing parts of Stand 6 and Stand 10. It consists mainly of sand, with a top layer of highly decomposed plant material, which causes this soil type to be somewhat poorly drained. Any harvesting that may occur within this soil type may need to occur on winter ground, when the soils are frozen, to better protect the soil quality.

The rest of the soils listed for the Pine Creek property comprise the remaining 24 percent of the total ownership acreage. The most significant of these soils is the **Nunica silt loam, one to six percent slopes (79B)** and the **Ocqueoc fine sand, zero to eight percent slopes (65B)**. The soil mapping unit 79B is located east of the creek, within Stand 8. It consists of a silt loam, with some clay components, and is considered to be well drained. These finer soil textures allow for a greater water holding capacity, which could cause more saturated soil conditions during the wet parts of the year, such as in the spring. Tree species that are both suited to drier conditions and that are more tolerant of wet conditions are suitable for this soil type. The soil mapping unit 65B is located west of the creek, within Stand 9, and consists mainly of a fine sand texture which is well drained. This soil texture is coarser, allowing for easier drainage of water. Tree species that are tolerant of drier conditions are most suited for this soil type. There are no serious limitations to harvesting equipment operability on these soils. Harvesting on soil unit 79B might be best on winter ground, to protect the soil quality from compaction.

Detailed technical information about each soil type on this property is included in the Appendix of this forest management plan. More information on the soil types found on this property may be obtained on the Natural Resources Conservation Service (NRCS) web site at: <http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx> or by contacting the NRCS Marquette, Michigan office at (906) 226-9460.

## ROADS AND TRAILS

There is good road access to all three properties. The forested acreage on the Village property can be accessed from 4<sup>th</sup> Street, which runs past the school facilities, through the school forest, and connects to North Birch Street. The Skanee property can be accessed from Skanee Road, which cuts through the property. Near the northeastern portion of the property there is a trail which provides access into the forested area south of Skanee Road. Currently the trail is bermed to prevent access from wheeled



Figure 10: Representative image of eastern side of Pananen road

vehicles, to protect the condition of the trail. The Pine Creek property can be access from Pananen Road, which can be accessed from Highway M-38. This road runs east and west near the northern boundary line of the property. The eastern portion of the road is in good condition, and is well maintained. There is a woods trail along the

eastern boundary of the property which connects to Pananen Road and provides access to federal lands south of this property. This trail was most likely used for the most recent harvest that occurred in Stand 9. The western portion of Pananen Road at the north side of this property has not been maintained, and is currently grown in with brush. There are two currently un-usable stream crossings near the northwestern corner of the Pine Creek property, one is an old, decaying bridge and one was a temporary crossing that has

been removed. The portion of Pananen Road that travels through the adjacent property to the west is in good condition, and can be accessed from Maki Road. This road system and at least one of the steam crossings would need to be improved when considering a future harvest on the western half of the Pine Creek property.

It is strongly recommended that the landowner or their consulting forester document the condition of all roads and trails prior to the start of any timber harvesting or other management activities on the property. Photographs or videos are a great way to accomplish this. Contracts between the landowner and any contractors should include a stipulation that roads and trails are to be returned to a condition that is as good as or better than they were in at the start of harvesting. Contractors should also be required to post a bond that can be used to pay for repairs if they are necessary. Any personal use trails on the property should be clearly marked and contracts should clearly state what condition these trails must be left in when harvesting is finished.



Figure 9: Image decaying bridge over stream crossing on western side of Pananen road

## **SECTION III: VEGETATION DESCRIPTIONS AND MANAGEMENT RECOMMENDATIONS**

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## VEGETATION ASSESSMENT

### METHODS

In May of 2022, a field inspection was conducted on this property. Prior to conducting the field inspection, geographic information system (GIS) software and aerial imagery of the property were used to delineate boundaries of different forest types, or stands, on the property. The stand boundaries were then loaded onto a GPS unit that was carried in the field by the forester conducting the inspection. During the field inspection, each stand was visited; the forester observed the conditions on the ground and adjusted the stand boundaries as needed to accurately delineate changes in forest vegetation. The forester takes a minimum of four variable radius plots in each stand using a 10 basal area factor prism. The forester also used the GPS unit to log the location of various features and points of interest including roads and trails, property corners, and structures, to name a few.

Within each stand, a number of observations and measurements were recorded including all attributes listed in the following table:

Tree Species Composition	Tree Quality and Health	Predominant Tree Size Class
Tree Stocking (Basal Area <sup>2</sup> )	Regeneration Stocking	Harvest History
Potential for Future Harvesting	Seasonal Restrictions to Harvesting	Ground Vegetation
Exotic and Invasive Plant Species	Soil Conditions	Wildlife and Endangered Species

Additionally, the condition of the roads and trails on the property was closely inspected. Roads and trails are an important property feature for most landowners, and the condition of roads and trails on the property are important factors in the feasibility and value of timber harvesting on a given piece of land.

Each stand has been given an alphanumeric timber type code that reflects the predominant species, primary size class, and total stocking level of the stand. In most cases, each stand on a given property will have a unique timber type code, however there are some cases where multiple stands may share a particular timber type code in order to reflect differences in past management or other conditions.

At the completion of the field inspection, GIS software was again used to “true up” the stand lines in order to arrive at an accurate estimate of acreage per stand. It is crucial to know with accuracy how large a stand is in order to accurately estimate timber volume within that stand. Soils data provided by the Natural Resources Conservation Service were used to generate a soils map of the property which is useful in predicting forest productivity and limitations to harvesting equipment. Other data provided by the State of Michigan were used to generate maps which depict the location of streams, lakes, and public roads.

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<sup>2</sup> Basal area is a measurement used by foresters to identify the relative density of the forest and reflects the cross-sectional area of all trees five inches in diameter and larger, as measured at four- and one-half feet above the ground, and expressed in units of square feet per acre. The higher the basal area, the more densely stocked a stand is. Basal area is one of the most useful measurements in determining when many timber types are ready to be harvested, and is closely related to timber volume.

Data and observations collected in the field were considered in arriving at the harvest recommendations and schedules provided later in this section. Some of the primary factors considered in making these recommendations include: forest type, size and stocking class, landowner objectives, site conditions observed in the stand, current and anticipated market conditions, and insect and disease problems.

Nine forested stands were identified on the property; additionally two nonforested stands were identified. Each stand will be described in detail in the following pages. After the description of each stand, management recommendations that consider the landowner objectives and desired future conditions of each respective stand will be provided.



## STAND DESCRIPTIONS AND MANAGEMENT RECOMMENDATIONS

### STAND 1

Acres:	27.7
Forest Type:	M (Northern Hardwoods)
Stocking Level:	6 (Over-stocked poletimber)
Tree Quality and Potential:	Average quality with average potential
Site Index:	63 feet tall in 50 years
Site Index Species:	Sugar maple
Basal Area:	120 square feet per acre
Management Objective:	Forest health and aesthetics; maintain hiking trails
Treatment Month and Year:	2032, 2042
Treatment Description:	Re-evaluate

### STAND DESCRIPTION:

Stand 1 is located solely within the Village property. It is found on the eastern half of the property, comprising most of the forested land which surrounds the school. This stand is dominated by sugar maple and red maple, along with yellow and paper birch, and some scattered balsam fir, white spruce, and hemlock. There are also some pockets of quaking aspen. The average diameter is around ten inches, though there is representation of larger diameter trees as well, ranging from 11 to 14 inches in diameter. Dieback was seen in the maples across the stand, which, although widely present, the damage is relatively minor. Most of the hiking trail system is found within this stand, and the summer trails are in excellent condition. The less used or winter use trails that contain the interpretive signage appear to receive less maintenance. Various student projects most frequently occur within this forested area, including the bat houses that were installed and interpretative signs that are installed.



Figure 11: Representative image of Stand 1

DOMINANT		CO-DOMINANT	
Sugar Maple	Red Maple	Yellow Birch	Paper Birch
		Quaking Aspen	Balsam Fir
		White Spruce	Hemlock

## MANAGEMENT RECOMMENDATIONS:

The management objective for Stand 1 is to manage for forest health and aesthetics, as well as to maintain the hiking trails. Considering the landowner's goals, and how this stand is the most frequented by the public and students for use of the trails and educational opportunities, a commercial timber harvest is not recommended and impractical. Such a harvest would not be feasible without some damage to the trail system that is in place. In lieu of any commercial harvesting events, the forest can instead be managed in a small scale, non-commercial method in order to maintain positive forest health. This practice is commonly referred to as a timber stand improvement (TSI). Further details on these non-commercial treatments are included in the following paragraphs in this section. It is recommended that the school has a professional forester out to re-evaluate the stand every ten years to monitor the forest health.

In order to maintain forest health, and in lieu of any commercial harvesting, TSI efforts can be implemented throughout the stand over time to improve the forest health, aesthetics, and productivity. Such thinning efforts would be beneficial to the stand as it would remove very poor quality and poor health trees, and help to open up the canopy space to allow for a few benefits. First benefit is by providing additional canopy space to the healthier trees to allow them to continue to grow. The second benefit is by allowing more sunlight to reach the forest floor, which encourages the growth of new seedlings and saplings, providing more un-even aged forest conditions. The management efforts can be implemented by insured contractors, community members, and possibly school staff if appropriate. Any management activities that take place within Stand 1 can likely be used as an educational opportunity for students.

The objective of a pre-commercial timber stand improvement, or TSI, is to remove low-quality and low-value individuals from a stand in an effort to promote growing conditions for higher-potential growing stock and trees of better health. In this stand, TSI work would include cutting smaller trees that have small crowns in order to provide growing space to surrounding larger trees. Trees with excessive dieback and dead branches would also be good candidates for removal. Only maple should be removed in this way within Stand 1, as it is the most abundant species present. Maintaining all other species will help to improve overall diversity within the area. It would also be beneficial to create occasional canopy gaps in order to encourage pockets of regeneration to provide better un-even aged conditions. Creating a canopy gap would include the cutting of all the overstory trees in a  $\frac{1}{4}$ - $\frac{1}{2}$  acre pocket. This will allow enough sunlight to reach the forest floor in order to stimulate successful regeneration. As a rule of thumb, no more than one-third of the density should be removed in an area at one given time. The trees cut can be felled and left to rot, utilized by the community for firewood, or grouped into brush piles to be used as cover by small mammals and other wildlife.

It would be a large and daunting task to enact a TSI treatment across the entirety of Stand 1 at one time. Instead, small and manageable portions of the stand can be treated at separate times. For example, Stand 1 could be split into four different equal areas, and each individual area is treated at different times. Maybe the first area is worked on for the first five years of this plan, and then the next area is worked on for the next five years after. In this example, the entire stand would receive treatment after 20 years, breaking the large project down into smaller, more manageable projects.

If the landowners need additional guidance on how to decide which stems to reserve and which stems to cut, it is recommended that they have a forester out for field visit to meet and discuss the recommendations on site. While the forester is out, they can mark a small area for an example on which individual stems should be removed. Then the landowners can use that example to make removal decisions across the rest of the area. It would also be an option to have a consulting forester mark all the trees for removal in an area according to these specifications, and then the school or the forester could find a contractor to perform the tree felling.

The hiking trails should continue to be maintained by school staff, checking the trail conditions on an annual basis and performing whatever maintenance work the landowner deems necessary. For instance, ensuring that the trail is kept free of debris, cutting back any encroaching vegetation, and dragging the trails during dry conditions. Dead trees within falling distance of the trail can pose some risk, but it is generally low. Most trees and branches will fall down during storms when there is little traffic on the trails. It is recommended that someone walk and monitor trail conditions shortly after severe storms to ensure that the trail is still clear and that there are no high-risk individual trees. A high-risk tree would likely be one that is broken and threatens falling on the trail, but is still standing or leaning on other trees and has yet to completely fall down.

Related to the hiking trails, it would appear that the interpretive trail signage had been installed on an older trail system that sees less use now. If this is true and the school would still like to maintain the interpretive signage, it is recommended that the signs and sign posts are moved to new locations on the current well maintained trail system. That way they are easier for the public and students to find and view. These sign posts and their material commonly breakdown and will require maintenance over time. In order to maintain interpretive signage, it is recommended that the signs are evaluated and updated annually. If annual updating and maintenance is too cumbersome, they should be checked once at least every 5 years at a minimum.

Lastly, there is an area within this Stand that is fairly open and undeveloped. This area is labeled on the maps included with this plan as "Point of interest, B". This location could be a spot for future forest development if the school has any ambitions for a small gathering location within the forested area. This site could be developed with a small shelter and used for outdoor forestry class activities, a community picnic site, or many other uses.

## STAND 2

Acres:	0.6
Forest Type:	Hm (Hemlock with Northern Hardwood component)
Stocking Level:	6 (Overstocked poletimber)
Tree Quality and Potential:	Average quality with average potential
Site Index:	63 feet tall in 50 years
Site Index Species:	Sugar maple
Basal Area:	100 square feet per acre
Management Objective:	Maintain aesthetics, utilize as outdoor classroom
Treatment Month and Year:	2032, 2042
Treatment Description:	Re-evaluate

### STAND DESCRIPTION:

Stand 2 is located within the Village property. It comprises a very small acreage of forested land that is nestled in between the school, parking lot, and the football field/tennis courts. It is dominated by hemlock, white spruce, and white pine, with a few red oaks as well. The understory is dominated by balsam fir, red maple, and hemlock. The average diameter of the overstory trees is about nine inches. There are a few benches located within this stand, suggesting that it has been used as an outdoor classroom for students in the past.



Figure 12: Representative image of Stand 2, showing the outdoor classroom

DOMINANT		CO-DOMINANT	
Hemlock	White spruce	White pine	Red oak

### MANAGEMENT RECOMMENDATIONS:

The management recommendation is to do nothing for the time being, but to re-evaluate every ten years to monitor for any decline in forest health. The conifers provide excellent aesthetics and a shaded understory, and should be maintained. Maintenance and removing of hazard trees should occur as the landowner deems necessary. The landowner may wish to consider to further develop the stand for use of an outdoor classroom. Dead limbs on the understory trees can be cut up to a height of six feet to make more room for easier walking and more student use space. Updating or installing extra benches could help to provide more seating. Additionally, the installation of about four picnic tables would give even more flexibility and opportunity to utilize this space for classroom related activities and lessons.

### STAND 3

Acres:	12.4
Forest Type:	Mf (Northern Hardwoods with fir/spruce component)
Stocking Level:	5 (Well-stocked poletimber)
Tree Quality and Potential:	Average quality with average potential
Site Index:	61 feet tall in 50 years
Site Index Species:	Red maple
Basal Area:	80 square feet per acre
Management Objective:	Village property: Maintain as buffer Pine Creek property: Economic revenue
Treatment Month and Year:	2032, 2042
Treatment Description:	Re-evaluate

### STAND DESCRIPTION:

Stand 3 is split between two different properties, the Village and the Pine Creek properties. The acreage of Stand 3 found on the Village property comprises of very small and narrow forested strips found near the northwest boundary and along the southern boundary of the property. It is dominated by red maple, hemlock, white spruce, balsam fir, white pine, and paper birch, averaging about seven inches in diameter. The northern strip is located on a very steep slope with a drainage which flows at the bottom of the valley.

The acreage of Stand 3 found on the Pine Creek property is located in the southeast corner of the property. It is separated from the adjacent stands by drainages, which flow at the north and west sides of the stand. These drainages stopped previous loggers from cutting the stand at the time when the aspen stand to the north was harvested. It is dominated by red maple, balsam fir, white spruce, and quaking aspen, along with some scattered sugar maple and ash. The average diameter is about ten inches. For the most part the stand is in healthy condition. There is damage from emerald ash borer noted in the ash trees, but it consists of a very minor component of the stand and therefore is not greatly impacted the overall health of the stand.

DOMINANT		CO-DOMINANT	
Red maple	Balsam Fir	White spruce	White pine
Hemlock		Paper birch	Quaking aspen

**MANAGEMENT RECOMMENDATIONS:**

The management recommendation for Stand 3 is to do nothing for the time being and to re-evaluate the stand conditions every ten years, to continue to monitor for changes in forest health and vigor. The acreage of Stand 3 in the Village property should be maintained as an un-managed area to continue to act as a visual buffer from neighboring properties. The northern strip should be left un-managed as a Riparian Management Zone for the drainage which flows at the bottom of the slope, to better protect against erosion and protecting the soil and water qualities. Hazard trees should be removed as needed near the parking lot areas, the road, and the hiking paths. The acreage of Stand 3 in the Pine Creek property is infeasible to harvest at this time due to the small acreage. That portion of the stand should be harvested at the same time when the aspen stand to the north is ready to be harvested again, which may not occur until around the year 2055.

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**STAND 4**


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Acres:	6.1
Forest Type:	Mf (Northern Hardwoods with a Fir/Spruce component)
Stocking Level:	6 (Overstocked poletimber)
Tree Quality and Potential:	Poor quality with average potential
Site Index:	38 feet tall in 50 years
Site Index Species:	White spruce
Basal Area:	140 square feet per acre
Management Objective:	Increase quality, health, and productivity
Treatment Month and Year:	Dry Summer/Winter 2023-2028
Treatment Description:	Modified Clearcut

**STAND DESCRIPTION:**

Stand 4 is located within the Skanee property, covering the northwestern portion of the property. Skanee road separates this stand from the rest of the property acreage. The stand is dominated by poor quality red maple, averaging about seven to eight inches in diameter, along with some white spruce and quaking aspen. Balsam fir dominates the understory, ranging anywhere from two to seven inches in diameter. There is a small cluster of hemlock located near the northwest corner of the stand, right along the Silver River, which flows just outside the property boundary. This area receives heavy deer usage, with well-used deer trails throughout the stand. The red maple on the stand are significantly impacted by various maple cankers.

DOMINANT		CO-DOMINANT	
Red maple		White spruce	Hemlock
		Quaking aspen	Balsam Fir

**MANAGEMENT RECOMMENDATIONS:**

Considering the high density of the stand and the poor quality of the stems, the management recommendation for Stand 4 is to implement a modified clearcut harvest between the years 2023-2028. **This harvest will aim to remove some of the lower quality stems, improving forest health, and creating more canopy space to allow for better continued growth of the residual trees.** The area was rather wet during field inspection which occurred in the Spring, after the snowmelt. It may dry up during the summer months, potentially allowing for a summer harvest. During timber harvest preparation operations, foresters should evaluate the site in mid-summer. If the area is too wet at that time, then it should be harvested during the winter months when the soils are frozen. This stand should be harvested at the same time as the adjacent red pine stand (Stand 5). It is likely that the harvest recommendations for Stand 4 and 5 won't be able to support a financially viable harvest operation, and therefore these harvesting recommendations may need to wait until Stand 6 is ready for its next harvest.

The modified clearcut harvest method entails cutting most trees five inches in DBH and greater within the stand with a few exceptions. All white pine, red pine, hemlock, oak, and cedar should be retained. Retaining these trees will help to provide structural diversity and biodiversity across the site following the harvest. Following the harvest, the site will be able to regenerate naturally. At that time, future timber stand improvements can help select and thin out desired individuals to help improve the overall quality in the future stand.



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**STAND 5**


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Acres:	2.7
Forest Type:	Rp (Planted Red Pine)
Stocking Level:	6 (Overstocked poletimber)
Tree Quality and Potential:	Good quality with good potential
Site Index:	66 feet tall in 50 years
Site Index Species:	Red pine
Basal Area:	223 square feet per acre
Management Objective:	Increase quality, health, productivity
Treatment Month and Year:	Dry summer/Winter, 2023-2028
Treatment Description:	Thinning

**STAND DESCRIPTION:**

Stand 5 consists of a small red pine plantation, located in the southwest corner of the Skanee property. The stand is primarily dominated by red pine, with black cherry and red maple regenerating underneath. The red pine average about ten inches in diameter. The stand is overstocked, and the canopy is becoming very tight, offering little room for further growth of the stems. Leaving trees to grow in such tight and restrictive growing conditions can lead to a decline in forest health over time.

**MANAGEMENT RECOMMENDATIONS:**

The management objective for Stand 5 is to increase the quality, health, and productivity of the stand. To meet this objective the management recommendation is to implement a third-row thinning within the stand, sometime between 2023-2028, or as soon as possible. In this harvest every third row should be cut, opening up the canopy and allowing room for further growth of the residual trees. Cutting every third row ensures that all trees are released on at least one side, and provides operational lanes for harvesting equipment now and in future harvests. The soil conditions of the stand allow for a summer harvest. However, it is recommended that the stand be harvested either during a dry summer or during the winter in order for the harvest of this stand to be connected with the harvest of Stand 4. As stated in the recommendations for Stand 4, it may not be feasible to harvest these two stands on their own. If this is the case, management in these stands should be delayed until Stand 6 is ready to be harvested again.

The objective for the red pine forest type is to manage it to produce high quality timber products. To meet this objective the forest management carried out in the red pine forest type should be conducted as follows. The initial thinning of the individual red pine stands should be a row thinning to provide access to the stand for future individual tree selection harvests. The row thinning should occur when the trees are between five and nine inches in DBH and the stand has a basal area of 140 square feet per acre or greater; this is generally around age 25. At this point every third row should be removed from the stand resulting in roughly one-third of the volume being harvested.

Depending on tree quality and spacing, it may be necessary for a forester to mark individual trees from the unharvested rows. The stand should then be allowed to grow until it reaches a basal area of 140 to 180 square feet per acre. Once it reaches that basal area range an individual tree selection harvest should be conducted. The individual tree selection harvest should reduce the basal area of the stand to 100 to 110 square feet per acre. The trees to be harvested should be selected using the following criteria:

1. Risk - Cut high risk trees that are likely to die or significantly decline in product grade between harvests. This includes diseased trees and those with tight "V" shaped forks that have a high risk of splitting and large trees with significant economic value that are at risk of declining in value in the next 15 years.
2. Release crop trees - Cut poorer quality competitors to provide crown growing space around 40-60 crop trees per acre promoting growth and quality development. Apply two-sided release in sawtimber sized trees and full release in pole and sapling sized trees.
3. Vigor - Cut low vigor trees, based on crown size and condition, crown class, and potential stem decay.
4. Stem form and quality - Cut poorly formed stems, based on usable log length and potential decay.
5. Undesirable species - Cut tree species that interfere with management objectives of landowner and species that interfere with growth of more desired species.
6. Improve Spacing - Create more uniform spacing between the healthiest trees to distribute growth more evenly throughout the stand.

Over the life of a pine plantation, it can be expected to undergo the initial row thinning plus two or three marked thinnings roughly 10 to 15 years apart before it is time to remove the overstory and replant the stand. The overstory removal harvest typically occurs when the stand is between the ages of 70 and 90 years old depending on site productivity tree condition and landowner objectives.

**STAND 6**

Acres:	17.2
Forest Type:	Am (Aspen with a Northern Hardwoods component)
Stocking Level:	5 (Well-stocked poletimber)
Tree Quality and Potential:	Average quality with average-good potential
Site Index:	70 feet tall in 50 years
Site Index Species:	Quaking aspen
Basal Area:	65 square feet per acre
Management Objective:	Allow aspen to grow and mature
Treatment Month and Year:	2032, 2042
Treatment Description:	Re-evaluate

**STAND DESCRIPTION:**

Stand 6 is found on the Skanee property, and consists of nearly the entire portion south of Skanee Road within the parcel. The stand is dominated by young quaking aspen and red maple, which average about five-six inches in diameter. There are pockets of three to four-inch regeneration of quaking aspen, red maple, black cherry, balsam fir, and white spruce. There are some scattered 14-inch red pine and white spruce, primarily found in the areas closest to the main road and the pine plantation. Based on a review of historically imagery, it would appear that this stand was clearcut around the year of 1998 or shortly before.

DOMINANT		CO-DOMINANT	
Quaking aspen		Red pine	White spruce
		Red maple	

**MANAGEMENT RECOMMENDATIONS:**

The management recommendation for Stand 6 is to do nothing for the time being, and allow the stand to further grow and mature. The stand should be re-evaluated every ten years to monitor forest health and productivity. Aspen dominated stands generally take about 35-45 years to mature from one coppice harvest to the next. Because it is estimated that the current aspen trees within Stand 6 are approximately 25 years old, it is likely that the next harvest opportunity within this stand will be around 2040, which is near the end of the life of this plan. The exact harvest timeline and recommendations should be provided when this plan is updated in 2042.

## STAND 7

Acres:	12.1
Forest Type:	Ma (Northern hardwoods with aspen component)
Stocking Level:	5-3 (Well-stocked poletimber with well-stocked seedlings)
Tree Quality and Potential:	Poor-average quality with good potential
Site Index:	65 feet tall in 50 years
Site Index Species:	Sugar maple
Basal Area:	70 square feet per acre
Management Objective:	Increase quality, health, and productivity
Treatment Month and Year:	Dry summer/winter, 2037-2042
Treatment Description:	Individual Tree Selection/Patch Clearcut

### STAND DESCRIPTION:

Stand 7 is found in the northwest portion of the Pine Creek property. It is primarily dominated by ten-inch red maple, with some sugar maple as well. While the health of the trees is good, the quality of the stems is rather poor. The last harvest that occurred in the stand was around 2015-2016, where the aspen had been removed and the hardwoods had been thinned. The trees that were left were of low quality, but were probably the best individuals that the site had to offer. There are patches of regenerating aspen from the aspen clones that were harvested, but being that they are growing up in partial shade under the maple overstory, they are likely to show low vigor and growth.



Figure 13: Representative image of Stand 7, showing pocket of aspen regen underneath hardwoods

DOMINANT	
Red maple	Sugar maple

## MANAGEMENT RECOMMENDATIONS:

The management objective for Stand 7 is to encourage an increase in the quality, health, and productivity of the stand. With the stand being only recently harvested, resulting in a reduced density with more open canopy space, it will not be ready to harvest again for another 15 years or so. With this objective in mind the management recommendation is to implement an individual tree selection thinning, with the installation of small patch clearcuts in the very low quality maple pockets around the years 2037–2042. As the soil conditions are on the wetter side, the harvest will need to occur either during a dry summer or during the winter, to better protect the soil and surrounding hydrology quality. This stand should be re-evaluated in 2035 to monitor the growth and quality.

Individual tree selection harvests in northern hardwoods help to accelerate the natural process of thinning, freeing up space for the most desirable trees in the stand and generating revenue for the landowner. Thinning hardwood stands also helps to create conditions more conducive to the establishment and growth of regeneration, thereby ensuring continued growth of the forest into the future. Foregoing timber harvests eventually leads to natural mortality of trees as they compete for sunlight, nutrients, and water. Trees to be harvested should be designated by a forester adhering to the following order of removals:

1. Risk - Cut high risk trees that are likely to die or significantly decline in product grade between harvests. This includes diseased trees and those with tight "V" shaped forks that have a high risk of splitting and large trees with significant economic value that are at risk of declining in value in the next 15 years.
2. Reduce overall stocking of ash to no more than 10 square feet per acre in order to minimize the future impact of emerald ash borer.
3. Release crop trees - Cut poorer quality competitors to provide crown growing space around 40–60 crop trees per acre promoting growth and quality development. Apply two-sided release in sawtimber sized trees and full release in pole and sapling sized trees.
4. Vigor - Cut low vigor trees, based on crown size and condition, crown class, and potential stem decay.
5. Stem form and quality - Cut poorly formed stems, based on usable log length and potential decay.
6. Undesirable species - Cut tree species that interfere with management objectives of landowner and species that interfere with growth of more desired species.
7. Improve Spacing - Create more uniform spacing between the healthiest trees to distribute growth more evenly throughout the stand.

Using an order of removals helps to ensure uniform tree selection throughout the forest. This will help the forest continue to grow in a relatively predictable fashion while providing a range of other benefits, including wildlife habitat and water quality preservation. Individual stands should be treated with a harvest when they reach a basal area of roughly 110 square feet per acre.

Following the timber harvest, the residual basal area should average approximately 70 to 80 square feet per acre. This stocking level allows adequate amounts of sunlight to reach the forest floor to stimulate the growth of regeneration, and recruitment of established regeneration into the poletimber size class. This stocking level also maintains enough overstory trees to prevent windthrow and loss of large limbs. The shade cast by the residual overstory will also help to limit the growth of brush that can outcompete regeneration of desirable tree species. All aspen and white birch should be harvested, and most hemlocks, white pine and red oak should be retained for diversity. Large snags and cull trees should be retained, unless they appear to be harboring some significant insect or disease problem. The benefits of snags and culls are detailed in the wildlife section of this Forest Management Plan.

Northern hardwood stands have an excellent capacity for natural regeneration, especially of the more shade-tolerant species such as sugar maple, red maple, balsam fir, and hemlock. This characteristic makes it possible to conduct periodic timber harvests which remove the low quality and high risk trees and open up space for the better quality trees. Provided that harvesting is done properly and no severe disturbances occur, this process can be repeated every 15 to 25 years without the need to completely clearcut the stand.

During the individual tree selection, patches can also be designated for clearcutting where the timber quality or potential is very low. This recommendation is provided to give the forester setting up the future harvest latitude to maximize future stand productivity. Areas with acceptable timber quality and growth will be thinned using the individual tree selection methodology, but it doesn't make sense to thin an area of trees with declining health and vigor. Areas of poor timber potential that are clearcut can be expected to regenerate in a mix of red maple, quaking aspen, spruce, and fir.

## STAND 8

Acres:	23.0
Forest Type:	M(Northern hardwoods)
Stocking Level:	8 (Well-stocked sawtimber)
Tree Quality and Potential:	Average quality with good potential
Site Index:	62 feet tall in 50 years
Site Index Species:	Sugar maple
Basal Area:	80 square feet per acre
Management Objective:	Increase quality, health, and productivity
Treatment Month and Year:	Dry summer/winter, 2037-2042
Treatment Description:	Individual Tree Selection

### STAND DESCRIPTION:

Stand 8 is found on the Pine Creek property, and consists of most of the area west of the small creek which runs through the center of the property. This stand is located on higher ground than Stand 7, and has better quality maples. It is dominated by 11 to 12-inch sugar maple and red maple, with sugar maple, red maple, yellow birch, black cherry, and ironwood regenerating underneath. This stand was last harvested around 2015-2016 where the hardwoods was thinned, removing the lowest quality trees, reducing the overall basal area and opening up the canopy for enhanced regeneration and growth of residual trees.



Figure 14: Representative image of Stand 8

DOMINANT	
Sugar maple	Red maple

**MANAGEMENT RECOMMENDATIONS:**

The management objective for Stand 8 is to increase the quality, health, and productivity of the stand. Presently the stand is not ready to be harvested again. The recent harvest thinned the stand well enough that there is room for further growth of the residual trees. The management recommendation is to implement another individual tree selection in about 15-20 years, around the years 2037-2042. This harvest should occur in conjunction with the harvest of Stand 7. The harvest can occur on summer ground during a dry summer, but may potentially require winter access due to the surrounding areas having wetter soil conditions. See the "Management Recommendations" for Stand 7 for a more detailed management procedure for the individual tree selection harvest.



## STAND 9

Acres:	23.4
Forest Type:	A (Aspen)
Stocking Level:	3 (Well-stocked seedlings)
Tree Quality and Potential:	Average quality with average potential
Site Index:	65 feet tall in 50 years
Site Index Species:	Quaking aspen
Basal Area:	NA
Management Objective:	Manage for economic revenue, allow aspen regeneration to mature
Treatment Month and Year:	2032, 2042
Treatment Description:	Re-evaluate

### STAND DESCRIPTION:

Stand 9 is located on the Pine Creek property, and consists of the area east of the creek found on the property. The stand was recently harvested around 2013-2014 where it had been clearcut. Currently it is dominated by a thick density of young quaking aspen saplings, along with some black cherry and red maple saplings mixed in.

### MANAGEMENT RECOMMENDATIONS:

The management recommendation for Stand 9 is to do nothing for the time being, and allow time for the stand to grow and mature. The overall arching management objective is to manage the stand for economic revenue. When the aspen reach rotation age in about 30-40 years the stand should then be treated with a modified clearcut to harvest the aspen and re-set the stand. The stand should be re-evaluated every ten years to monitor the health and growth of the aspen.



Figure 15: Representative image of Stand 9, with trail along the eastern property boundary

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**STAND 10**


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Acres:	8.6
Forest Type:	XL (Lowland brush)
Stocking Level:	NA
Tree Quality and Potential:	Poor potential
Site Index:	38 feet tall in 50 years
Site Index Species:	White spruce
Basal Area:	NA
Management Objective:	Maintain wildlife habitat, protect soil and water quality
Treatment Month and Year:	2032, 2042
Treatment Description:	Re-evaluate

**STAND DESCRIPTION:**

Stand 10 can be found on two different properties, the Skanee and the Pine Creek properties. The portion of Stand 10 on the Skanee property is located in the southeast corner of the parcel. It is mainly dominated by various different lowland shrubs and brush, including dogwood and tag alder. The area looks as if it could be wet during the spring months, but may dry up during the summer months. The portion of Stand 10 on the Pine Creek property is located along the creek, which runs north to south through the center of the property. This portion is dominated by tag alder, with some scattered maples and other shrubs along the creek bank.

**MANAGEMENT RECOMMENDATIONS:**

The management recommendation for Stand 10 is to do nothing. The stand should be left alone for wildlife habitat and allowed to growth in its natural succession. The brushy areas around streams and wetlands also play an important role slowing and filtering surface water runoff before contaminants can reach the water features. When harvesting in adjacent stands, heavy operating equipment should avoid entering into Stand 10 so as to protect the soil and water quality.

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**STAND 11**


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Acres:	40.1
Forest Type:	Non-forested
Management Objective:	Village property: Continue to manage for successful everyday school operations. Smartly plant and manage vegetated areas for urban benefits while minimizing future maintenance costs. Skaneec Property: Allow County to manage Skaneec Road right of way as needed.
Treatment Month and Year:	NA
Treatment Description:	No Active Forest Management

**STAND DESCRIPTION:**

Stand 11 contains all the non-forested, human developed areas. On the Skaneec parcel, this area solely consists of Skaneec Road. On the Village property, this forested stand covers a much larger and more dominant area that contains all the school facilities. This includes the buildings, playground, sports fields, parking lots, and lawns/courtyards.

**MANAGEMENT RECOMMENDATIONS:**

As this stand is nonforested, there are no forest management recommendations as they pertain to this plan. Instead, the school staff should continue to manage and utilize these areas as they see fit. The county road commission is likely the organization that cares for Skaneec Road on the Skaneec Parcel.

While there are no forest recommendations for Stand 11, discussions with the superintendent and head of maintenance staff have led to questions that are related to management of individual trees within this area. Maintenance staff have to make decisions on how to care for and maintain the grounds and the landscape trees within these areas. Additionally, the school is sometimes donated tree saplings to plant and they have to decide where to plant those trees and how to care for them. With these thoughts in mind, the following paragraphs will provide a few broad recommendations for the school to consider in these instances. For specific situations or questions, it is then recommended that the school contact a professional forester or arborist at that time.

First, consider where to plant trees. Urban landscape trees are considered to be very beneficial for a variety of reasons. Just a few of these benefits include sequestering carbon, reducing energy usage, wind breaking, reducing snow drifting, slowing and limiting storm runoff, providing shade, providing positive aesthetics, and so on. Therefore, trees can be planted all over the school grounds for a variety of benefits as long as they are not in the way. Lawns, courtyards, grassy areas are all good candidates of where to plant additional landscape trees. Planting trees around some of the edges of the sports fields could give visitors and viewers shade when watching games. Planting trees along the edges of parking lots could provide shade and cover to cars.

Next, let's discuss which trees to plant. When determining what tree to plant in a location, or where to plant a donated tree, we should consider the full life and size of that tree when mature. If there is a powerline overhead, planting a tree that will grow to 70 feet in height is only asking for future maintenance costs and issues, and ultimately an unhealthy tree and failed planting. If planting landscape trees close to a building, don't plant a short-lived species that naturally grows big fast, commonly drops branches, and then dies early, as that can cause undesired and costly maintenance issues down the road. If looking for a big shade tree in an open front courtyard setting, select a tree that will naturally grow large and with a wide canopy.

While the previous paragraph considers the above ground portion of the tree, it is just as important to consider the below ground portion of the tree, or the roots. Trees have two main kinds of roots, structural roots, and feeder roots. Structural roots are big solid rooting structures that are found close to the trunk of the tree. Structural roots provide the main source of tree stability, holding it upright day to day, and especially during windy conditions. Structural roots grow out from the tree trunk, and as a general rule of thumb, grow out to about the same width as the tree's crown does. This means that the most important roots for holding the tree upright are found directly under the crown. Having the area underneath the tree crown free of pavement, sidewalks, buildings, and roads is important for tree stability. Feeder roots are much smaller and fibrous, and are the main rooting structure that pull in water and soil nutrients for the tree. Feeder roots can grow out as far as five times the height of the tree. It is not essential that feeder roots are able to grow freely in all directions, but it should be understood that pavement, roads, buildings and other structures can all limit the growth and health of feeder roots. Additionally, compacted soil or active construction can limit or harm the growth and health of these rooting systems. In general, the more unrestrictive soil space a tree's root system can have, the more water and nutrients the roots can gather, ensuring better opportunities for tree health and longevity.

In conclusion on rooting space and canopy space, the larger the space available, the larger the tree that can be planted there (size of tree at maturity). So, for tight lawn spaces between sidewalks/buildings and under powerlines, smaller trees should be planted like crab apples, hawthorn, and mountain ash. Medium sized spaces can be planted with medium sized trees, like paper birch, river birch, balsam fir, and cedar. Large sized spaces with plenty of above ground and below ground space can be planted with large sized trees, such as oaks, red maple, Norway spruce, white spruce, red pine, white pine, and possibly hackberry and honey locust. The species listed here are also some recommended candidates that can be used when buying trees from nurseries using donated funds.

It is very important to care for trees when they are young. It's easy to let a tree go unmaintained when it is small and growing, but it is important to set up a tree for success when it is young. For starters, newly transplanted trees have just undergone a significant stress, and likely have lost a significant amount of rooting structure in the process. It is important to water newly planted trees well for the first couple years. Watering should be relatively frequent in the first growing season after transplanting, and can taper off in the following 2-3 years. Additionally, it is recommended that no pruning of the branches take place in these first couple years. As the newly planted trees are trying to regrow root structures, it is important that they have as many leaves for photosynthesis production as possible. After the transplanted seedlings are reliably growing in height each year (2-4 years after transplanting) it is important to "train prune" the saplings. Train pruning is where a young tree is pruned in a fashion to encourage a positive form

of growth to ensure a healthy structure and improve overall longevity. As a rule of thumb, it would be wise to have an arborist evaluate newly planted trees every 2-5 years for the first 20 years of their life to ensure they are train pruned and growing with the best form possible. Just like how we educate students when they are young and adaptable, we should prune and train landscape trees while they are young and adaptable as well.

Lastly, lets discuss when a tree should be taken down. It is recommended that an arborist is consulted in this process, but here are a few of the basics. Trees grow, and eventually rot out and degrade over time. Once their trunks or roots rot out enough, they become unable to support themselves, and will fall over at some point, likely during a wind event. If a landscape tree is starting to show signs of decline and rot, it has likely reached its prime and will only continue to degrade. Signs of decline can include but are not limited to: thinning of the canopy, dying of outer branches, formation of epicormic branches (suckers), rot within the trunk forming, bark separation to show interior dead wood, wood pecker damage, early leaf senescence (turn color and fall off). While the signs of decline are not an immediate indicator that a tree should be removed, it is a sign that the tree should be monitored more closely. If the tree is in close proximity of a lot of foot traffic, or close to a building that could be easily damaged if it comes down in a storm, then it should be considered for removal sooner than later. If a declining tree is growing alone in a field and not likely to damage or hurt anyone if it comes down in a storm, then it can likely be left for a longer time. Again, it is recommended that a professional arborist is consulted when needing to make these decisions.

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## RECOMMENDED MANAGEMENT SUMMARY TABLE

The following table lists each stand located on this property corresponding to the recommended treatments that were discussed above. A treatment schedule is described for each stand and treatment.

Stand	Acres	Acres to Treat	Treatment Description	Treatment Year	Re-Evaluation Year
1	27.7	~25	Timber Stand Improvement	2022-2042	2032, 2042
2	0.6	0	Utilize, develop, and maintain as an outdoor classroom as desired; No Active Forest Management	NA	2032, 2042
3	12.4	0	Re-evaluate	NA	2032, 2042
4	6.1	~5	Modified Clearcut	2023-2028	2032, 2042
5	2.7	2.7	Thinning	2023-2028	2032, 2042
6	17.2	0	Re-evaluate	NA	2032, 2042
7	12.1	12.1	Individual Tree Selection/Patch Clearcuts	2037-2042	2032, 2042
8	23.0	23.0	Individual Tree Selection	2037-2042	2032, 2042
9	23.4	0	Re-evaluate	NA	2032, 2042
10	8.6	0	Re-evaluate	NA	2032, 2042
11	40.1	0	No Active Forest Management; Manage as maintenance staff see fit; Consult professional arborist as needed on individual landscape tree maintenance.	NA	Every 5 years by a professional arborist

## RECORD OF COMPLETED MANAGEMENT PRACTICES

Use the following table to track the management activities on your property as you complete them. If you need additional copies of this table, please contact Green Timber Consulting Foresters at (906) 353-8584.

You're encouraged to retain copies of harvest records (scale slips, bid prospectus, bid results, maps, photos, and tax documentation). Such information can be useful in planning future management.

Stand	Acres Treated	Management Activity	Management Year	Notes



## SECTION IV: GLOSSARY AND APPENDICES

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## GLOSSARY

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

**Basal Area (Tree)** - cross sectional area of a tree at 4.5 feet off ground in units of square feet (ft<sup>2</sup>).

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

**Biomass** - harvesting and using whole trees or parts of trees for energy production.

**Birdseye** or **Bird-eye** - an abnormality in the grain of wood, most commonly sugar maple, that creates a propensity of small knots visible throughout sawn lumber. Birdseye was once a defect but now is a high-value product when found in quality sawlogs. The mere presence of birdseye in a log does not automatically increase its value exponentially, buyers of birdseye consider many factors when setting prices.

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

**Bolt** - 8-foot-long piece of wood of a quality that can be sawn into lumber but not meeting agreed-upon standards to be classified as a sawlog. Bolts typically either have a smaller diameter than standard sawlogs, or do not have the grading faces to meet sawlog standards.

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

**Bucking** - the process of cutting a felled tree into merchantable segments, usually at least 8 feet in length. Careful bucking decisions by an experienced operator can maximize the yield of quality sawlogs

**Buncher** or **Feller-Buncher** - a harvesting machine, typically on tracks, that can cut multiple trees and lay them in bunches in the woods to be brought to the landing by a skidder. The cut trees may be delimbed by chainsaw operators in the woods, or may be limbed at the landing by a slasher, processor, or delimber. A buncher may also be called a hot saw.

**Canopy** - the top layer of leaves and branches in the forest, consisting of the overstory trees.

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

**Clay Soil** - soil textural class consisting of mineral fragments (less than or equal to 0.002 millimeters in diameter). Clay soils are very fine and poorly drained. This means that they hold excessive water during wet times of the year.

**Clearcut** - the harvest of all the trees in an area to reproduce trees that require full sunlight. Reproduction following a clearcut may consist of stump and root sprouts (as in the case of red maple and aspen, respectively), seed (as in the case of spruce and fir) or artificial (as in the case of a red pine plantation).

**Coarse Woody Debris** - down and decaying trees on the forest floor. Coarse woody debris is generally larger than eight inches in diameter and eight feet long.

**Cord** - a unit of wood cut for fuel or fiber that is equal to a stack 4 x 4 by 8 feet long or 128 cubic feet; however a cord does not actually contain 128 cubic feet of wood due to bark and empty space between logs. A **Face Cord** is a unit of measurement consisting of a stack of wood measuring 4 feet high x 8 feet wide x a shorter length, typically between 12 and 24 inches and cut for fuelwood. A **Lake States Cord** is a cord of wood having a length of 100 inches (8.33 feet). The Lake States Cord

was developed at a time when the extra volume was intended to pay for the costs of hauling the wood to the mill.

**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, typically a tree that is capable of producing at least one Grade 2 or better sawlog.

**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 tree that has no timber value as a result of poor shape or damage. Large cull trees may have high value for wildlife or aesthetics.

**Curl** - a grain abnormality, often found associated with birdseye, that creates a wavy appearance in cut lumber. Curl is eye catching but not quite as valuable as birdseye. Curl is most commonly found in red maple and sugar maple but may be found in other species as well. Like birdseye, the mere presence of curl does not automatically increase the value of a log.

**Cut-to-Length Logging** - modern, and typically highly mechanized, system of logging which typically consists of one processor and one forwarder. The processor cuts the trees down and then cuts them into segments based on quality and product specifications, and the forwarder hauls them to the landing. In high-value northern hardwood, oak, or pine stands, chainsaw operators may be involved in the felling and bucking of trees in order to maximize value.

**Dendrochronology** - the study of forest growth, climate patterns, and past forest fires using the scars and other evidence observed in the annual growth rings of trees.

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

**Diameter-Limit Harvest** - a timber harvest in which all trees over a specified DBH may be cut. Diameter-limit harvests do not consider tree quality and may harvest excellent-quality trees with potential to increase in value while retaining poor-quality smaller trees. Diameter-limit harvests are generally not considered an acceptable silvicultural method.

**Ecology** - the study of how living things interact with each other and the non-living parts of their environment.

**Ecosystem** - the living and non-living components that make up a biological community.

**Endangered Species** - a species in danger of extinction.

**Even-Aged Stand** - a stand in which the age difference between the oldest and youngest trees is minimal (<10 years).

**Forest Stand Improvement (FSI)** - any practice that increases the health, composition, value, or rate of growth in a stand. Also called **Timber Stand Improvement (TSI)** when the focus is on increasing timber volume and value. The term TSI is most commonly used when describing a non-commercial practice, often in sapling sized stand.

**Forwarder** - a logging machine, typically on rubber tires that has a grapple boom to pick up cut logs in the woods and carry them to the landing. Forwarders are typically paired with processors and have relatively low impact on a site compared to a conventional skidder.

**Group Selection** - harvesting groups of trees to open the canopy and encourage development of uneven-aged stands that include species with moderate to high sunlight demands.

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

**Habitat Type** - A particular association of trees and plants that is commonly associated with, or indicative of, a unique set of site conditions and potential for forest growth. Analysis of the habitat type of a particular stand can help inform management decisions. The concept of habitat types has been developed to assess the true potential of a site regardless of past forest management, this is why it is heavily connected to the assemblage of understory plants.

**Hardwoods** - a general term encompassing broadleaf, deciduous trees.

**High Grading** - to remove all good quality trees from a stand and leave only inferior trees. This practice is not considered sound forestry because it focuses only on maximizing current revenue without consideration of future quality and value.

**Intolerance** - characteristic of certain tree species that does not permit them to survive in the shade. Examples of intolerant species include aspen, white birch, red pine, jack pine, and red oak.

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

**Landscape Management** - Management that considers how different parts of the landscape interact to provide wildlife habitat, clean water, and other outcomes. Landscape management must often occur above the individual property ownership level and therefore is difficult to coordinate.

**Loam** - soil textural class consisting of a mix of clay, silt, and no more than 50% sand.

**Log Rule** - a method for estimating the volume of lumber (in board feet) that may be sawn from a particular tree or log by using its diameter and length. Scribner, Doyle and the International 1/4-inch rule are common log rules used in Michigan. A log that scales a certain volume may yield more or less lumber than the rule estimates due to variations in the log, skill of the sawyer, and even inaccuracies of the rule being used. Log rules were devised in the early days of logging to create a basis on which to measure logs and set prices.

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

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

**Mid-Tolerant** - tree species that can regenerate under partial forest canopy. Examples of mid-tolerant species include yellow birch, basswood, white pine, and red maple.

**Mature** - the point in a tree's life cycle at which it has reached optimal age, size, quality, vigor, or some combination of these attributes. The definition of maturity is dependent upon tree species, site conditions, and landowner objectives. In an industrially-managed aspen forest, 40-year-old trees may be considered mature, while on a parcel being managed for production of coarse woody debris for wildlife habitat, 40 years old is not even halfway to the target age.

**Merchantable** - tree that meets size or quality specifications to be sold for a particular product.

**Muck** - soil texture consisting of poorly-decomposed organic matter that is typically saturated with water for all or most of the year. Muck forms in areas where the biological processes of decomposition are very slow due to low oxygen and highly acidic conditions.

**Northern Hardwoods** - forest type consisting primarily of sugar maple or beech with lesser amounts of red maple, basswood, yellow birch, white ash, red oak, and other species.

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

**Overstocked** - trees are so closely spaced that they are not growing at their full potential due to competition for resources.

**Poletimber** - trees having a DBH ranging from 5 to 11 inches.

**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.).

**Processor** - A timber harvesting machine that may have steel tracks or rubber tires and that is capable of cutting down trees, delimiting them, and cutting them into pieces of a given length to be sold.

**Productive Forest** - forest capable of producing 20 cubic feet of wood per acre per year.

**Pulpwood** - wood suitable for use in paper manufacturing.

**Regeneration** - the process by which a forest is reseeded and renewed, or the size class of a forest consisting of trees having a DBH of less than 5 inches.

**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. Also known as **Riparian Management Zone (RMZ)** or **Streamside Management Zone (SMZ)**.

**Salvage Harvest** - the removal of dead, damaged, or diseased trees to recover value. In the event of a fire or other natural disaster, or severe insect or disease outbreak, salvaging should occur as soon as possible to minimize losses to staining and decay. Oftentimes a significant portion of volume is lost in a fire or other event that warrants a salvage harvest.

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

**Sawlog** - log large enough to be sawn into lumber, usually larger than 10 inches in diameter on the small end and at least 8 feet long.

**Sawtimber Stand** - a stand of trees having an average DBH greater than 11 inches.

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

**Scarification** - The act of physically disturbing the surface of the soil to encourage regeneration of species with light seeds that require contact with mineral soil to germinate and grow. Jack pine, white birch, and red pine benefit from scarification.

**Sealed-Bid Sale** - a timber sale in which buyers submit secret bids for a predetermined harvest area and volume of timber. Sealed-Bid Sales should always have a clear deadline and bid opening time. Bids submitted after the deadline should be rejected to be fair to all bidders.

**Seed Tree Harvest** - harvest that retains only a few trees per acre (generally less than 20 per acre depending on species and landowner objectives). Those trees retained should be healthy, vigorous, and capable of producing seed to regenerate the stand. The objective of a seed tree harvest is to regenerate an even-aged stand of trees with high sunlight demands. In some cases, the seed trees that are retained may never be harvested.

**Selection Harvest** - harvesting single trees or groups at regular intervals to maintain uneven-aged forest. Selection harvesting allows land managers a great deal of control over site conditions to regenerate shade tolerant or mid-tolerant species. In many selection harvests, each tree to be harvested is marked with paint.

**Shelterwood Harvest** - a two-staged harvest method intended to regenerate species with moderate to low shade tolerance. The first harvest in a shelterwood system is known as a prep cut; typically, this harvest brings canopy cover down to approximately 50 percent. When regeneration reaches adequate density and size, the overstory is removed to give the regeneration full sunlight to develop into a new stand. In Michigan, the shelterwood harvest is most commonly used to regenerate red oak, but may have applications for other species as well.

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

**Silviculture** - the practice of controlling forest composition, structure, and growth to maintain and enhance the forest's utility for a given purpose. Silviculture must consider a range of factors including management goals and objectives, site conditions, species characteristics, and a bit of guesswork to account for unforeseeable events.

**Site Index** - measure of quality of a site based on the height of a dominant tree species at a given age. In Michigan most site indices are based on the average tree height at age 50.

**Site Preparation** - treatment of an area prior to reestablishment of a forest stand to control vegetative competition or expose a suitable seed bed for the desired species. Site preparation may consist of herbicide application, scarification, or manual cutting of competing vegetation with a chainsaw or other hand tools.

**Skidder** - a rubber-tired machine with a cable winch or grapple to drag logs out of the forest. Skidders are usually used only in whole-tree harvest operations and can have very high impacts on some sites. In certain forest types, especially white birch, jack pine, and red pine, using skidders can help to create a seed bed for regeneration. Skidders may also be modified to use for other treatments including pesticide application, firefighting, and scarification.

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

**Slasher** - A logging machine that typically operates at the log landing. Skidders bring trees to the landing and the slasher cuts them into merchantable segments based on quality and product specifications. A slasher typically consists of a grapple boom and a large rotating sawblade.

**Snag** - a dead tree that is still standing and that may 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.

**Species Removal Harvest** - A harvest in which all trees of a given species are designated for harvest. Typical species designated for harvest include aspen, spruce, and fir in a hardwood stand.

**Stand** - a group of forest trees of sufficiently uniform species composition, age, and condition to be considered a homogeneous unit for management purposes. An individual stand is typically geographically contiguous, but may consist of multiple units, or polygons, on a parcel of land.

**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 poorly-stocked, overstocked, 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.

**Sustainable** - a practice that, based on current understanding of a natural system, may be repeated over and over at a particular interval without damaging the ability of a site to continue to meet the desired outcomes. What is considered sustainable on a particular site may change with time due to changes in landowner objectives, environmental conditions, or economic values. In this regard, sustainability may be thought of as a three-legged stool with the legs represented by economic outcomes, social values, and ecological concerns. If one of the three legs is compromised, the stool will not stand.

**Sustained Yield** - concept in forestry that considers the productive capacity of a site or stand, and losses due to natural mortality. In an economically and ecologically sustainable forest management system, harvest volume will not exceed total growth minus losses to mortality. **Maximum Sustained Yield** is a condition in which removals and mortality are approximately equal to growth.

**Thinning** - partial cut in an immature, overstocked stand of trees to increase the stand's value and growth. Thinning is typically implemented in even-aged stands.

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

**Tolerance** - the capacity of a tree species to grow in shade

**Understocked** - trees so widely spaced, that even with full growth, crown closure will not occur. Trees growing in understocked conditions often develop large branches which is undesirable from a timber production standpoint. From an economic standpoint, an understocked stand is not making full use of the site, and therefore is not growing to its full potential.

**Understory** - the level of forest vegetation beneath the canopy.

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

**Veneer Log** - a high-quality log of a desirable species suitable for conversion to veneer. Specifications for veneer logs may differ from those for standard sawlogs, and in some cases, veneer logs may be of a shorter length or smaller diameter than what is standard for a conventional sawlog.

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

**Whole-Tree Logging** - Logging system that typically consists of a buncher, skidder, and slasher. Chainsaw operators may also be involved in various stages of this system depending on the quality and species of timber being cut.

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



## APPENDIX

- Copy of Landowner Questionnaire
- Green Timber Consulting Foresters Timber Type-Size-Density Guide
- Timber Tax Information
- Forest Health/Invasive Species Information
- MNFI Species Abstracts for Threatened and Endangered
- NRCS Soils Information





# GREEN TIMBER CONSULTING FORESTERS, INC.

**GREEN TIMBER TREE FARM GROUP**

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This is an optional questionnaire that is designed to help spark ideas and help us prepare a Forest Management Plan for a School Forest to best serve the teachers and students that use it. Please fill out as thoroughly as you see fit. Not all items will be relevant for everyone.

Completed By: \_\_\_\_\_ Susan  
Tollefson \_\_\_\_\_

## TEACHER CONTACT INFORMATION

Teacher's Name(s): Emily Maxson, Callie Cram
Mailing Address: 201 N 4th St, L'Anse, MI 49946
Phone(s): 906-524-6000
Email Address(es): stollefson@laschools.us
Other key people (owners, family members, caretakers, contact people): L'Anse Area Schools

<b>Current Uses of the Property:</b>
Who uses the property the most? community
What are the most common human activities on the property? school field trips, snow shoeing, hiking, dog walking
Are there other human activities that might be important to note? new tennis courts
List any "special places" or "special species" on the property that should be considered? marked trail, bat houses

## LANDOWNER BACKGROUND

List relevant personal education or personal interests: K-12 school, student recreation and student outdoor education opportunities, management of taxpayer resource	
<b>Landowner Goals - What you really want from/for the land in the long-term and short-term (describe goals &amp; objectives, circle/underline priorities):</b>	
Recreational Goals (e.g., motorized, non-motorized, both; aesthetics, solitude, etc.): Community and student recreation, some community requesting pickle ball court (modify tennis court?)	Priority (circle): Moderate
Wildlife/habitat Goals (e.g., game, non-game, both, food plots): bat houses installed - maintain, many deer use the area	Priority (circle): Low
Economic Goals (e.g., market, subsistence, both; timber, carbon trading or other): manage timber resources	Priority (circle): High
Social/Family Goals (e.g., legacy, family heritage, tradition, future ownership, etc.): community family use - keep it open to the public	Priority (circle): High
Conservation/Ecosystem Goals (e.g., native vegetation, soil, water quality, rare species, etc.): unknown	Priority (circle):
Other Goals: Maintenance of trail	Priority (circle): High
Planned Management/Conservation Activities:	
<b>Landowner Participation/Investment</b> <b>What you (plan to) put into the property:</b>	
How many days per year, on average, do you (plan to) spend at the property? 180 school days	
How would you describe your interest & ability to invest time and/or money in managing the property? maintenance staff time is limited but they can address annual maintenance	

**ASSISTANCE NEEDED**

Please list any current issues/ desires/problems/concerns/questions about forest management.

It has been awhile since a forest management plan has been updated

Please list any specific types of assistance that you are looking for.

Timber management

# GTCF Timber Type Guide

## Timber Types

A – Aspen  
B – Birch  
M – Northern Hardwoods  
D – Central Hardwoods  
E – Lowland Hardwoods  
K – Oak  
H – Hemlock  
F – Spruce / Fir  
C – Cedar  
Q – Lowland Conifer  
T – Bog Conifer  
P – Natural Mixed Pine  
W – Natural White Pine  
Wp – Planted White Pine  
R – Natural Red Pine  
Rp – Planted Red Pine  
J – Natural Jack Pine  
Jp – Planted Jack Pine  
S – Natural White Spruce  
Sp – Planted White or Black Spruce  
L – Planted Larch  
O – Open  
XL – Lowland Brush  
XU – Upland Brush  
XW – Water  
XR – Road

1. Capital letter represents dominant timber type.
2. Lower case letter represents co-dominant timber type.
3. First number represents size / density of all merchantable stocking.
4. Second number describes the significance of co-dominant type
5. Co-dominant type only to be used if the presence of co-dominant type alters prescribed management.
6. **Size Class** is determined by the class with the highest basal area representation.
7. Stands with less than 20 ft<sup>2</sup>/acre of merchantable stems should be considered seedling stands (size classes 1, 2 or 3).
8. **Density** is determined by the total basal area of **all** merchantable stems.

## Example

**Mf 6-2** – Represents an over stocked northern hardwood pole stand (majority of the basal area represent by trees ranging from 5-10 inches at DBH) with a total merchantable basal area greater than 100 ft<sup>2</sup>/acre. Spruce / Fir well stocked regeneration (stems 1-4 inches at DBH) is the co-dominant type.

## Size / Density

### Seedling Stands: Determined by average DBH of tree stocking (1-4 inch DBH)

- 1 – Poorly Stocked Regeneration: 1-4 inch DBH (< 20 ft<sup>2</sup>/acre) = <5 cords per acre
- 2 – Moderately Stocked Seedlings: 1-4 inch DBH (< 20 ft<sup>2</sup>/acre) = <5 cords per acre
- 3 – Well-Stocked Seedlings: 1-4 inch DBH (< 20 ft<sup>2</sup>/acre) = <5 cords per acre

### Pole Stands: Determined by average DBH of basal area (5-10 inch DBH)

- 4 – Poorly Stocked Poletimber: 5-10 inch DBH (20-59 ft<sup>2</sup>/acre) = ~5-15 cords per acre
- 5 – Well-Stocked Poletimber: 5-10 inch DBH (60-99 ft<sup>2</sup>/acre) = ~15-25 cords per acre
- 6 – Overstocked Poletimber: 5-10 inch DBH (100+ ft<sup>2</sup>/acre) = ~25+ cords per acre

### Saw Stands: Determined by average DBH of basal area (11+ inch DBH)

#### & over 50% of basal area contains at least one, 8 ft. grade 3 sawlog

- 7 – Poorly Stocked Sawtimber: 11+ inch DBH (20-59 ft<sup>2</sup>/acre) = ~5-10 cds & ~1-2 MBF / ac
- 8 – Well-Stocked Sawtimber: 11+ inch DBH (60-99 ft<sup>2</sup>/acre) = ~10-20 cds & ~2-3 MBF / ac
- 9 – Overstocked Sawtimber: 11+ inch DBH (100+ ft<sup>2</sup>/acre) = ~20+ cds & 3+ MBF / ac

# TIMBER TAX TIPS

## Get a Second Opinion

By Jim Burns

Over the past several years I have written quite a few articles explaining the substantial tax savings possible for landowners who use Section 631(b) & loggers who use IRC Section 631(a) to report their timber income as long-term capital gain.

These two sections are real – they are part of the Internal Revenue Code. They can easily be looked up to verify the provisions and requirements. Basically they allow the timber owner to report timber income as long-term capital gain after taking a depletion deduction.

The 2003 Tax Act reduced long-term capital gain tax rates by 5% with a minimum rate of 0% and a maximum rate of 15%. Ordinary income tax rates begin at 25% and increase in steps to a maximum of 35%. In addition, timber sales reported as ordinary income means that you also have to pay a Social Security self-employment tax of 15.3%; you can do the math.

In spite of the large tax savings possible and the fact that it is perfectly legal for any taxpayer, I get a disturbing number of calls every year from readers who tell me that their tax accountant informed them it was not legal, or it could only be used by big corporations, or farmers could not use it, or various other reasons too numerous to mention. It makes me wonder how many other taxpayers received the same treatment, but didn't bother to call me.

It's only mid-December as I write this article and I have already received three of these calls. Each of the callers took copies of my past articles and one also included a Form T. Even with this information, they were told they could not use capital gain tax treatment in "their" situation.

If this happens to you, get a second opinion. It's your money!

### EXAMPLES:

One client who inherited her property five years ago received approximately **\$5,000 revenue from a timber sale**.

-If her accountant had filed it as regular income and if she was in the 25% tax bracket, she would have paid over \$2000 in tax on her timber sale.

-BUT, because she filed a Form T and took a depletion deduction, she **did not pay a penny in taxes** on her timber sale, and she **took over a \$6,000 long-term loss on her taxes**.

Another client purchased his property three years prior and received **\$63,000 for his timber**.

-If his accountant had filed it as regular income under the 25% tax bracket, he would have paid over \$25,000 in tax on his timber sale.

-Instead he paid **NO TAX** and took **long term loss of over \$12,000** on his taxes.

Another client had his property in his family for decades and received over **\$11,000 from his timber sale**.

-If his accountant had filed it as regular income under the 25% tax bracket, he would have paid over \$4,000 in tax on his timber sale.

-Instead he was responsible for **15% tax on his capital gain** of approximately \$700, **paying only \$105 in tax**.

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before you pay a penny

**OUR SERVICES ARE DEDUCTIBLE FROM  
YOUR REGULAR INCOME.**

Susan Metcalfe

989-348-3596

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Forestry Consultant, A.C.F.

MI Registered Forester #46000

Member MAT, MFA, SAF

Mich Tech University, M.S. Forestry

# TIMBER TAX FACTS

## **BURNS & METCALFE TIMBER TAX SERVICES**

402 Chestnut St. Grayling, Mi. 49738 Phone: 989-348-3596

The tax treatment of timber sale income and management expenses is a highly specialized area of the federal tax code. Interpreting the provisions of Sections 631 (a) or 631 (b) requires the services of a professional forester. Many tax preparers do not encounter timber sales on a frequent basis and are not aware of the tax provisions or how to implement them for maximum tax savings.

Report timber income as **LONG-TERM CAPITAL GAIN**. The tax code allows timber income to be reported as capital gain or as ordinary income. In all situations timber income receives much lower taxation if reported as capital gain, and eliminates the possibility of raising ordinary income to a higher tax bracket.

The first step is to create a **DEPLETION ACCOUNT**. All depletion accounts are based upon the actual cost basis of the timberland as of the date of acquisition whether by purchase, gift, or inheritance, and allocated into **land** and **timber accounts** using fair market values of the respective components of value at that date.

The value allocated to the trees is called the cost basis of the timber and is used to determine the Depletion Deduction. For example, *if you sold a cord of timber for \$20.00 and your depletion deduction was \$10.00 per cord, your net taxable gain would be \$20 minus \$10 or \$10.00*. The depletion deduction is a tax free return of capital. The higher the depletion deduction, the less income tax you pay. The reverse is true as well. People who have recently purchased their timberland usually pay little or no tax on a sale of timber. People who bought their land a long time ago will pay more in tax because their cost basis is lower.

The next step is to record all **MANAGEMENT EXPENSES** associated with the timber sale and management of the property. Some management expenses such as: payments to a forester to sell the timber, advertising, contract expense, etc., can be directly deducted from timber income. Other expenses, such as: property boundary survey, tree planting, etc., will have to be capitalized into the cost basis and recovered through depletion. Either way, documenting all expenses will reduce the tax liability.

The final step is to prepare a **FEDERAL FORM T** which substantiates the depletion deduction, expenses, and capital gain or loss. The Form T is filed with the general income tax return at year-end.

If reported in this manner, timber income will receive a tax rate lower than your ordinary income marginal rate and you **will not pay** the 15.3 % self-employment tax (social security). When the depletion deduction is included, a savings of 30 % or more is possible on your tax bill.

Amended tax returns can be filed to claim a tax refund from previous timber sales. These returns must be filed within two-years of the original filing date. For most taxpayers this means three calendar tax years from April 15th of the current tax season.

We do not advise on, or prepare general income tax returns - we only specialize in timber. In that capacity, we can assess your potential tax savings, create your depletion account, and prepare the Federal Form T for you or your tax preparer.

**FREE ESTIMATES** – Know your savings  
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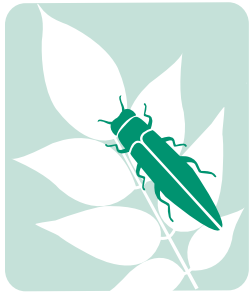
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Mich Tech University, M.S. Forestry





Ohio  
**Emerald  
Ash  
Borer**  
Ash Alert Team

The Ohio State University  
College of Food, Agricultural,  
and Environmental Sciences  
Section of Communications and Technology

# fact sheet

## What is Emerald Ash Borer?

**Daniel A. Herms**, Associate Professor, Department of Entomology, Ohio Agricultural Research and Development Center, and State Specialist, Ohio State University Extension

Emerald ash borer (*Agrilus planipennis*) is an exotic, invasive wood-boring insect that infests and kills native North American ash trees (*Fraxinus* spp.), both in forests and landscape plantings. Just like chestnut blight and Dutch elm disease before it, EAB is capable of eliminating an entire tree species from forests and cities throughout the land. This makes it one of the most serious environmental threats now facing North American forests.



### History

Emerald ash borer was unknown in North America until June 2002, when it was discovered killing ash trees in southeast Michigan and neighboring Windsor, Ontario. It is native to eastern Russia, northeastern China, Mongolia, Taiwan, Japan and Korea, where it occurs on several species of ash. It was probably imported into Michigan via infested ash crating or pallets at least 15–20 years ago. Since its accidental importation, EAB has infested and killed millions of trees in southeast Michigan and northwest Ohio.

### Economic and Ecological Impact

All major North American ash species have been killed by emerald ash borer, which infests trees ranging in size from saplings to fully mature trees in forests. While most native borers kill only severely weakened trees, emerald ash borer kills healthy trees as well, making it especially devastating.



The economic and ecological impact of emerald ash borer has already been substantial, and it will be staggering as this exotic pest continues to spread. EAB has the potential to virtually eliminate ash from North American forests, with dramatic effects on ecosystem processes as well as plant and animal communities. Ash species, which inhabit a variety of soils and ecosystems, are dominant throughout the forests of eastern North America. A study by the U.S. Forest Service found there to be more than 3.8 billion white ash trees in Ohio, and the Ohio Department of Natural Resources estimates that one in every 10 trees in the state is an ash. The standing ash timber in Ohio is valued at more than \$1 billion. Prior to the arrival of EAB, ash was one of the most important nursery and landscape species in the United States. According to the U.S. Department of Agriculture, wholesale value of ash sold by Ohio nurseries exceeded \$2 million in 1998, and the Ohio Nursery and Landscape Association reported that the value of the standing crop exceeded \$20 million, a market that has been eliminated by this diminutive insect.

The costs of removing dead and dying ash trees have overwhelmed municipal budgets in many of the affected counties, and private property owners must often pay in excess of \$1,000 per tree for removal of large shade trees. Alternatively, they are faced with annual costs of insecticide treatments, which can quickly exceed that amount. A quarantine on ash timber has also had a negative economic impact on sawmills, tool handle factories, and firewood dealers in Michigan and Ohio.

## Taxonomy and Biology

Taxonomically, emerald ash borer is a beetle (Coleoptera) belonging to the family known as metallic wood-borers (Buprestidae). Adults of many species in this family are brightly colored with a metallic glint, making them favorites of collectors. Larvae of these beetles are known as flatheaded borers, deriving their common name from the larval stage, which appears to have a broadly flattened head (it is actually the thorax which mostly conceals the much smaller head). EAB larvae are white with a long (about one inch when mature) narrow, segmented abdomen that is also flattened, which gives them the appearance of small tapeworms. Adults are elongate, half inch-long beetles with striking, metallic green coloration.



Emerald ash borer belongs to the same genus (*Agrilus*) as bronze birch borer (*A. anxius*) and twolined chestnut borer (*A. bilineatus*), which are both native to North America. The biology of emerald ash borer is quite similar to its native relatives. There is one generation each year. Adults emerge from late May through early August, with emergence peaking in early July. As adults emerge, they leave small (one-eighth of an inch), distinctly D-shaped exit holes in the trunk and main branches, which is a sure sign of infestation. Adults feed on foliage for one to two weeks prior to mating. Females produce about 50 to 100 eggs, which are laid individually on the bark surface or within bark cracks and crevices.

Observations indicate that higher branches and upper portions of the trunk are colonized initially, making it difficult to detect early infestations.

As larvae hatch, they tunnel into the tree, where they feed through the summer and early fall on the phloem and outer sapwood, excavating S-shaped, serpentine galleries just under the bark. Larvae continue to feed through summer and into the fall, with most completing their development prior to over-wintering in the outer bark or just under the inner bark within the outer inch of sapwood. Pupation occurs in mid- to late-spring. Adults emerge soon thereafter to complete the typical one-year cycle.

## Host Plants and Host Impact

Ash species known to be infested by emerald ash borer include green (*Fraxinus pennsylvanica*), white (*F. americana*), black (*F. nigra*), and blue ash (*F. quadrangulata*), as well as horticultural cultivars of these species. Only living trees are colonized. EAB will not colonize a dead tree. Native host plants in Asia also include ash species, with *F. mandshurica* (Manchurian ash) and *F. chinensis* being primary hosts.

Adult beetles feed on foliage, resulting in irregular, jagged-edged patches of missing tissue along the leaf margin, the impact of which is negligible. The larva is the damaging stage, girdling the tree as it tunnels under the bark where it feeds primarily on phloem and xylem tissue. This disrupts the flow of carbohydrates and water between the canopy and roots, which results in canopy thinning, branch dieback, and finally tree death, typically within two to four years of initial infestation.





For more information about EAB, check out these additional fact sheets:

[http://ashalert.osu.edu/checkoff\\_factsheet.pdf](http://ashalert.osu.edu/checkoff_factsheet.pdf) (signs and symptoms)

[http://ashalert.osu.edu/F\\_59\\_Rev06.pdf](http://ashalert.osu.edu/F_59_Rev06.pdf) (management options)

[http://ashalert.osu.edu/treat\\_fs\\_feb06.pdf](http://ashalert.osu.edu/treat_fs_feb06.pdf) (treatment)

[http://ashalert.osu.edu/insecticide\\_17may06.pdf](http://ashalert.osu.edu/insecticide_17may06.pdf) (insecticide options)

# Eutypella Canker On Maple

**The fungus *Eutypella parasitica* kills the growing layer of cells under the bark, the cambium, and causes a pronounced bulge of callus to develop around the infected area of red, sugar, silver, Norway, and other maples.**

Dead bark remains attached to the canker which may be on one side of the trunk or completely girdle the tree. Often, there is a dead branch stub in the center of the swollen, cankered area.

Maples, especially young trees, in ornamental plantings and in the forest are susceptible to this fungus. In most cases, between 2% and 10% of the trees may be affected. However, it has been observed in some stands to canker over 20% of the maples. Not only is the aesthetic value of the tree reduced by the presence of the swollen, callused trunk, the tree is very susceptible to attack by wood decay fungi and then to wind breakage. The infected tree becomes a hazard to people and property in the vicinity.

The canker is most often seen between 3 and 10 feet above the ground. This perennial canker enlarges year after year and may become 3 feet long. The tree produces callus during the growing season in response to the presence of the fungus. The fungus kills this callus and invades more cambium and bark during the tree's dormant season. Sometimes the fungus dies in the tree and the tree produces a large roll of callus along the canker's edge.

The fungus produces spores (ascospores) sexually in the centers of old cankers (more than 5 yrs. old). These spores are forcibly discharged during mild, moist weather and are carried by the wind 75 feet or more. Although the fungus also produces a sickle-shaped spore (conidia) asexually, these spores are thought to be unimportant in the disease spread.

## Symptoms And Signs

- A large roughened area of bark, sunken in the center with heavy callus around the margin, is observed on the branch or main trunk. Usually there is a branch stub in the center of the canker and the canker is within 10 to 12 feet of the ground.
- When bark is removed from the upper and lower ends of the canker at the junction between the diseased and healthy wood, a light tan to cream colored mat of fungus

is observed.

- Black fungal fruiting structures protrude from the bark near the centers of 5 year old or older cankers.

## Management

- Remove trees with cankers on the main trunk.
- Remove all cankered branches, cutting 4-6 inches below the canker. Do this pruning when the weather is dry.
- In the case of highly valuable trees, use a sharp chisel to remove all of the cankered wood and fungal mat plus 1" to 1.5" of the surrounding, apparently-healthy bark and wood.
- When the long range plan for a tree is to remove the lower limbs, do so when those limbs are less than 1 inch in diameter.
- When a limb breaks, remove the remains with a clean cut close to the branch collar without damaging the collar. If the collar has been damaged or the bark has been stripped down the trunk, use a sharp chisel to shape the outline of the damaged area into a clean-edged, vertically-oriented oval if possible. Do not point the ends of the oval. If some callus has already begun to form, do not damage that callus.

Prepared by Gary W. Moorman, Professor of Plant Pathology

## [extension.psu.edu](http://extension.psu.edu)

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**PennState Extension**

# SUGAR MAPLE BORER

By Douglas C. Allen

One of the most detrimental pests of sugar maple is an insect known as the sugar maple borer. The seriousness of this problem arises from both the location and nature of the damage, and the susceptible condition of sugar maple in many of today's northern hardwood stands. Outbreaks of this pest are relatively mundane compared to those of the principal maple defoliators. In the absence of additional disturbances (e.g., unfavorable weather such as drought, poor site and stand conditions), however, sugar maple usually can withstand one or two years of moderate to heavy defoliation. On the other hand, once a tree is attacked by maple borer the damage endures and its degrading effects may amplify over time.

## THE INSECT

The adult borer is a dark brown to blackish, thick bodied beetle approximately an inch long and marked with distinct bright yellow bands that vary in width and length. It belongs to a group commonly referred to as the longhorn beetles; a name evoked by the unusually long antennae or feeler-like structures that are attached to the head.

Each female deposits one to a few eggs in bark crevices or holes that she chews through the bark. Eggs, and subsequent damage, usually are concentrated on the lower 20 feet of the tree trunk. Many trees are probably used for egg laying, but vigorous maples overcome feeding attempts by young larvae. Following egg hatch, the white to cream-colored, legless, grub-like larva enters the tree and feeds beneath the bark. Eventually it excavates a shallow transverse feeding gallery engraved on the surface of the sapwood (Figure 1). This gallery, which usually extends 4 - 6 feet up the trunk, and accompanying damage partially girdle the tree.

The presence of the larval gallery in the center of a conspicuous scar (Figure 1) distinguishes maple borer damage from that of stem cankers associated with certain fungal infections. Recently formed borer scars are masked by dried and spongy bark that has not sloughed away (Figure 2).

The borer requires two years to develop from egg to adult. In preparation for overwintering during the second year, the fully grown larva excavates an 3/8 - 5/8 inch diameter vertical gallery that is several inches long and penetrates the sapwood to a depth of 2-4 inches.

Figure 1. (right) Typical sugar maple borer injury. Note the horizontal larval gallery in the center of the scar.



Figure 2. (below) Cryptic sugar maple borer damage. Note telltale cracks in the bark (white arrows).



## THE DAMAGE

Whether or not the maple borer causes significant damage, depends on your management objectives. By definition, in order to be considered a pest an insect must prevent you from maximizing your management goals.

For example, if you own a woodlot solely for aesthetic reasons, as a place to hunt, or as a source of firewood, you probably would not consider the maple borer a pest. Should your objective be to produce maple syrup or a variety of wood products, however, the borer can have an important economic impact.

Because sugar maple borer most often attacks at some point on the first 20 feet of the stem, it damages the most valuable part of the tree from a sawtimber standpoint - the butt log. This damage is manifested as

mineral stain (a discoloration resulting from the tree's response to invasion), callus tissue that forms at the margins of the scar (another defensive mechanism that the tree uses to isolate or compartmentalize injury), and holes in the outer 4-6 inches of sapwood where the insect excavates a tunnel in preparation for its second winter. Generally, this interaction between the insect and the tree greatly decreases the value of the first log, because it is not acceptable for veneer or gives an undesirable appearance to lumber cut from the injured portion of the infested stem.

Damage affects sugarbush operators in two quite different ways. As a result of stem girdling, often large limbs are killed immediately above the injury, which effec-

(Cont'd)

4 tively decreases crown size (and, hence, the volume of sap produced by the injured tree). When damage occurs within the region of the bole that normally is used for tapping (4-6 feet above the ground), the area of bole suitable for tapping is reduced.

When a tree 6-8 inches in diameter at breast height is attacked, it may be especially susceptible to wind snap. The tree bole may be weakened where the larval gallery becomes oblique or nearly horizontal (in the vicinity of the catfaced scar) and during high, gusty winds many tree stems break at this spot.

#### **CONTROL SUGAR MAPLE BORER WITH A CHAIN SAW!**

The most effective means of minimizing borer damage is to maintain tree vigor. Studies indicate that the maple borer is a secondary insect; that is, it can only successfully attack sugar maple that is under

stress. The most common source of stress associated with maple borer damage is intense competition for growing space between trees in overcrowded stands. Proper thinning of stands during the highly susceptible pole timber stage, when trees are between 5 and 11 inches in diameter at breast height, is especially important in a program of preventative maintenance. If your management objective is to produce wood products, removal of previously damaged trees is also recommended during thinning or timber stand improvement activities. This will improve the quality of the residual stand, because it relinquishes growing space to sound, and presumably, more valuable trees.

Sugarbush operators can afford to be more liberal. If your objective is to produce maple syrup, use careful judgement before condemning a tree. It is not necessary to remove a tree just because it has a

borer scar. As long as the tree pays its way in terms of sap production it should be retained in the bush.

Sugar maples in most of today's northern hardwood stands are especially vulnerable to borer damage, because these stands have not been properly managed. Most landowners can not justify the cost of thinning when the material removed has no or limited market value. Hence, stands are ignored or repeatedly highgraded; both practices degrade stand health and set the stage for additional damage by maple borer. ▲

*Douglas C. Allen is Professor of Forest Entomology in the Faculty of Forestry at the State University of New York, College of Environmental Science and Forestry (SUNY/ESF); 146 Illick Hall, One Forestry Drive, Syracuse, NY 13210. All photos are by Professor Allen unless acknowledged otherwise.*



## Introduction

Maple decline affects primarily sugar maple (*Acer saccharum*), Norway maple (*A. platanoides*) and red maple (*A. rubrum*) in the Northeast. The problem is not a new one; stagheaded maples were described as early as 1917 in Massachusetts. At that time, dieback was attributed mainly to drought and to the poor conditions for tree growth afforded by the urban environment. However, reports of the incidence and severity of maple decline have increased markedly in recent years to include urban, sugarbush, and forest environments.

In forests, maples usually begin decline after several successive years of defoliation by insects. Affected trees not only lose their first set of leaves to these insects, but will often use up valuable food reserves to produce a second set. During and after "refoliation", chemical changes occur in the tree that increase its susceptibility to secondary pathogens. *Armillaria mellea* (root rot), *Nectria cinnabarina* (branch canker) and *Steganosporium ovatum* (twig blight) are three fungi that frequently attack and may kill trees weakened by defoliation and refoliation.

In sugarbushes, predisposing stresses include drought, heavy grazing, over-tapping, and/or heavy traffic by farm machinery. Seriously affected trees are often over-mature and have been heavily tapped for many years. Tapping holes, animal-damaged roots, and machine-damaged roots are all routes for entry of wood decay organisms. If this scenario is followed by insect defoliation as previously described, the result is often mortality of the stressed trees.

In urban sites principal stress factors in maple decline include drought, de-icing salts and/or road and sidewalk construction. These stresses also facilitate invasion by secondary organisms including root rots, decays and twig blights which greatly reduce chances of recovery from original stress(es). No matter which of the three environments maple decline occurs in, the sequence of events is similar. Healthy trees are stressed repeatedly, the stresses alter the tree's internal chemistry to allow repeated attack by secondary organisms, and the trees ultimately die.

## Symptoms

- 1. Reduced twig growth.** Yearly twig growth varies considerably between trees and even within the canopies of individual trees. If the distance from bud scar to bud scar is less than or equal to five cm on a non-shaded twig, the tree may be in trouble.
- 2. Reduced foliage growth.** Keep in mind the normal, healthy appearance of the particular maple species' foliage. Foliage that is sparse, light green and/or scorched signals that the tree may be declining.



**Figure 1: Early symptoms.**



**Figure 2: Dieback in crown.**

**3. Early fall coloration.** Maples normally begin showing fall color after the first frost or in mid-to-late September. When fall color develops earlier than normal, in late July or early August, the maple is suffering from decline.

**4. Dead branches in upper canopy.** Small dead branches seen in tree tops in late spring or early summer are indicative of decline. Over time, larger, more visible branches and limbs will dieback. The more numerous the dead twigs or branches are, the more severe the decline condition.

**5. Poor root condition.** If roots can be examined, look for reduced occurrence of small feeder rootlets; dead, brittle roots; and decaying buttress roots.

## Control Strategies

Treatment for declining urban maples includes watering, fertilizing, pruning dead branches, and reducing salt-laden spring water runoff over the roots. Thoroughly water trees every week or two during extended dry weather. Trees should be watered with a slow stream from a hose. Move the hose periodically to soak the entire soil area under the tree's branches to a depth of six or more inches. Fertilize trees with a complete fertilizer in the spring and/or late fall. The general recommendation is 2 to 4 lbs fertilizer per inch of tree diameter (0.35 to 0.7 kg per cm of tree diameter at 1.5 m above ground). Broadcast the fertilizer over the surface of the ground. Some risk of burn on nearby turf may occur at the higher rates. Prune dead branches as well to possibly stimulate renewed, vigorous shoot growth. Pruning is best done in the early spring, prior to budbreak, to promote healing of the pruning cuts. Road salt impact can be reduced by placing a barrier (curb, burn, ditch, etc.) which will catch and/or divert the spring runoff water which often contains copious amounts of salt. If soil and foliar analyses have been run and high sodium or chloride concentrations were found, then leaching the soil with fresh water or applying gypsum to improve the soil structure or texture may be useful.

By the time symptoms are noticed, the tree may be beyond being restored to its original splendor. However, at this time another tree may be planted which will eventually replace the declining maple. In this way the newly planted tree will have a few years to grow prior to the removal of the declining maple. Plant young maple trees away from roads to avoid de-icing salt problems.

The success of treatment to declining maples depends primarily on early detection of maple decline, the health



of the tree prior to treatment, and/or its ability to respond to treatment. Positive diagnosis will often depend on "on the spot" examination or the amount of information obtainable from the person submitting a sample. However, the prescribed treatments of fertilizing, watering and pruning will not damage healthy trees.

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This publication may contain pesticide recommendations. Changes in pesticide regulations occur constantly, some materials mentioned may no longer be available, and some uses may no longer be legal. All pesticides distributed, sold, and/or applied in New York State must be registered with the New York State Department of Environmental Conservation (DEC). Questions concerning the legality and/or registration status for pesticide use in New York State should be directed to the appropriate Cornell Cooperative Extension Specialist or your regional DEC office. **READ THE LABEL BEFORE APPLYING ANY PESTICIDE.**

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**The Plant Disease Diagnostic Clinic** at Cornell University is located at **334 Plant Science Building, Ithaca, NY, 14853**.  
Phone: 607-255-7850, Fax: 607-255-4471, Email: [kls13@cornell.edu](mailto:kls13@cornell.edu) or [slj2@cornell.edu](mailto:slj2@cornell.edu)



# Japanese Barberry *Berberis thunbergii* DC.

**Native Range:** Japan

**Description:** Japanese barberry is a compact, spiny, deciduous shrub in the barberry family (*Berberidaceae*) that commonly grows from 2 to 3 feet tall (although it can grow up to six feet in height). Roots are shallow but tough. The smooth-edged leaves range from oval to spoon-shaped and are clustered in tight bunches close to the branches. The single spines bear small leaves in their axils. Yellow flowers bloom in May, are about one third of an inch wide, and are solitary or in small clusters of 2-4 blossoms. The bright-red fruits mature in mid-summer and hang from the bush during autumn and into winter. The berries are small, oblong, and found singly or in clusters. The plant regenerates by seed and creeping roots. Birds and rabbits are known to eat the seeds and distribute the species. Branches root freely when they touch the ground; thus allowing single plants to become quite large.



**Habitat:** Japanese barberry prefers well-drained soils, although it has been found in wet, calcareous situations, (specifically in a black ash swamp). It is typically found in locations of partial sunlight such as woodland's edge; it can survive well under the shade of an oak canopy. It is also found along roadsides, fences, old fields, forest edges, and open woods. Japanese barberry can be found invading oak woodlands and oak savannas; it is widespread in Wisconsin woodlands south of the tension zone. A related non-native species, *B. vulgaris*, was widely planted for similar purposes, but has been exterminated because it is the alternate host of black rust, a disease that affects wheat crops. Japanese barberry competes poorly with grasses and may succumb to drought conditions.

**Distribution:** This species is reported from states shaded on the Plants Database map. It is reported invasive in CT, DC, DE, IN, KY, MA, MD, ME, MO, NC, NH, NJ, NY, OH, PA, RI, TN, VA, VT, WI, and WV.



**Environmental Impact:** It often escapes cultivation. Plants shade out other understory species. Recent research studies in New Jersey indicated that Japanese barberry changes the soil chemistry in environment it inhabits.

## Control and Management:



- **Manual-** Mechanical removal of the plant is recommended in early spring because barberry is one of the first shrubs to leaf out, thereby making identification easier. Cutting, pulling or digging are effective in areas where there are only a few plants. A hoe, weed wrench, or mattock should be used to uproot the bush and all connected roots. Thick gloves are recommended for protection from the shrub's spines. Japanese barberry may be relatively easy to control in fire-adapted communities. Fire is thought to kill these plants and prevent future establishment.
- **Chemical-** Triclopyr has been used as a cut-stump treatment with success. Other herbicides labeled for brush control, such as glyphosate, may prove to be effective. Care in application is essential because glyphosate is a non-selective herbicide that can kill native species as well. Herbicides are suggested only for plants that are difficult to remove mechanically.

**Reference:** <http://www.dnr.state.wi.us/org/land/er/invasive/factsheets/b...>, <http://plants.usda.gov/> <http://webapps.lib.uconn.edu/ipane/browsing.cfm?descriptionid=26>, [www.forestryimages.org/](http://www.forestryimages.org/) [www.nps.gov/plants/alien](http://www.nps.gov/plants/alien), Czarapata, Elizabeth J. *Invasive Plants of the Upper, an Illustrated Guide to their Identification and Control*, 2005, p. 88-89

## PRINTED REFERENCES

- Batcher, M.S. and S.A. Stiles. 2000. Element stewardship abstract for *Lonicera maackii* (Amur honeysuckle), *Lonicera morrowii* (Morrow's honeysuckle), *Lonicera tatarica* (Tatarian honeysuckle), and *Lonicera x bella* (Bell's honeysuckle): The bush honeysuckles. The Nature Conservancy, Arlington, VA.
- Brock, T.D. 2004. Use of herbicide in the eradication of honeysuckle (Wisconsin). *Ecological Restoration* 22(2):145-146.
- Cochrane, T.S. 1995. *Lonicera maackii* (Caprifoliaceae) naturalized in Wisconsin. *The Michigan Botanist* 34:79-83.
- Czarapata, E.J. 2005. Exotic Honeysuckles. p. 32-35. In: *Invasive Plants of the Upper Midwest: An Illustrated Guide to Their Identification and Control*. University of Wisconsin Press, Madison, WI.
- Glass, S. 1994. Experiment finds less herbicide needed to control buckthorn. *Restoration and Management Notes*. 12(1):93.
- Gould, A.M.A. and D.L. Gorchov. 2000. Effects of the exotic invasive shrub *Lonicera maackii* on the survival and fecundity of three species of native annuals. *American Midland Naturalist*. 144:36-50.
- Hoffman, R. and K. Kearns (eds.). 1998. Exotic bush honeysuckles. p. 19-21. In: *Wisconsin manual of control recommendations for ecologically invasive plants*. Bureau of Endangered Resources, Wisconsin Department of Natural Resources, Madison, WI.
- Luken, J.O. 1996. *Lonicera maackii*, *L. morrowii*, *L. tatarica*: Bush honeysuckle. p. 60-61. In: J.M. Randall and J. Marinelli (eds.). *Invasive plants: Weeds of the global garden*. Brooklyn Botanic Garden Publications, Handbook #149, Brooklyn, NY.
- Schmidt, K.A. and C.J. Whelan. 1999. Effects of exotic *Lonicera* and *Rhamnus* on songbird nest predation. *Conservation Biology* 13(6):1502-1506.

## WEBSITES

- [www.nps.gov/plants/alien/factmain.htm](http://www.nps.gov/plants/alien/factmain.htm)  
Plant Conservation Alliance Alien Plant Working Group fact sheets on alien plant invaders of natural areas, including honeysuckle
- [www.ipaw.org/invasives/honeysuckle/index.htm](http://www.ipaw.org/invasives/honeysuckle/index.htm)  
Invasive Plants Association of Wisconsin summary on invasive honeysuckles
- <http://plants.usda.gov>  
U.S.D.A. Natural Resources Conservation Service summary of United States invasive weeds
- [www.dnr.state.mn.us/invasives/terrestrialplants/woody/exotichoneysuckles.html](http://www.dnr.state.mn.us/invasives/terrestrialplants/woody/exotichoneysuckles.html)  
Minnesota Department of Natural Resources summary of honeysuckles
- [www.wscf.ec.gc.ca/publications/inv/14\\_e.cfm\\*targ6](http://www.wscf.ec.gc.ca/publications/inv/14_e.cfm*targ6)  
Environment Canada, Canadian Wildlife Service publication of invasive plants of natural habitats in Canada
- [www.botany.wisc.edu/wisflora](http://www.botany.wisc.edu/wisflora)  
University of Wisconsin-Madison Herbarium checklist of the vascular plants of Wisconsin; shows range of honeysuckles in Wisconsin
- [www.dnr.state.wi.us/invasives/plants.asp](http://www.dnr.state.wi.us/invasives/plants.asp)  
Wisconsin Dept. of Natural Resources Endangered Resources; fact sheets on invasives including honeysuckles
- [www.imapinvasives.org/GIST/ESA/esapages/loni\\_spp.html](http://www.imapinvasives.org/GIST/ESA/esapages/loni_spp.html)  
The Nature Conservancy summary of honeysuckles

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Additional honeysuckle brochures are available from your county Extension office and local Wisconsin DNR Service Center (PUB-FR-448-2009-Invasive Exotic Shrub Honeysuckles).

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# Invasive Exotic Shrub HONEYSUCKLES



## MAJOR THREATS TO MIDWESTERN WOODLANDS

## THREATS

Invasive exotic shrub honeysuckles

- ❖ can displace native understory vegetation;
- ❖ form an impenetrable understory layer;
- ❖ may degrade wildlife habitat;
- ❖ can cause long-term decline of forests by shading out other woody and herbaceous plants;
- ❖ may compete with native plants for pollinators, reducing seed set of native plants;
- ❖ may not serve as a source of high-fat, nutrient-rich fruit for migrating birds.

## IDENTIFICATION

**Growth:** Invasive exotic shrub honeysuckles are medium to large-sized, deciduous, multi-stemmed shrubs growing 6–15 feet tall and 6–12 feet wide. They have dense, upright, vase-shaped to rounded forms. Amur honeysuckle (*Lonicera maackii*) and Bell's honeysuckle (*L. x bella*), usually grow slightly taller than Morrow's honeysuckle (*L. morrowii*) and Tatarian honeysuckle (*L. tatarica*). Honeysuckles are fast growing and shallow rooted, forming dense colonies when they invade woodlands.

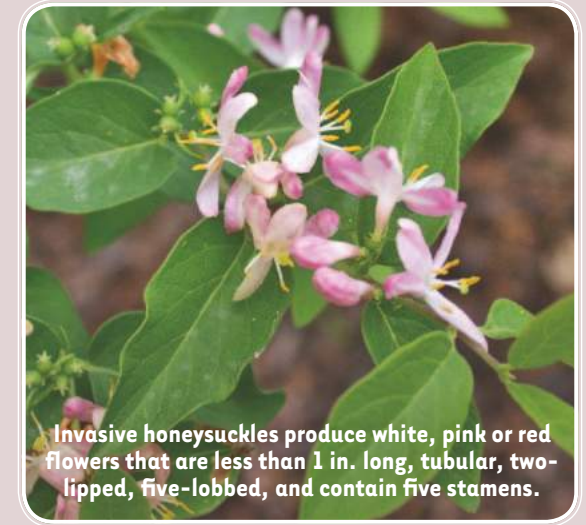
**Leaves:** Leaves of invasive exotic shrub honeysuckles are simple, opposite, oval to oblong, with entire margins and short petioles. They typically measure 1–2½ inches long and 1–1½ inches wide. Amur honeysuckle has darker, larger, somewhat glossy leaves (2–3 inches long) that taper to a distinct, long, slender point at the tip and are slightly hairy. Morrow's honeysuckle has hairy, gray-green leaves, while Tatarian honeysuckle has smooth, hairless, dull, bluish-green leaves. Bell's honeysuckle, a hybrid between Tatarian and Morrow's honeysuckle, has

dull leaves that are slightly hairy on the undersides. Invasive exotic shrub honeysuckles are easy to find in early spring and late autumn, as they tend to leaf out early and retain their leaves late into the fall. Invasive exotic shrub honeysuckles do not have distinctive fall color.

**Stems:** Stems of older, invasive exotic shrub honeysuckles are often hollow, with light, grayish-brown, shaggy bark in long strips. Buds along the stem are opposite and project at almost right angles to the stem. In comparison, native shrub honeysuckle stems have solid, white piths (i.e., stem centers).

**Flowers:** Invasive exotic shrub honeysuckles flower from early to late May until early June, depending on location. Flowers are borne in pairs at the nodes along the stem (i.e., in the leaf axils). Flowers are generally less than 1 inch long, fragrant, tubular, two-lipped and five-lobed, with five stamens (i.e., male floral parts). Nectar collects at the base of the flower tube and is attractive to both insect and hummingbird pollinators.

Amur and Morrow's honeysuckles produce white flowers that fade to yellow with age but Morrow's honeysuckle flowers are hairy and are borne on hairy peduncles (i.e., flower stems). Tatarian honeysuckle produces smooth flowers that are white, pink or crimson-red (especially on cultivars)



and do not yellow with age. Bell's honeysuckle has white to pink flowers, fading to yellow, on slightly hairy stems. *Lonicera* 'Freedom' and *L.* 'Honeyrose', two cultivars that are the result of a complex hybrid of several honeysuckle species, produce pink-tinged white flowers and rosy-red flowers, respectively.

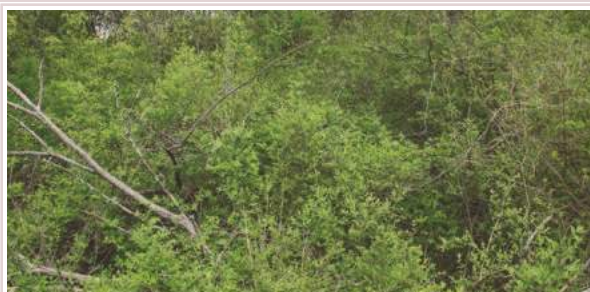
**Fruit and Seed:** Honeysuckle fruit ranges from red to orange-yellow, depending on species and cultivar, and ripen in mid-summer (Morrow's, Tatarian, Bell's, Freedom, and Honeyrose honeysuckles) or early to mid autumn (Amur honeysuckle). The fleshy, ¼-inch diameter berries contain many seeds. Seeds are less than ⅛-inch long, oval, flattened, and yellow. Every year, invasive exotic shrub honeysuckles produce large quantities of viable seed that are readily dispersed by birds. The seeds require a cold, moist period to break dormancy, which occurs in the soil during winter. The germination rate of honeysuckle seeds is high under a wide range of environmental conditions. However, germination is highest on open ground or where understory development is sparse. Honeysuckle seeds remain viable in soil for two or more years.

## HISTORY

Invasive exotic honeysuckles are native to Asia and southern Russia. They were introduced into North America as ornamentals in the mid-18<sup>th</sup> and 19<sup>th</sup> centuries, due to their showy flowers and fruit. They were also used for wildlife food and cover, and soil erosion control. Bell's honeysuckle (*L. x bella*), a hybrid of Tatarian honeysuckle (*L. tatarica*) and Morrow's honeysuckle (*L. morrowii*), has quickly become as invasive as its parents. Unfortunately, some invasive exotic honeysuckles, especially the Tatarian honeysuckle cultivars 'Arnold Red' and 'Zabelii', as well as Freedom and Honeyrose honeysuckles, are still sold due to their ornamental characteristics and form, but should be considered invasive and should not be planted.

## DISTRIBUTION AND HABITAT

Invasive exotic honeysuckles range from southern New England and Canada south into North Carolina, west to the Great Plains and north into the Midwest. They often invade woodlands, especially those that are grazed or disturbed. They can also occur along lakeshores, forest edges, abandoned fields, pastures, roadsides, and other open, upland habitats. Morrow's and Bell's honeysuckle can also invade sand plains, bogs and fens. These honeysuckles can live under a broad range of light and moisture conditions, as well as in many different plant communities. However, they do not perform as well in shady environments. Large, urban areas are often invaded by honeysuckles. However, rural infestations have occurred where honeysuckles have been introduced to provide wildlife cover and food.



Invasive exotic honeysuckles invade forest understories, crowding out native shrubs, groundcovers, and ephemerals.

## SIMILAR SPECIES

Other exotic honeysuckles may look like their invasive cousins, but they are not considered invasive plants. These include Clavey's Dwarf and Mini Globe honeysuckles (*L. x xylosteoides* 'Clavey's Dwarf' and 'Mini Globe'), and Emerald Mound honeysuckle (*L. xylosteum* 'Emerald Mound'). Other native, rarely seen shrub honeysuckles include American fly honeysuckle (*L. canadensis*), bearberry honeysuckle (*L. involucrata*), swamp fly honeysuckle (*L. oblongifolia*), and mountain fly honeysuckle (*L. villosa*). Except for the native swamp fly honeysuckle, exotic shrub honeysuckles have hairy styles (i.e., female reproductive structures). Bush honeysuckle (*Diervilla lonicera*), is not a true honeysuckle, but is related, native, and has small, yellow flowers at the tips of branches in summer, and dry, brown capsules in late summer.

Some honeysuckles are twining, woody vines, rather than shrubs. Native examples include the grape honeysuckle (*L. reticulata*, formerly *L. prolifera*); hairy honeysuckle, (*L. hirsuta*), and limber honeysuckle (*L. dioica*). Non-native, vine honeysuckles, such as Dropmore Scarlet honeysuckle (*L. x brownii* 'Dropmore Scarlet'), yellow honeysuckle (*L. flava*), goldflame honeysuckle (*L. x heckrottii*),



Invasive exotic honeysuckles have been used as a hedge shrub due to their ornamental characteristics and form, but should not be used due to their invasiveness.

Mandarin honeysuckle (*L. 'Mandarin'*), woodbine honeysuckle (*L. periclymenum*), and trumpet honeysuckle (*L. sempervirens*), are not considered invasive. However, the non-native Japanese honeysuckle vine (*L. japonica*), is highly invasive and readily grows in native areas, especially woodlands. This honeysuckle has fragrant, white flowers that turn yellow with age, and produces black fruit. This species is very invasive in the southern Midwest and throughout the eastern U.S.

## SPREAD

Invasive exotic honeysuckles can rapidly form dense shrub layers in the forest understory. These honeysuckles produce large numbers of fruit that are highly attractive to birds. In the eastern United States, over twenty species of birds feed on honeysuckle fruit. Thus, birds commonly move honeysuckle seeds across the landscape. Invasive exotic honeysuckle seedlings grow in areas with sparse vegetation, especially under tall trees and shrubs. They also spread vegetatively by producing suckers and sprouts at the base of the plant, especially after severe pruning. Because of this, invasive exotic honeysuckles tend to persist in an area once they have become established and can not be easily removed by cutting alone.

Invasive exotic honeysuckles are responsible for crowding and shading out many native trees, shrubs, groundcovers, and spring wildflowers. In addition, they may compete for pollinators, reducing fruit formation and seed set of native species. Invasive exotic honeysuckles may also have a negative impact on wildlife. American robins (*Turdus migratorius*) nesting in invasive shrub honeysuckles experienced higher predation than those nesting in native species, due to lower nest heights, a lack of protective thorns, and a more conducive branch structure for predator movement. However, these results were specific to a single location and it is not known whether they will be applicable to other sites or bird species. Finally, honeysuckle fruit, while plentiful, may not offer migrating birds the high-fat, nutrient-rich food source they need for long flights.

## CONTROL METHODS

Control of invasive exotic honeysuckles is best achieved with early identification, and removal of isolated plants before they begin to produce seed. Once established, honeysuckles can shade out existing vegetation and prevent establishment of the native understory. In large infestations of honeysuckle, larger, seed-producing plants should be removed first.

**Hand pulling:** Honeysuckle plants with a stem diameter of ½ inch or less can be easily removed by hand pulling when soil is moist. Because honeysuckles have shallow roots, larger plants can be dug or pulled out using a rope or chain placed around the base of the plant. All larger roots must be removed as the shrubs can resprout from any remaining roots. Digging will disturb the soil, which can lead to honeysuckle reinvasions. Be sure to revisit the site the following summer to remove newly emerged plants.

**Fire:** Prescribed burns in early spring or autumn show promise in controlling invasive honeysuckle seedlings, but kills only the tops of larger shrubs, which can resprout. Fire works best on seedlings in fire-adapted plant communities (e.g., prairies, savannas, and oak woods), and should not be used where native plant communities might be adversely affected. Repeated burning every one to two years may be necessary. Consult with a restoration expert before attempting a burn. When burning, be sure to follow all local ordinances and state fire codes, and obtain local permits as needed.

**Cutting:** Larger plants that are hard to remove by hand pulling should be cut at the base with a lopper, hand saw, or carefully with a chainsaw. Shrubs can resprout from cut stumps or from the root systems if not treated with herbicides. Repeated basal pruning during the growing season may eventually weaken the plant resulting in reduced sprouting.

**Herbicides:** The effectiveness of cutting can be improved by immediately painting or spraying

cut stumps with a selective herbicide such as triclopyr (e.g., Ortho® Brush-B-Gon® or Garlon 4®) or a non-selective herbicide such as glyphosate. Glyphosate is the active ingredient in many herbicides including Roundup Pro®, Touchdown®, or Rodeo® (for use near waterways). Use a 20–25% (by volume) solution to ensure death of the plant and to prevent resprouting. Apply the herbicide to stumps immediately after cutting using a low-pressure hand sprayer, spray bottle, or sponge applicator. Herbicide applications to stumps should be directed to the vascular (i.e., water-conducting) tissue located just inside of the bark. Follow-up treatments may be needed for the next several years if resprouting occurs.

For younger, smaller shrubs, a basal bark application of a 12.5% (by volume) oil-formulated triclopyr solution (Garlon 4®) may be used to control honeysuckle in autumn without the need for cutting. Oil formulations of triclopyr are more effective than triclopyr formulations diluted in water. Triclopyr is a selective herbicide and only kills broad-leaved plants. It does not harm most grasses. This herbicide is volatile and should not be used at temperatures above 80°F.

Foliar applications of herbicides to seedlings and larger plants can also be effective. However, this technique is best reserved for treating areas with large numbers of honeysuckle seedlings, as non-target vegetation can be easily damaged or killed. Herbicide concentrations of triclopyr or glyphosate are generally lower for foliar sprays (1–3% by volume) than for stump applications.

Dyes can be added to the herbicide formulation to help identify treated areas. As with any pesticide, read the label prior to use to verify that the rates listed here are consistent with those legally allowed for on the label, and to read about proper safety precautions.

Because invasive honeysuckles retain their leaves and continue to grow into late autumn, the best

time for foliar sprays of glyphosate to treat honeysuckles is in mid to late autumn when many non-target plants are going dormant and are least likely to be damaged. In addition, in autumn, honeysuckle shrubs are transporting nutrients to their roots and thus uptake of herbicides is best at this time resulting in the highest mortality. Winter applications are also very successful for fresh cut stumps, decreasing the risk of damaging non-target species. However, if shrubs are cut in winter and herbicide treatments are not applied, vigorous resprouting occurs in spring. Spring cut-stump applications of triclopyr after budbreak, can effectively control honeysuckles.

Repetition of mechanical and chemical control methods may be necessary for at least three to five years in order to deplete honeysuckle plants and their seed bank. Replant areas that were infested with invasive species with native species tolerant to existing environmental conditions. This can help prevent reinvasion of invasive species.

**Biological Control:** At this time, no biological control agents are available to control any of the exotic shrub honeysuckles.

**Education:** One of the best honeysuckle control methods is education. Tell your neighbors about invasive honeysuckles. A neighbors' honeysuckle can produce large amounts of fruit and seed that can be disseminated into your backyard and the surrounding neighborhood by birds. Encourage your neighbors to remove their invasive honeysuckles and monitor their yards for seedlings.

**NOTE:** References to pesticide and other products in this publication are for your convenience and are not an endorsement or criticism of one product over similar products. You are responsible for using pesticides according to the manufacturer's current label directions. Follow directions exactly to protect the environment and people from pesticide exposure. Failure to do so violates the law.

# Spotted Knapweed

## Background, Life History

Spotted knapweed (*Centaurea stoebe micranthos*) was likely introduced into the United States in 1890s through commercial seed imports from Eurasia. It prefers sunny, well-drained soils.

It is often found in heavily disturbed sites, such as roadsides, gravel pits and agricultural field margins, but also can be present in undisturbed dry prairies, oak and pine woodlands and rangeland.

Spotted knapweed is a tap-rooted, short-lived perennial. By the end of the first year, a knapweed plant is a small basal rosette. It usually bolts in the second year producing branched stems up to 4 feet tall. The plant gets its name from the spotted bracts immediately below the numerous, pink flowers. A single plant can have as few as one stem or as many as 20. The leaves are alternate, deeply lobed and pale blue-grey in color.

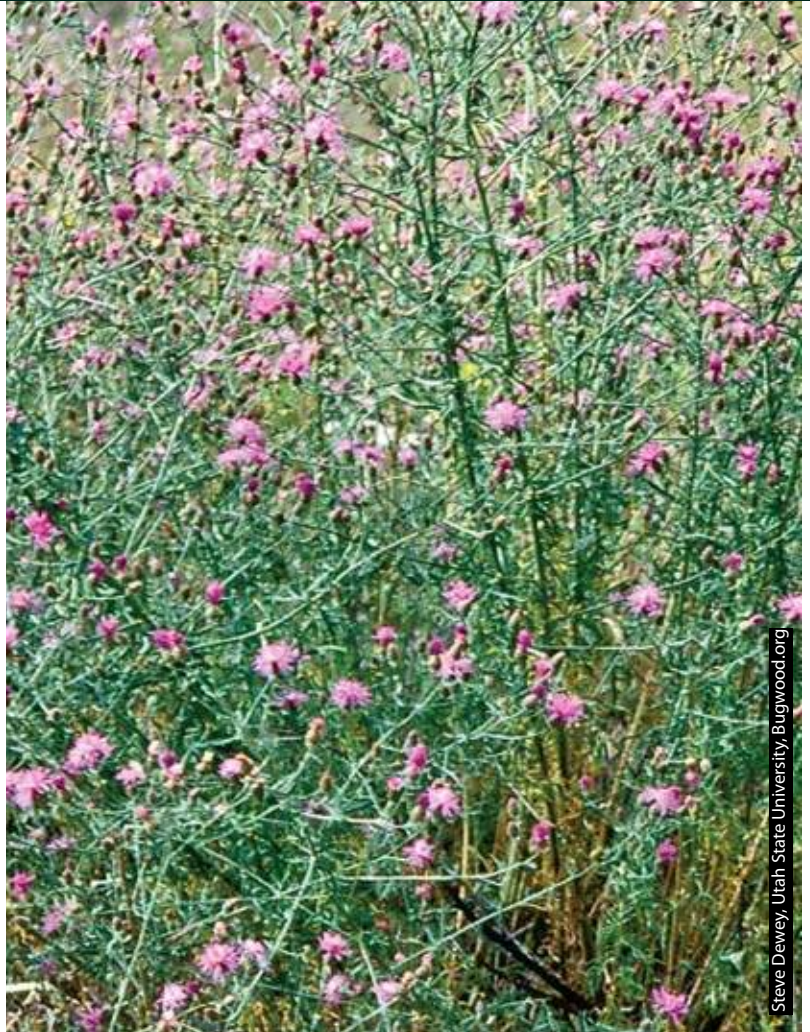
The small, pink, thistle-like flowers bloom in June and July. The numerous flowers can produce as many as 1,000 seeds per plant. The seeds are the main form of dispersal and can be as abundant as 5,000 seeds per square foot. They can remain viable for at least eight years. The seeds have pappuses (little hairs) that enable wind dispersal. Germination occurs in early spring.

As spotted knapweed seeds mature in late summer and fall, they can be spread on mowing equipment and in infested hay, seed and gravel. When purchasing hay, seed or gravel, it is important to know the location of the source. Seeds can also spread by hitchhiking on vehicles, other equipment, and even clothing. Always clean anything exposed to spotted knapweed infested areas while mature seeds are present to prevent spreading seeds to new areas. Natural pathways for spread include wind and water.

## Impacts

This plant produces chemicals that inhibit growth of surrounding plants. This reduces the amount of diversity in the area and degrades wildlife habitat. It is unpalatable to wildlife and most livestock, so food sources become limited as well. Runoff, erosion and sedimentation increase, affecting streams and aquatic organisms.

It is estimated that Montana loses \$4.5 million dollars annually in recreation, forage and costs related to knapweed control.





Linda Wilson, University of Idaho, Bugwood.org

*In the first year, spotted knapweed is a small basal rosette.*



Montana Statewide Noxious Weed Awareness and Education Program Archive, Montana State University, Bugwood.org

*Look for alternate, lobbed leaves.*



Cindy Roche, Bugwood.org

*Note the black spots on the bract.*

## Control

The Missouri legislature designated spotted knapweed a noxious weed in 2008. Hand-pulling is effective for small infestations if completed prior to seeding. Remove the entire crown and taproot to prevent regrowth. Use of gloves is necessary as this plant contains an irritant. Long-term grazing by sheep and goats also can be successful in controlling the plant. These activities will have to be repeated each year until the seed bank is exhausted.

The most effective control strategy for large infestations is an integrated approach using bioagents, mechanical removal and herbicides. The recommended chemical control is the application of a herbicide containing aminopyralid, such as Milestone, in the spring before the plant flowers. Applying 2,4-D to rosettes in the fall or early spring also is effective. Read and follow all herbicide label directions. Bioagent insects are being used in Missouri and many other states to control large stands of spotted knapweed. The most effective insects include a combination of seedhead (*Larinus minutus*) and root-boring (*Cyphocleonus achates*) weevils. These insects have been approved by USDA/APHIS, and only survive as long as knapweed is present. Burning and mowing are not effective control measures.

## Identifying Spotted Knapweed

- up to 4 feet tall
- bracted stems
- spotted bracts below flowers
- alternate, lobbed leaves

## For Additional Information

[www.na.fs.fed.us/fhp/invasive\\_plants/weeds/spotted-knapweed.pdf](http://www.na.fs.fed.us/fhp/invasive_plants/weeds/spotted-knapweed.pdf)

[www.invasive.org/eastern/biocontrol/13Knapweed.html](http://www.invasive.org/eastern/biocontrol/13Knapweed.html)

[www.invasive.org/species/subject.cfm?sub=3013p://plants.usda.gov/java/profile?symbol=CESTM](http://www.invasive.org/species/subject.cfm?sub=3013p://plants.usda.gov/java/profile?symbol=CESTM)

[ftp-fc.sc.egov.usda.gov/MT/www/technical/invasive/Invasive\\_Species\\_Tech\\_Note\\_MT1.pdf](http://ftp-fc.sc.egov.usda.gov/MT/www/technical/invasive/Invasive_Species_Tech_Note_MT1.pdf)

[www.ppws.vt.edu/scott/weed\\_id/cenma.htm](http://www.ppws.vt.edu/scott/weed_id/cenma.htm)

[www.MissouriConservation.org](http://www.MissouriConservation.org)

For more information or to report a population, contact your local Missouri Department of Conservation office, e-mail [WildlifeDivision@mdc.mo.gov](mailto:WildlifeDivision@mdc.mo.gov), or write:

**Spotted Knapweed**  
**Missouri Department of Conservation**  
**Invasive Species Coordinator**  
**P.O. Box 180**  
**Jefferson City, MO 65102-0180**





# COMMON TANSY: Options for control

**Common Tansy**, a class-C noxious weed in Lincoln County, Washington (*Tanacetum vulgare*) of the Asteraceae family. It is also known as bitter but-tons, cow bitter, mugwort and golden but-tons. Common tansy is an aromatic perennial forb that reproduces by seed or root-stalks. The leaves are deeply divided into leaf-lets with toothed margins, alternate and are consistent in size, and smell like camphor. The stems are often purplish-red and grow 1 to 6 feet tall. Yellow-orange button-like flower heads that lack long petals (ray flowers) are numerous (20 to 200) in flat-topped, dense clusters on the terminal stem. The yellowish-brown seeds have five-toothed ridges.

Originally from Europe, common tansy was introduced into the United States for its ornamental

and medicinal qualities, and has escaped cultivation. In Early Modern Europe, herbalists used Common tansy oil to induce miscarriages. The tanacetum, the oil in the stem and leaves, can also be fatal to both humans and animals. In Medieval times, people ate young Common tansy leaves during Lent to remind them of the bitter herbs that the Jews ate on Passover. Today, it is used in floral arrangements, as the bright yellow flowers retain their color when dried.

Common tansy is an undesirable forage for livestock. It is generally found along roadsides, waste areas, stream banks, vacant lots, and in pastures throughout most of the U.S. It prefers disturbed places, particularly those with access to water.



Common tansy over-winters as a basal rosette.



Leaves are dark green in color and look like ferns.



Tall upright stems are often purplish red and dotted with glands.

## Key identifying traits

- Perennial with 2 to 6 ft. tall **purplish-red stems** topped with dense clusters of bright yellow flowers.
- Leaf has **distinct smell** not shared by its look-a-like tansy ragwort.
- Alternate **leaves** are **deeply toothed**, look like **ferns**, are **furry** on the underside and **smooth** above.
- **Flower** head has 20-200 button-like disk flowers that do not have petals.
- **Flower** heads turn brown and maintain their shape at seed set.
- **Roots** are fibrous and produce rhizomes.

## Biology and ecology

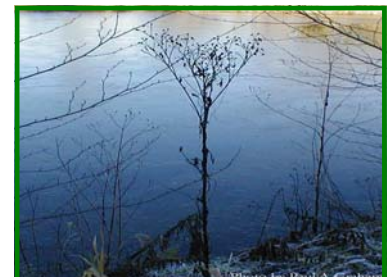
- Perennial plant reproduces by **seeds** and **root stalks**. Flowering is from July to September.
- A single large plant may produce **150,000 seeds**, which may lie dormant in the soil for as long as **15 years**.
- **Foliage** contains the insecticide pyrethrin, neurotoxin thujone, toxic oil tanacetin, and camphor. **Tainted milk** results when dairy cows eat the **leaves**.
- **Human consumption** of concentrated plant extracts, has resulted in **illness** and **death**.
- **Found** in full sun along stream banks, trails and roadsides, in waste areas and vacant lots and pastures.
- Often **confused** with class B noxious weed tansy ragwort, and groundsel.



Numerous seeds are tufted and dispersed by wind and water.



Flowers are yellow, button-like in flat topped dense clusters, resembling the center of a daisy.



Often found along stream banks, here's a picture of the rust colored winter stalk.

# CONTROL MEASURES:

For this and other publications, see our website at: [www.co.lincoln.wa.us/weedboard](http://www.co.lincoln.wa.us/weedboard)

## Prevention:

- Beware of fill dirt, hay and seed from outside your area. **Early detection** is vital to prevent invasion.

## Biological:

- No known bio control exists at this time.

## Cultural:

Healthy competitive vegetation helps lessen chance of invasion, but doesn't preclude it.

## Mechanical:

- Repeated tillage or digging can be effective, but must be done frequently to wear out rootstocks.
- Hand pulling is only effective where there are

few plants in their first year of growth. Be sure to pull before plants set seed.

- Tansy recovers well from mowing.

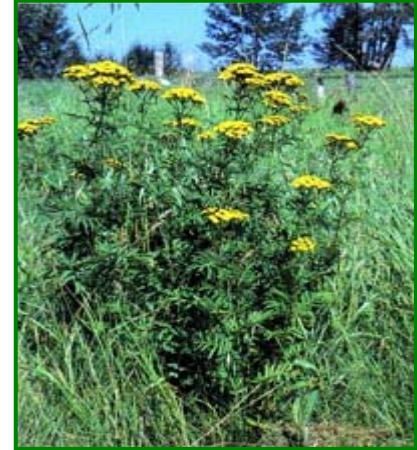
## Chemical:

- Metsulfuron (Escort) or Telarat 0.3 oz. per acre.
- Aminopyralid (Milestone) can be used up to the water's edge.
- Spot spraying with 2,4-D to water's edge.
- Dicamba + 2,4-D (Weedmaster) is an effective tool.
- A non-ionic surfactant to help with herbicide uptake.
- **Read the label** instructions before applying.

Common tansy contains alkaloids that are toxic to both humans and livestock, if eaten in large amounts, but animals seldom graze it, because of the strong smell. Gloves are a must when pulling common tansy, as the plant's toxins are absorbed through the skin. Horses and cows will browse tender young leaves, but won't touch bitter mature plants.



Common Tansy is wide spread across the United States.



Once Common tansy escapes from the garden, it invades pastures, meadows, roadsides and stream banks. With adequate moisture, this hostile weed will force out native plants. It threatens the biological structure of natural areas by reducing forage, wildlife habitat, and species diversity.

Photos and references courtesy of: King County Noxious Weed Control; photo, Steve Dewey, Utah State University; Montana State University; Wikipedia; Weeds B.C.

Lincoln County Noxious  
Weed Control Board  
405 Ross St.  
Davenport, WA 99122  
509-725-3646



# Japanese knotweed

*Fallopia japonica* (*Polygonum cuspidatum*)

Japanese knotweed is a non-native invasive plant that was introduced from Asia as an ornamental plant. Knotweed spreads vegetatively by rhizomes and also sprouts from fragments of root and stem material, which are dispersed by water, equipment or in fill. It forms fertile hybrids with giant knotweed (*Polygonum sachalinense*). Some populations, particularly hybrids, produce fertile seed.

Knotweed forms dense monocultures, with a thick layer of accumulated leaf and fibrous stem litter. A number of mechanisms contribute to its ability to exclude native species; light limitation, alteration in nutrient cycling and allelopathy—the ability to suppress growth of a potential plant competitor by releasing toxic or inhibiting chemicals.

Knotweed can contribute both to stream bank erosion and to flooding, when its large, fibrous stems wash into the water during periods of peak flow. Its rhizomes and shoots can penetrate asphalt and cracks in concrete. It is most aggressive on sites with natural or human disturbance; stream and riverbanks, roadsides and construction sites.

**Japanese knotweed is legally prohibited in Michigan. It is illegal to possess or introduce this species without a permit from the Michigan Department of Agriculture, and Rural Development except to have it identified or in conjunction with control efforts.**

## Identification

### Habit:

Japanese knotweed is a perennial, herbaceous shrub growing from 1 to 3 m (3-10 ft) in height. It has a deep taproot and an extensive network of rhizomes that may extend laterally from 7 to 20 m (23-65 ft). Its hollow stalks persist through winter and resemble bamboo.

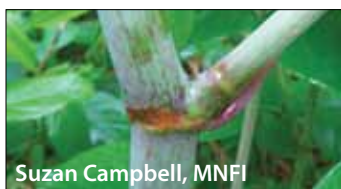
### Leaves:

Its leaves are simple, alternate and broad, typically growing up to 15 cm (6 in) long and 12 cm (5 in) wide. They have an abruptly pointed tip and a flat or tapering base.



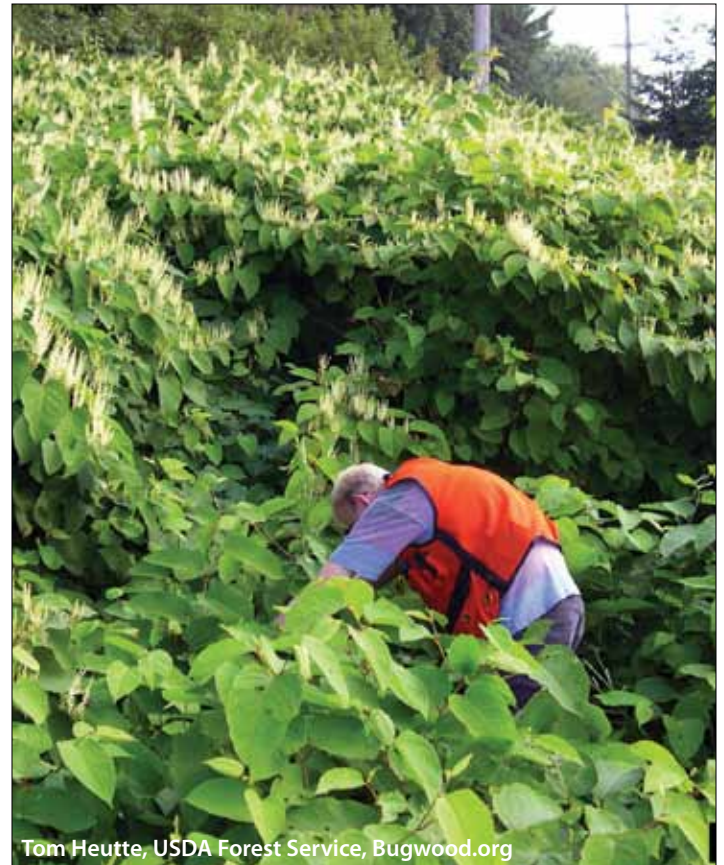
Suzan Campbell, MNFI

### Stems:



Suzan Campbell, MNFI

Japanese knotweed stems are upright, round, hollow, and often mottled, with a fine whitish coating that rubs off easily.



Tom Heutte, USDA Forest Service, Bugwood.org

### Flowers:



Suzan Campbell, MNFI

Knotweed has numerous, small, creamy white flowers. They are arranged in spikes near the end of the plant's arching stems. In Michigan, they bloom in August and September. Knotweeds are insect-pollinated.

### Fruits/Seeds:

Knotweed fruits are three-winged and 8 to 9 mm (0.32 in) long. Its seeds are dark and glossy, and may be dispersed by wind, water, birds and insects. Not all seed is fertile.



Chris Evans, River to River CWMA, Bugwood.org

### Habitat:

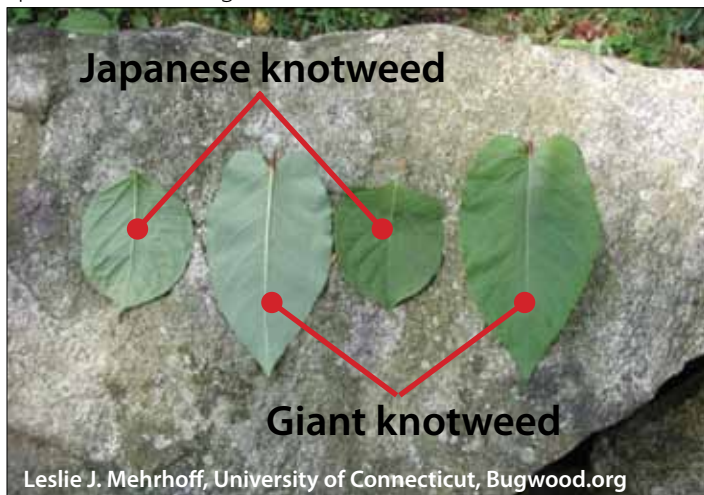
Japanese knotweed is semi-shade tolerant but grows best in full sun. It is found along roadsides, stream and river banks, wetlands, wet depressions and woodland edges, and can tolerate a wide array of soil and moisture conditions.

## Similar species

Several other knotweed species are similar to Japanese knotweed. All are invasive non-natives, and control methods discussed here are appropriate for all three species.

### Giant knotweed

Giant knotweed (*Fallopia sachalinensis*) is larger than Japanese knotweed, often reaching 4m (13 ft) in height. It can be distinguished by its larger leaves and heart-shaped leaf bases. Its leaves range from 5 to 30 cm (6-12 in) in length, while those of Japanese knotweed are usually 15 cm (6 in) long or less. They taper towards their tips, rather than being abruptly pointed. Giant knotweed leaves have long, wavy hairs on their undersides, while the hairs on Japanese knotweed are reduced to barely visible bumps. Use leaves from the middle of the stem for comparison as those at the tips are most variable. Giant knotweed flowers are held in spikes or branching clusters.



Giant knotweed and Japanese knotweed hybridize to form Bohemian knotweed (*Fallopia Xbohemicum*). The hybrids are fertile and back-cross readily, yielding a continuous range of variation between the characteristics of their parent species, including size, leaf bases and tips. The hairs on the leaf undersides are short with broad bases.

### Himalyan knotweed



The related non-native Himalyan knotweed (*F. polystachyum*) has narrower, sharply-pointed lance-shaped leaves that are up to 20 cm (8 in) long. Its leaf bases may be tapered or slightly heart-shaped. It can grow up to 1.8

m (6 ft) tall. It has not been reported in Michigan to date.

## Reproduction/Dispersal

Most reproduction in Japanese knotweed is believed to be vegetative, although the role of sexual reproduction is receiving increasing attention. As much as two thirds of the mature plant's biomass is stored underground in its extensive systems of thick rhizomes. Rhizomes can reach 7.5 cm (3 in) in diameter and penetrate at least 2 m (7ft) in suitable soils.

In addition, fragments of both stem and root material can sprout, giving rise to new plants or entire colonies. While fragments near the soil's surface are most likely to sprout, sprouting has been demonstrated from fragments up to 1 m (39 in) deep. Because of this, it presents an enormous threat along rivers, streams and floodplains, where plant parts may be washed downstream by flood waters. It can also be spread inadvertently during construction and road maintenance, by mowing crews and in fill dirt.

In Europe, all Japanese knotweed populations appear to be clones of a single female genotype and do not produce pollen. However, they are able to accept pollen from the closely related giant knotweed, producing the fertile hybrid Bohemian knotweed. The hybrid appears to be spreading faster than either of its parent species.

In North America, the situation is more complex and the potential for sexual reproduction both within the species and between related species is a focus of increased interest. Though the European female clone is widely dispersed in the US, other genotypes are also present. Populations have been documented with both male and female plants. Some may maintain reduced forms of the reproductive organs of the other sex. Though the female plants do not produce pollen, they can produce viable seeds. Male plants contribute pollen and may produce the occasional seed. Reproduction by seed has been documented in the Northeast and also in Wisconsin. The potential for spread of the hybrid knotweed may be even greater; both male and female fertile hybrids have been found without either of their parental species in New England. Japanese, giant and hybrid knotweed populations in Michigan should be monitored for seed production, which offers additional opportunities for spread.

Knotweed seedlings generally do not survive under the canopy of their parent plant and appear most likely to establish on bare soil, as they do in their native habitat. In western states, much of their most devastating spread has been along waterways, where soil is continually eroded and re-deposited downstream.

In Michigan, roadside maintenance equipment appears to contribute significantly to knotweed spread, as cut fragments are dispersed along roadways. Dumping of landscape waste by homeowners has also been documented as a source of new populations.

## Planning a control program

Resources for invasive species control invariably fall short of the actual need, so it is important to prioritize sites for treatment and plan carefully. It should be noted that control for all knotweeds is similar. Assessing the scope of the problem in the region of interest is a critical first step:

- Map known populations.
- How was the knotweed population under consideration introduced—was it deliberately planted? Or did it disperse from another population that should be also be eradicated or controlled?
- Identify potential dispersal pathways and monitor them;
  - Is the population along a stream or lake?
  - Is it being spread in landscaping waste?
  - Does it lie in the path of road-mowing crews that might spread it further? Are there construction sites in the area where it might be introduced in fill dirt?
  - Are home owners disposing of landscape waste or distributing cuttings as an ornamental plant?
- How is the species behaving in your area? Is it spreading rapidly? Is it reproducing by seed?
- Does it occur in high quality habitat or on important recreational, hunting or fishing lands?

Given this information, develop a strategy for control:

1. First, prevent further spread; block pathways for dispersal, e.g. road maintenance practices, contaminated fill.
2. Choose appropriate control methods, given site conditions and available resources.
3. If using herbicide, be sure to read the product label before finalizing plans. Is there potential for harm to non-target species? Have you made adequate provisions to minimize damage?
4. Do these control methods require any permits (i.e. herbicide application in wetlands, prescribed burning)?
5. Prioritize high value sites for treatment where the potential for successful control is high.
6. Where knotweed is being spread along waterways, begin control efforts upstream and work downstream; concentrate on sites where erosion/dispersal of fragments is greatest.
7. Eradicate smaller satellite populations.
8. Treat larger core infestations of lower value as resources permit.
9. Monitor to ensure desired results are being achieved; adapt management to improve success.

### Best survey period

Japanese knotweed is easiest to locate for mapping or control in August and September when it is in bloom. Its clustered spikes of creamy white flowers are distinctive and easy to spot.

## Documenting occurrences

In order to track the spread of an invasive species on a landscape scale, it is important to report populations where they occur. The Midwest Invasive Species Information Network (MISIN) has an easy-to-use interactive online mapping system. It accepts reports of invasive species' locations from users who have completed a simple, online training module for the species being reported. MISIN can also accept batch uploads of large quantities of data for any species.

Herbaria also provide an authoritative record of plant distribution. The University of Michigan Herbarium's database can be searched online for county records of occurrence, for example.

When Japanese knotweed is first encountered in a county where it had not been known previously, specimens should be submitted to the Herbarium to document its presence. Check the "Online Resources" section for links to both of these resources.

## Control

Mechanical methods alone will not effectively control large Japanese knotweed populations and may make them worse. Control efforts must target knotweed's massive underground system of rhizomes. This network allows it to spread to new areas even as it is being attacked mechanically. Accordingly, chemical treatments are given priority in the following section and then mechanical methods are discussed as some may enhance the effectiveness of chemical control. Specific herbicides, application methods and rates are listed on the reference table at the end of this fact sheet.

To date, a combination of chemical and mechanical techniques, in conjunction with on-going monitoring, provides the most effective control of this species. **Knotweed rhizomes that have not been completely killed off may send up new shoots as many as three years later.** In all cases, monitoring and follow-up treatment will be required for four to ten years, depending on the size and age of the population being treated.

## Chemical control

Japanese knotweed has always been considered difficult to eradicate, even with herbicides. Differing levels of success have been reported for the same chemical on different sites. These results are probably related to differences in the amount of root mass underground.

Older infestations have more extensive root systems and are harder to eradicate or control. Specific site conditions, weather on the day of application, calibration of equipment and applicator experience can also contribute to differing levels of effectiveness.



## General considerations

Anyone applying herbicides as part of their employment must become a certified pesticide applicator. In addition, certification is required for the use of some herbicides under any circumstances. The certification process is administered by the Michigan Department of Agriculture and Rural Development and a link to their website is included in the Online Resources section.

A permit from the Michigan Department of Environmental Quality is usually required to apply herbicide where standing water is present—in wetlands, along streams, rivers or lakes, or over open water. A permit is also required for herbicide use below the ordinary high water mark along the Great Lakes or Lake St. Clair shoreline, whether or not standing water is present. A link to their website is included in the “Online Resources” section.

A number of adjuvants or additives may be used with herbicides to improve their performance including mixing agents, surfactants, penetrating oils and dyes. Some are included in premixed products while others must be added. Adjuvants do not work with all products; consult the product label to determine which adjuvants may be used with a specific herbicide formulation.

Dyes are useful in keeping track of which plants have been treated and making spills on clothing or equipment apparent. Some premixed herbicide formulations include them or they can be added to others. Clothing dyes such as Rit® can be added to water soluble herbicides, while other products require oil-based dyes. Consult the product label for specific instructions.

Crop Data Management Systems, Inc. (CDMS) maintains a database of agro-chemicals that includes herbicide labels for specific products. Herbicide labels contain information on application methods and rates, specific weather conditions, equipment types, nozzles etc. to provide the desired coverage and minimize the potential for volatilization or drift. They also contain critical information about the potential for damage to valuable non-target species. A link to the CDMS website is included in the “Online Resources” section.

**Read the entire pesticide label before use. Follow all directions on the label.**

## Herbicide specifics

Imazapyr (e.g., Arsenal®) has shown the greatest documented effectiveness on this species to date. Of all the herbicides included here, it also has the greatest potential for collateral damage to valuable species nearby. Imazapyr can move within roots and be transferred between intertwined root systems of different plants and other species. It has the potential to cause significant damage or death to trees and other species in the area. This movement of herbicide is exacerbated when imazapyr is incorrectly over-applied.

**Because of its potential for collateral damage, imazapyr may not be appropriate for use in high-quality areas, with many desirable native species nearby.**

Imazapyr acts slowly, reaching the massive root system before damaging the leaves. Although it appears to not be working initially, it results in significantly higher die-off rates a year later. Spray should be directed toward the actively growing portions of the plant. Imazapyr persists in the soils for long periods of time—an advantage in providing greater control. However, since it is non-selective it can also kill valuable non-target species wherever it contacts their roots.

Sites where imazapyr has been used should not be planted for at least one year, because of its lingering effects. Imazapyr is available in several wetland-approved formulations but they must be applied by a certified pesticide applicator. Wetland approved formulations must be used wherever standing or open water is present.

Imazamox (e.g., Clearcast®) is also effective against Japanese knotweed, although there has been less research on it than imazapyr to date. Some imazamox formulations are approved for aquatic and wetland sites and can be used in upland settings also. Because it is non-selective, it may kill or harm desirable non-target species, although its impacts vary with concentration and mode of application. See label for additional information.

Aminopyralid (e.g., Milestone®), a broadleaf herbicide, is being tested on Japanese knotweed in other states and also appears to provide effective control. Although it does not kill established native grasses, it may damage nearby trees. As it remains active in the soil for a long period of time, a soil bioassay is needed before planting wildflowers or legumes, which are particularly vulnerable to it. It may be added to the “Quick reference” chart at the back of this document later, as more information on its effectiveness becomes available.

Although glyphosate (e.g., Roundup®, Aquamaster®) kills knotweed foliage quickly, the herbicide is not effectively transported to the roots. In most cases, the plant rebounds the following year. In other cases, regrowth is reduced, but stems and foliage are deformed and do not provide enough surface area for re-treatment. With less surface area, less herbicide will reach the roots and eventually the plant will grow back. On sites where glyphosate is the only permitted herbicide, it should be used in conjunction with other control methods (see the section on Digging under Mechanical Control, including the discussion of cutting through roots to stimulate healthy new growth). Glyphosate, like imazapyr, is non-selective and will kill non-target species.

A number of other herbicides are also effective in controlling knotweed including dicamba, picloram and tebuthiuron but are not recommended because of their potential for groundwater contamination.

## Foliar application

Herbicide can be applied to knotweed leaves in a number of ways; it can be wiped onto individual plants on sensitive sites or in very small infestations or sprayed on with hand-held, backpack or boom-mounted sprayers. A non-ionic surfactant should be added to allow the herbicide to penetrate the plant's cuticle. Dyes are also useful in indicating which plants have been sprayed and the extent of coverage. Other adjuvants may be suggested on the labels of the specific herbicide being used.

The herbicide applicator is responsible for calibrating equipment, and managing drift and damage to non-target vegetation. Wind speeds between 3 and 10 miles per hour are best for foliar herbicide spraying. At higher wind speeds, herbicide may be blown onto adjacent vegetation or water.

At lower wind speeds, temperature inversions can occur, restricting vertical air movement. Under these conditions, small suspended droplets of herbicide can persist in a concentrated cloud and be blown off-target by variable gusts of wind. Ground fog indicates the presence of a temperature inversion, but if no fog is present, smoke movement on the ground can also reveal inversions. Smoke that layers and remains trapped in a cloud at a low level indicates an inversion, while smoke that rises and dissipates indicates good air mixing.

In hot, dry weather, herbicide evaporates rapidly; set equipment to produce large droplets to compensate for this.

Some herbicides can be applied as invert emulsions; thickened mixtures designed to minimize spray drift and run-off and maximize the amount of herbicide that sticks to and covers leaves and stems. Always follow all directions on the label of the specific herbicide being used, in order to prevent damage to non-target vegetation or water bodies.

## Injection

Injection is extremely labor intensive and impractical for most situations. It may be useful for applying herbicide on sensitive sites with very small knotweed populations. Typically, a measured amount of herbicide is injected into the plant stem between the second and third node or into the hollow of a cut stem. Stems that are not treated are not killed. For each type of herbicide, there is a maximum amount that can be applied safely per acre, per year, and with large populations, it is possible to reach this amount before all stems have been treated.

## Mechanical control

### Hand-pulling

Mature Japanese knotweed populations have deep, extensive root systems and hand-pulling the species is not an effective control method.

On sites where there is reproduction by seed, seedlings may be hand-pulled while they are still small. Typically, seeds will not germinate below mature plants but will do so on bare mineral soils nearby.

### Cutting/Mowing

Cutting or mowing Japanese knotweed is not recommended. Stem fragments can root at the nodes and generate new plants. Frequently, knotweed is spread by roadside mowing crews in just this manner. Although cutting is often recommended to reduce the plant's height and facilitate treatment, unless all plant parts can be removed and destroyed, the risks outweigh the benefits.

### Digging/Tilling/Excavating

For very small infestations (fewer than 50 stems), digging up and removing ALL of the plant's parts may provide control, but the site should be carefully monitored for at least four years. Again, all plant parts should be destroyed.

Since root fragments may sprout to form new plants, **for most populations, digging alone will not provide effective control.** Tilling or cutting through roots will also increase sprouting. Without herbicide, this is disastrous. When the plant's foliage has been burned by previous herbicide application, however, this will increase the surface area of new, healthy foliage that is available for herbicide absorption during re-treatment.

Excavating living rhizomes from previously treated, deformed plants will also result in new stems with healthy foliage, which will respond more favorably to herbicide treatment in the following year. In conjunction with herbicide applications, the removal of rhizomes may help to deplete a colony's stored energy. Excavating reduces root biomass and increases the stem to root ratio, allowing a more effective follow-up herbicide treatment for any new foliage. Without herbicide follow-up however, knotweed will quickly re-establish with renewed vigor.

Digging, tilling and excavating are never appropriate along river or stream banks, where soil disturbance may result in fragments being washed downstream.

### Prescribed burning

Little information is available on Japanese knotweed's response to burning but it is not particularly flammable. Giant knotweed has been tested for use as a potential firebreak in Russia and researchers concluded that it "suffers little from the effect of fire."

On sites with fire-adapted communities, Japanese knotweed may alter fire ecology as it will not burn, and fuels do not accumulate beneath it. If prescribed burning is introduced as part of an overall management program, Japanese knotweed will still require additional control measures.



## Biological control

Native North American pests do little damage to Japanese knotweed, but it has over 200 natural enemies in its native range. One species of sap-sucking plant louse, *Aphalara itadori*, has been tested extensively for host-specificity in Great Britain. It was released at several sites for field testing in Britain in March of 2010. It has not been tested for host-specificity in the United States.

## Disposal of plant parts

If you must cut knotweed, all plant parts should be disposed of carefully to prevent regeneration, in accordance with Michigan's invasive species legislation. Options include landfills or some municipal incinerators. Materials to be

placed in landfills should be bagged and tied in black plastic bags. Municipal solid waste treatment facilities that are engineered to inactivate potential pathogens in biosolids and maintain temperatures above 55° C for at least three consecutive days will safely destroy plant parts.

Where burning ordinances permit, plant refuse can be dried out thoroughly above ground and burned on site. Plant parts should not be allowed to contact soil during this time to prevent sprouting. Plant parts should not be composted.

Although landscape waste cannot generally be disposed of in landfills, Michigan law permits the disposal of invasive species plant parts. See the "Online resources" section below for a link to the relevant legislation.

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## Online resources:

### CDMS - herbicide labels:

<http://www.cdms.net/LabelsMsds/LMDefault.aspx?t=>

### Fire Effects Information System, *Polygonum* species:

<http://www.fs.fed.us/database/feis/plants/forb/polspp/all.html>

### Invasive.org, *Fallopia japonica*:

<http://www.invasive.org/species/subject.cfm?sub=3414>

### Invasipedia at BugwoodWiki, *Polygonum cuspidatum*

[http://wiki.bugwood.org/Polygonum\\_cuspidatum](http://wiki.bugwood.org/Polygonum_cuspidatum)

### Invasive Plant Atlas of New England, *Polygonum cuspidatum*

[http://www.eddmaps.org/ipane/ipanespecies/herbs/Polygonum\\_cuspidatum.htm](http://www.eddmaps.org/ipane/ipanespecies/herbs/Polygonum_cuspidatum.htm)

### Midwest Invasive Species Information Network, Japanese Knotweed

<http://www.misin.msu.edu/facts/detail.php?id=25>

### The Michigan Department of Agriculture and Rural Development—Pesticide Certification

[www.michigan.gov/pestexam](http://www.michigan.gov/pestexam)

### The Michigan Department of Environmental Quality—Aquatic Nuisance Control

[www.michigan.gov/deq/0,4561,7-135-3313\\_3681\\_3710---,00.html](http://www.michigan.gov/deq/0,4561,7-135-3313_3681_3710---,00.html)

[http://www.michigan.gov/deq/0,4561,7-135-3313\\_3681\\_3710---,00.html](http://www.michigan.gov/deq/0,4561,7-135-3313_3681_3710---,00.html)

### Michigan Department of Natural Resources—Local DNR Fire Manager contact list

[http://www.michigan.gov/dnr/0,4570,7-153-30301\\_30505\\_44539-159248--,00.html](http://www.michigan.gov/dnr/0,4570,7-153-30301_30505_44539-159248--,00.html)

### Michigan's Invasive Species Legislation

Natural Resources and Environmental Protection Act 451 of 1994, Section 324.4130

<http://legislature.mi.gov/doc.aspx?mcl-324-41301>

### Michigan Legislation—landscape waste, disposal of invasive species plant parts

Natural Resources and Environmental Protection Act 451 of 1994, Section 324.11521, 2 (d)

<http://legislature.mi.gov/doc.aspx?mcl-324-11521>

### The Nature Conservancy's Weed Control Methods Handbook: Tools and Techniques for Use in Natural Areas

<http://www.invasive.org/gist/handbook.html>

### University of Michigan Herbarium - Michigan Flora Online

<http://michiganflora.net/>





## Quick reference—Japanese knotweed

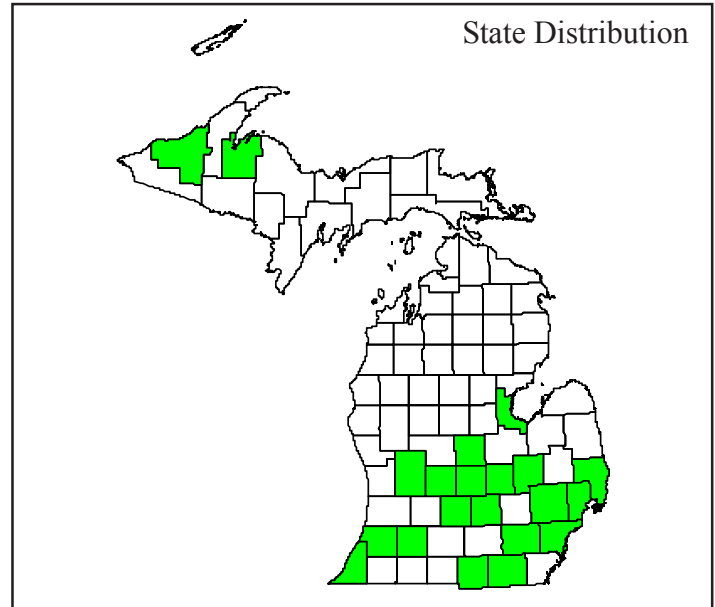
This chart has been provided as a convenience, to summarize the pros and cons of each herbicide and to present details on adjuvants, concentrations, etc. that do not fit into the discussion in the preceding sections. Although every attempt has been made to ensure accuracy, the product labels for the listed herbicides are the ultimate authority for their usage. Where there are conflicts, always follow the label directions. Techniques are listed in order of general preference by MDNR Wildlife Division staff but not all are suitable for wetlands or sensitive sites. Site conditions vary—choose a method that is best suited to conditions on the site being treated.

Anyone using herbicides in the course of their employment is required to be a certified pesticide applicator. Treatment in wetlands or over open water requires a permit from the Michigan Department of Environmental Quality.

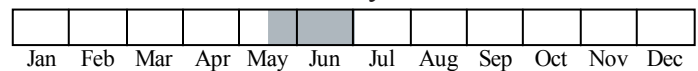
These chemicals are available in a variety of formulations and concentrations. In some cases, concentration is listed below as a percentage of the active ingredient (AI) to facilitate use of different products. Where this is not possible, the label recommendation for the example product is used. Always follow all directions on the product label including mixing instructions, timing, rate, leaf coverage and the use of personal protective equipment.

	Herbicide	Conc.	Adjuvant	Timing	Pros	Cons
Foliar Spray	<b>Imazamox</b> (e.g., Clearcast®)	5% Clearcast® by volume	Use a wetland-approved non-ionic surfactant (e.g., Cygnet Plus®).  Use dye for identifying treated areas.	Spray late September or October AFTER flowering.	Provides effective control.  Available in formulations that are approved for wetland and aquatic sites.	Selectivity varies with concentration and mode of application but it may kill desirable non-target species.
Foliar Spray	<b>Imazapyr</b> (e.g., Arsenal®)	1-1.5 % AI or 2 qts/acre	Use a non-ionic surfactant (e.g., Cygnet Plus®).  Use dye for identifying treated areas.	Spray late September or October AFTER flowering.	Provides effective control.  Available in formulations that are approved for wetlands.	Imazapyr is non-selective, highly active in the soil and may kill nearby plants, including trees.
Foliar Spray	<b>Triclopyr ester</b> (e.g., Garlon 4 Ultra®)	3% AI	Use a non-ionic surfactant (e.g., Cygnet Plus®).  Use dye for identifying treated areas.	Spray late September or October AFTER flowering.	Provides some control.  Broad-leaf specific—may be used where desirable grasses are present.	Less effective than imazamox or imazapyr.  May damage foliage without killing roots.  Not approved for use in wetlands.
Foliar Spray	<b>Triclopyr amine</b> (e.g., Garlon 3A®)	3% AI	Use a wetland-approved non-ionic surfactant (e.g., Cygnet Plus®).  Use dye for identifying treated areas.	Spray late September or October AFTER flowering.	Provides some control.  Broad-leaf specific—may be used where desirable grasses are present.  Can be used in wetlands.	Less effective than imazamox or imazapyr.  May damage foliage without killing roots.

Note: Be careful not to move stems or other plant tissues as Japanese knotweed can regenerate from stem nodes. See section on disposal of plants for additional information. **Treated sites should be monitored for at least four years to ensure that there is no regrowth.**



Best Survey Period



**Status:** State threatened

**Global and state rank:** G5/S2

**Family:** Orchidaceae (orchid)

**Synonymy:** *Orchis spectabilis* Linnaeus, *Orchis humilis* Michx., *Galeorchis spectabilis* (Linnaeus) Rydberg

**Taxonomy:** Showy orchis was maintained in the genus *Orchis* by most taxonomists until recently. Some now include this species in the genus *Galearis* as originally proposed by Rafinesque in 1836. Two species are known from this genus, only one of which (*G. spectabilis*) occurs in North America, the other occurring in eastern Asia.

**Total range:** This North American species is distributed throughout the eastern deciduous forest region, ranging from Quebec and New Brunswick through south-central Michigan and Wisconsin to southern Minnesota and Iowa, south to Arkansas, Missouri, and Kansas.

**State distribution:** In Michigan, showy orchis is known primarily from the five southern-most tiers of counties in the Lower Peninsula, with its northern-most location in Bay County. Disjunct populations are also known from Ontonagon and Baraga counties in the western Upper Peninsula. The species appears to be declining in the state and it was recently upgraded from State special concern to State threatened (MDNR 1999).

**Recognition:** Showy orchis is a low growing orchid (6-20 cm) arising from a short, tuberless rhizome (underground stem) with **one pair of ovate basal leaves** and a **single stout and often stubby flower stalk** bearing from one to

ten flowers. The flowers appear two-parted with a **deep pink upper “hood”** formed by the joining of sepals and lateral petals, perched above a **white lower petal which forms a spurred lip**. **Deep green, conspicuous, leaflike bracts subtend the flowers**, creating a striking color contrast from which the plant likely derives its name “showy” orchis. Although striking, Michigan populations are apparently less colorful, shorter, and stubbier than those in the Blue Ridge and Cumberland Plateau regions.

**Habitat:** This species is found primarily in rich deciduous woods, although vigorous woodland colonies are known to spread to more open habitat in Michigan, and in New England it is reported from hemlock forests (Case 1987). Showy orchis often occurs near temporary spring ponds in sandy clay or rich loam soils, or in the shadier and richer microhabitats alongside such common spring ephemerals as *Claytonia virginica* (spring beauty), *Trillium grandiflorum* (large-flowered trillium), and *Hepatica* spp. (hepatica). In Fort Custer Training Center in Kalamazoo County, associates include *Liriodendron tulipifera* (tulip), *Quercus rubra* (red oak), *Fraxinus americana* (white ash), *Tilia americana* (basswood), *Carya glabra* (pignut hickory), *Ostrya virginiana* (ironwood), *Carpinus caroliniana* (blue-beech), *Erigeron bulbosus* (harbinger-of-spring), *Caulophyllum thalictroides* (blue cohosh), *Hydrophyllum appendiculatum* (water-leaf), *Carex hirtifolia* (sedge), *C. jamesii* (sedge), and *Hystrix patula* (bottle-brush grass).

**Biology:** Showy orchis generally flowers from mid-May to June and apparently does not tolerate much competition. In some areas it is locally abundant, but more commonly it



grows as isolated plants or in small colonies.

**Conservation/management:** Protection of the orchid's rich forest habitat is critical for the survival of this species. It is likely vulnerable to canopy removal and to significant changes in hydrology. It is also possibly at risk of exploitation due to its attractiveness.

**Related abstracts:** mesic northern forest, Assiniboia sedge, fairy bells, ginseng, goblin fern, goldenseal, green spleenwort, Hart's-tongue fern, large toothwort, walking fern, red-shouldered hawk

### **Selected references**

Case F.W. Jr. 1987. Orchids of the Western Great Lakes Region. Rev. ed. Cranbrook Inst. of Science Bull. 48.

Luer, C.A. 1979. The Native Orchids of the United States and Canada excluding Florida. N.Y. Bot. Garden, New York, NY.

Michigan Department of Natural Resources. 1999. Endangered and threatened species list. Lansing, MI 48909-7944.

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### **Abstract citation**

Higman, P.J. and M.R. Penskar. 1997. Special plant abstract for *Galearis spectabilis* (showy orchis). Michigan Natural Features Inventory, Lansing, MI. 2 pp.

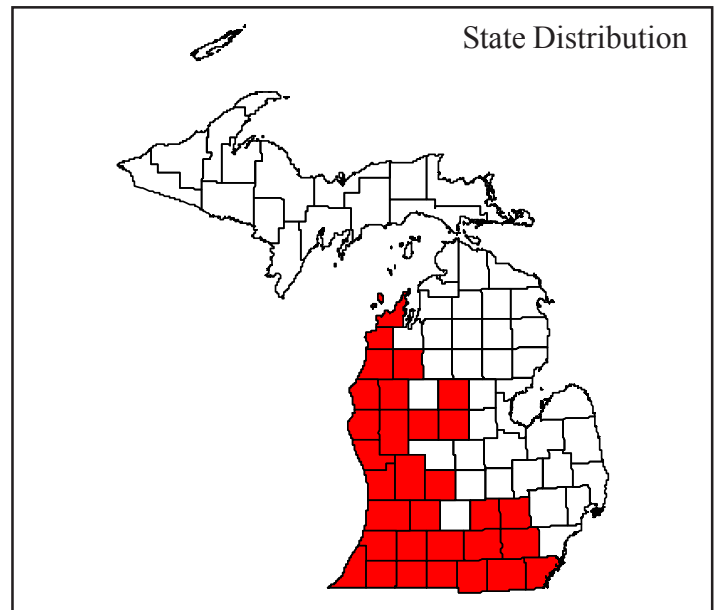
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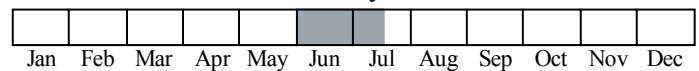
Funding for abstract provided by Michigan Department of Natural Resources - Wildlife Division, Non-Game Program.

2-00/pjh





Best Survey Period



**Status:** State special concern

**Global and state rank:** G5T5/S3

**Family:** Emydidae (pond and box turtle family)

**Range:** The eastern box turtle occurs from Ne. Massachusetts to Georgia, and west to Michigan, Illinois, and Tennessee. The subspecies *Terrapene c. triunguis* (three-toed box turtle) ranges from Missouri to Texas and south central Alabama. *Terrapene c. major* (Gulf Coast box turtle) occurs along the Gulf Coast region of Florida and southern Louisiana and *Terrapene c. bauri* (Florida box turtle) occurs in the Florida peninsula and in some of the Keys. The various races of *Terrapene carolina* intergrade with one another where their ranges come in contact (Conant and Collins 1998).

**State distribution:** Historically eastern box turtles have been found in the southern and western Lower Peninsula in 31 counties. They are locally common in the southwestern counties but are rare throughout the rest of their former Michigan range. In the past ten years the eastern box turtle has been reported in 20 counties including Allegan, Barry, Berrien, Calhoun, Cass, Clare, Jackson, Kalamazoo, Kent, Lake, Manistee, Mason, Muskegon, Newaygo, Oakland, Oceana, St. Clair, St. Joseph, VanBuren, and Washtenaw counties.

**Recognition:** The eastern box turtle is a small land turtle with a **high-domed carapace** (upper part of shell) and a **hinged plastron** (bottom part of shell) which allows it to close its shell tightly and hide its head, legs and tail. The carapace has a **slight keel** (raised ridge) along the midline

and ranges from 4.6 to 7.8 inches (11.8 to 19.8 cm) in length. It is **brown or black with a highly variable pattern of yellow or orange markings within each scute** (a large scale or plate). The plastron can be yellowish, brown or black and is either plain or marked with blotches or lines. Males are usually larger and more brightly colored than females, often have reddish or pinkish eyes (brown in females) and have a concave plastron (flat or slightly convex in females). The skin of the head and legs is usually dark with yellow streaks and spots, although in some individuals (especially males) the yellow or orange can cover most of the head and forelimbs. There are four toes on each hind foot and the tail is quite short. Hatchling turtles have a much flatter shell than adults and are mostly grayish brown with a spot of yellow on each large scute (hatchling spotted turtles (*Clemmys guttata*) have a blacker shell). Other adult Michigan turtles of similar size or shape to the eastern box turtle are the wood (*Clemmys insculpta*) and Blanding's (*Emydoidea blandingii*). The wood turtle has a flatter carapace, usually with characteristic roughly grooved circular growth rings, and its plastron lacks a hinge. The larger Blanding's turtle has a domed carapace that is elongated, smooth and unkeeled, with a profusion of light dots. It also has a bright yellow chin that contrasts strongly with its dark head (Harding 1997).

**Best survey time:** Box turtles can be seen anytime between April and October, although most sightings coincide with egg laying, which occurs from early June through mid July. Weather is a more predictable factor than time of year in determining turtle activity as they are often found the morning after a rainstorm, otherwise spending much time buried under leaf litter, brush piles and rotting



logs (Harding 1997).

**Habitat:** The eastern box turtle is Michigan's only truly terrestrial turtle. It typically occurs in forested habitats with sandy soils near a source of water such as a stream, pond, lake, marsh or swamp (Tinkle et al. 1979). They also may be found in adjacent thickets, old fields, pastures, vegetated dunes, marshes and at bog edges. Access to unshaded nesting sites in sandy, open areas, is critical for successful reproduction.

**Biology:** The box turtle's annual cycle begins in April and ends in October. Mating generally occurs soon after the turtles emerge from their hibernacula in April but may also occur in summer and fall. Egg laying usually takes place in the evening from early June until the middle of July, with 3 to 11 leathery shelled eggs being buried often in an open elevated location. Incubation requires 50 to 90 days with hatching typically occurring in September or October. Hatchlings are rarely seen as they spend most of their time hiding under forest debris.

Box turtles dig into the soil at the onset of cool weather, digging deeper as temperatures decline. The most common night and winter retreat is a cavity constructed by the turtle in leaves, debris or soil. Some individuals move about in the winter and may leave their hibernacula in the spring well before the last frost (Claussen et al. 1991), although some turtles die when early spring thaws are followed by a return to severe cold (Harding 1997). Box turtles exhibit a high degree of natural freeze tolerance and have been shown in laboratory studies to survive the freezing of 58% of their body water for up to 72 hours without injury (Costanzo and Claussen 1990).

Box turtles are diurnal and most active in the spring and fall. In the summer they may have a brief activity period in the morning, or following moderate to heavy rain showers (Harding 1997). Stickel (1950) found that weather conditions most favorable to turtle activity are high humidity, warm sunny days, and frequent rains. In hot weather box turtles will soak at the edges of ponds and streams, yet avoid deep water since they are generally poor swimmers (Harding and Holman 1990). During the heat of midsummer they may congregate in mudholes, burrow in the mud in marshy areas (Smith 1961) or burrow beneath logs or rotting vegetation (Conant and Collins 1998). Sunning takes place in forest openings with protective cover nearby. Turtles not actively moving about are usually found using habitat cover of brush piles or tangles of vines and briars.

Typical home ranges are small, ranging from 3.7 to 40 acres, although males wander widely which may help to maintain genetic diversity within and between populations (Harding 1997).

It is estimated that nest mortality in Michigan box turtle populations ranges between 70% to 100% and juvenile mortality is thought to be nearly as high (Harding 1999).

Skunks, raccoons and foxes prey on box turtle eggs; smaller juvenile turtles are vulnerable to these mammals as well as shrews, birds and snakes. The plastral hinge is not functional in very young turtles but they can give off a strong odor that may act to deter predators (Harding 1997). The young are largely carnivorous and eat mostly insects, earthworms and other invertebrates, yet take more plant foods as they grow. Adults are omnivorous eating a great variety of plants, insects, worms, slugs, snails, carrion, mushrooms, berries and fruit. Sexual maturity in females is usually not reached until they are 10 years old. Eastern box turtles are reported to have lived over a century although the average lifespan is thought to be 50 years with individuals rarely living past 80 years. It is possible to estimate a growing turtle's age by counting the growth rings on the scutes of the plastron. Estimates beyond the age of 20 are unreliable since most turtles have stopped growing by this age and the plastron is often worn smooth (Stickel 1978).

**Conservation/management:** Harding (1997) cites the rapid conversion of woodlands and wetlands into agricultural land over the past century as the primary cause for the elimination of the box turtle from much of its former range. The present spread of suburban development continues to fragment habitat and isolate the remaining populations, in addition to increasing their vulnerability to road mortality. Demand for box turtles in the domestic and international pet trade has encouraged poaching and has contributed to the depletion of their populations (Harding 1997). In 1994 the box turtle was added to Appendix II in CITES (The Convention on International Trade in Endangered Species of Wild Fauna and Flora). This prevents unauthorized exports of box turtles and more closely regulates commercial trade to help prevent them from becoming threatened (Liebermann 1994). In Michigan, under the Director's Order No. DFI-166.98, Regulations on the Take of Reptiles and Amphibians, it is unlawful to take a box turtle from the wild except as authorized under a permit from the director (legislated by Act 165 of the Public Acts of 1929, as amended, Sec.302.1c (1) and 302.1c (2) of the Michigan Compiled Laws). Harding (1997) believes that these laws offer some important protection, but fail to protect box turtles from their worst enemies, bulldozers and automobiles. There is much concern that the high rates of nest predation and juvenile mortality in Michigan coupled with the number of adults killed on roads, and the time it takes for turtles to reach sexual maturity, dim the long term outlook for the box turtle (Harding 1999). Conservation efforts should concentrate on protecting large tracts of habitat on public land to provide the box turtle additional protection from the effects of development (Tinkle 1979). Wetland hydrology and quality should be maintained by preventing improper off road vehicle (ORV) use and controlling invasive weeds in these areas. Upland nesting areas should be identified, protected and in some cases created. New roads should be routed to avoid separating the turtle's habitat from nesting areas (Harding 1999). Finally, the local public should be



educated about the laws protecting reptiles and amphibians and encouraged to leave wild turtles in their natural habitats rather than collecting them for pets.

**Research needs:** Additional surveys are needed to locate box turtle populations and important nesting areas so they can be adequately protected. Studies should focus on understanding population structure and determining the factors that contribute to population viability (Harding 1999).

**Related abstracts:** Blanding's turtle, eastern massasauga

### Selected references

- Claussen, D.L., P.M. Daniel, S. Jiang, and N.A. Adams. 1991. Hibernation in the eastern box turtle, *Terrapene c. carolina*. J. of Herp. 25:334-341.
- Conant, R. and J.T. Collins. 1998. A Field Guide to Reptiles and Amphibians of Eastern and Central North America. 3rd ed. (expanded). Houghton Mifflin, Boston, MA. 616 pp.
- Costanzo, J. P. and D.L. Claussen. 1990. Natural freeze tolerance in the terrestrial turtle, *Terrapene c. carolina*. J. of Exp. Zoo. 254:228-232.
- Harding, J.H. 1997. Amphibians and Reptiles of the Great Lakes Region. U. of Mich. Press, Ann Arbor, MI. 378 pp.
- \_\_\_\_\_. 1999. Personal communication, June 7, 1999. Mich. State Univ., East Lansing, MI.
- Harding, J.H. and J.A. Holman. 1990. Michigan Turtles and Lizards. East Lansing Cooperative Extension Serv, Mich. State Univ. Bull. E-2234. 94pp.
- Lieberman, S. 1994. Can CITES save the box turtle? Endangered Species Tech. Bull. Vol.XIX No. 5.
- Smith, P.W. 1961. The amphibians and reptiles of Illinois. Bull. Illinois Nat. Hist. Survey Bull. 28. Art. 1. 298pp.
- Stickel, L.F. 1950. Populations and home range relationships of the box turtle, *Terrapene c. carolina* (Linnaeus). Ecol. Monographs. 20: 352-378.
- Stickel, L.F. 1978. Changes in a box turtle population during three decades. Copeia. 2:221-225.
- Tinkle, D.W., P.E. Feaver, R.W. Van Devender, and L.J. Vitt. 1979. A survey of the status, distribution and abundance of threatened and endangered species of reptiles and amphibians. Mich. DNR. Unpubl. Rep.

### Abstract citation

Hyde, D.A. 1999. Special animal abstract for *Terrapene c. carolina* (eastern box turtle). Michigan Natural Features Inventory, Lansing, MI. 3 pp.

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7-99/dah



# Michigan Natural Features Inventory

MSU Extension

## *Bombus terricola* Yellow banded bumble bee

### Key Characteristics

Yellow banded queens and workers are similar in appearance, with the queen being of a larger size (length to 0.8 inches versus 0.6). The front of the thorax, second and third abdominal segments are yellow, with some yellowish brown hairs on the fifth segment as well. Head, legs, and remainder of thorax and abdomen are primarily black, with the thorax and abdomen showing slight variation in some individuals. Males average 0.6 inches in length. Intermixed yellow and black hairs cover most of the head, except the front of the face, which is a solid pale yellow. The front of the thorax is pale yellow, while the rear two-thirds are black. Bright yellow hairs are found on the second and third abdominal segments, giving a double-banded appearance. The legs and remaining abdominal segments are black (Evans et al. 2008).

### Status and Rank

**US Status:** No Status/Not Listed

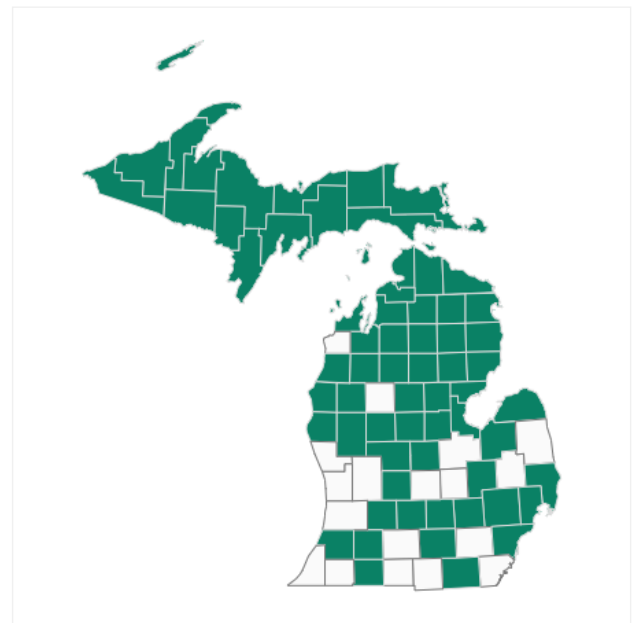
**State Status:** SC - Special Concern (rare or uncertain; not legally protected)

**Global Rank:** G3G4 - Rank is uncertain, ranging from vulnerable to apparently secure

**State Rank:** S2S3 - Rank is uncertain, ranging from imperiled to vulnerable

### Occurrences

County	Occurrences	Year Last Observed
Alcona	2	1959
Alger	17	2022
Alpena	1	1966
Antrim	3	2017
Arenac	1	2017
Baraga	15	2018
Barry	1	1965
Bay	1	1940
Charlevoix	5	1935
Cheboygan	7	2019
Chippewa	9	2020
Clare	1	1976



Information is summarized from MNFI's database of rare species and community occurrences. Data may not reflect true distribution since much of the state has not been thoroughly surveyed.

### Habitat

This species has been found most often in or around wooded areas (Colla and Dumesh 2010).

## Natural Community Types

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### Unknown

For each species, lists of natural communities were derived from review of the nearly 6,500 element occurrences in the MNFI database, in addition to herbarium label data for some taxa. In most cases, at least one specimen record exists for each listed natural community. For certain taxa, especially poorly collected or extirpated species of prairie and savanna habitats, natural community lists were derived from inferences from collection sites and habitat preferences in immediately adjacent states (particularly Indiana and Illinois). Natural communities are not listed for those species documented only from altered or ruderal habitats in Michigan, especially for taxa that occur in a variety of habitats outside of the state.

Natural communities are not listed in order of frequency of occurrence, but are rather derived from the full set of natural communities, organized by Ecological Group. In many cases, the general habitat descriptions should provide greater clarity and direction to the surveyor. In future versions of the Rare Species Explorer, we hope to incorporate natural community fidelity ranks for each taxon.

## Management Recommendations

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Formerly common and widespread across much of the eastern United States and seven Canadian provinces, the yellow banded bumblebee has vanished from all but isolated patches of its range, along with several other North American bumblebees of the same subgenus (Evans et al. 2008). Nesting and foraging habitat loss caused by increased urbanization and intensified agricultural landscapes, the spread of pathogens from bumblebees used as commercial pollinators, and recent widespread use of a pesticide group highly toxic to bees (neonicotinoids), are blamed for much of this drastic population decline (Colla and Packer 2008, COSEWIC 2010, Evans et al. 2008, Grixti et al. 2009). Bumblebee management strategies include scaling back the use of herbicides and pesticides, conservation of healthy habitat areas, and promoting native wildflower reestablishment within agricultural and urbanized landscapes. Additionally, planting hedgerows and restoring native grasses along field margins, and in urban parks and residential yards provides habitat for small mammals, whose abandoned holes will in turn become bumblebee nesting and hibernating habitat (Goulson 2010).

## Active Period

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Active from third week of April to second week of October

## Survey Methods

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Surveys typically involve capturing foraging bumblebees with an aerial net and identifying the individual species (Colla and Packer 2008, Grixti et al. 2009).

### Aerial net, visual survey

Survey Period: From third week of April to second week of October

Time of Day: Daytime



## References

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### Survey References

- Colla, S.R. and L. Packer. 2008. Evidence for decline in eastern North American bumblebees (Hymenoptera: Apidae), with special focus on *Bombus affinis* Cresson. *Biodiversity and Conservation* 17: 1379-91.
- Grixti, J.C., L.T. Wong, S.A. Cameron and C. Favret. 2009. Decline of bumble bees (*Bombus*) in the North American Midwest. *Biological Conservation* 142: 75-84.

### Technical References

- Colla, S.R. and L. Packer. 2008. Evidence for decline in eastern North American bumblebees (Hymenoptera: Apidae), with special focus on *Bombus affinis* Cresson. *Biodiversity and Conservation* 17: 1379-91.
- Colla, S.R. and S. Dumesh. 2010. The Bumble Bees of Southern Ontario: Notes on Natural History and Distribution. *Journal of the Entomological Society of Ontario* 141:38-67.
- COSEWIC. 2010. COSEWIC assessment and status report on the Rusty-patched Bumble Bee *Bombus affinis* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. 34pp.
- Evans, E., R. Thorp, S. Jepsen and S.H. Black. 2008. Status Review of Three Formerly Common Species of Bumble Bee in the Subgenus *Bombus*. Prepared for the Xerces Society of Invertebrate Conservation. [Online] [http://www.xerces.org/wp-content/uploads/2008/12/xerces\\_2008\\_bombus\\_status\\_review.pdf](http://www.xerces.org/wp-content/uploads/2008/12/xerces_2008_bombus_status_review.pdf).
- Goulson, D. 2010. *bumblebees: behavior, ecology and conservation*. Second Edition. Oxford University Press, New York. 317pp.
- Grixti, J.C., L.T. Wong, S.A. Cameron and C. Favret. 2009. Decline of bumble bees (*Bombus*) in the North American Midwest. *Biological Conservation* 142: 75-84.



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# Michigan Natural Features Inventory

MSU Extension

## *Mertensia paniculata* Northern Bluebell

### Key Characteristics

Delicate herb from moist and rich forests in the northwestern Upper Peninsula; from 30 to 100 cm tall; stiff hairs on calyx and leaves, and often pedicels and stems; calyx lobes acute; petals 10 to 15 mm long, broader than long, glabrous, blue (pink in bud or anthesis), with lobes obtuse or rounded.

### Status and Rank

**US Status:** No Status/Not Listed

**State Status:** SC - Special Concern (rare or uncertain; not legally protected)

**Global Rank:** G5 - Secure

**State Rank:** SNR - Not ranked



Tyler Bassett

### Occurrences

County	Occurrences	Year Last Observed
Alger	1	1973
Baraga	3	1959
Gogebic	1	1920
Houghton	4	1950
Iron	1	1991
Keweenaw	19	2017
Marquette	2	1994
Ontonagon	7	2019



Information is summarized from MNFI's database of rare species and community occurrences. Data may not reflect true distribution since much of the state has not been thoroughly surveyed.

## Habitat

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This species is limited to the northwestern Upper Peninsula, where it is primarily found in conifer and hardwood-conifer swamps and rich upland forests and occasionally occurs in hardwood stands. In swamps, it may often be found on drier, sphagnum hummocks, while in upland forests it is generally found in cool, moist microhabitats, including drainages, shaded moist depressions, wet seepage areas, near or along rivers, and areas of filtered light.

## Natural Community Types

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[Hardwood-conifer swamp](#)

[Mesic northern forest](#)

[Rich conifer swamp](#)

For each species, lists of natural communities were derived from review of the nearly 6,500 element occurrences in the MNFI database, in addition to herbarium label data for some taxa. In most cases, at least one specimen record exists for each listed natural community. For certain taxa, especially poorly collected or extirpated species of prairie and savanna habitats, natural community lists were derived from inferences from collection sites and habitat preferences in immediately adjacent states (particularly Indiana and Illinois). Natural communities are not listed for those species documented only from altered or ruderal habitats in Michigan, especially for taxa that occur in a variety of habitats outside of the state.

Natural communities are not listed in order of frequency of occurrence, but are rather derived from the full set of natural communities, organized by Ecological Group. In many cases, the general habitat descriptions should provide greater clarity and direction to the surveyor. In future versions of the Rare Species Explorer, we hope to incorporate natural community fidelity ranks for each taxon.

## Associated Plants

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Wild leeks (*Allium tricoccum*), speckled alder (*Alnus incana*), sarsaparilla (*Aralia nudicaulis*), Jack-in-the-pulpit (*Arisaema triphyllum*), lady fern (*Athyrium filix-femina*), northern shorthusk (*Brachyelytrum aristosum*), wild marsh marigold (*Caltha palustris*), sedges (*Carex arctata*, *C. brunnescens*, *C. crinita*, *C. gynandra*, *C. intumescens*, *C. pedunculata*, *C. scabrata*), small enchanter's-nightshade (*Circaea alpina*), goldthread (*Coptis trifolia*), broad-leaved aster (*Eurybia macrophylla*), Canadian fly honeysuckle (*Lonicera canadensis*), false spikenard (*Maianthemum racemosum*), ostrich fern (*Matteuccia struthiopteris*), broad-leaved twayblade (*Neottia convallarioides*), sensitive fern (*Onoclea sensibilis*), ironwood (*Ostrya virginiana*), northern beech fern (*Phegopteris connectilis*), downy solomon's-seal (*Polygonatum pubescens*), thimbleberry (*Rubus parviflorus*), zig-zag goldenrod (*Solidago flexicaulis*), nodding trillium (*Trillium cernuum*), bellwort (*Uvularia grandiflora*), and marsh violet (*Viola cucullata*).

## Management Recommendations

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Protect occupied habitat by maintaining the overstory, reducing erosion, and ensuring a continuous cool groundwater supply to maintain microsite conditions. Maintain healthy intact, mature forests and avoid clear cutting. Minimize development and fragmentation. When possible, leave large tracts of unharvested forests and allow natural processes to operate unhindered.

## Survey Methods

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Random meander search covers areas that appear likely to have rare taxa, based on habitat and the judgment of the investigator.

### Meander search

Survey Period: From first week of May to second week of July

## References

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### Survey References

- Elzinga, C.L., D.W. Salzer, and J.W. Willoughby. 1998. Measuring and Monitoring Plant Populations. The Nature Conservancy and Bureau of Land Management, Denver. BLM Technical Reference 1730-1. 477pp.
- Goff, G.F., G.A. Dawson, and J.J. Rochow. 1982. Site examination for Threatened and Endangered plant species. Environmental Management 6(4): 307-316
- Nelson, J.R. 1984. Rare Plant Field Survey Guidelines. In: J.P. Smith and R. York. Inventory of rare and endangered vascular plants of California. 3rd Ed. California Native Plant Society, Berkeley. 174pp.
- Nelson, J.R. 1986. Rare Plant Surveys: Techniques For Impact Assessment. Natural Areas Journal 5(3):18-30.
- Nelson, J.R. 1987. Rare Plant Surveys: Techniques for Impact Assessment. In: Conservation and management of rare and endangered plants. Ed. T.S. Elias. California Native Plant Society, Sacramento. 8pp.

### Technical References

- Gleason, H. A., and A. Cronquist. 1991. Manual of Vascular Plants of Northeastern United States and Adjacent Canada. Second edition. The New York Botanical Garden, Bronx. 910pp.
- Gray, A. 1950. Gray's Manual of Botany; eighth ed. Van Nostrand Reinhold, New York. 1632pp.
- Holmgren, N.H. 1998. Illustrated Companion to Gleason and Cronquist's Manual. Illustrations of the vascular plants of Northeastern United States and adjacent Canada. New York Botanical Garden, Bronx. 937pp.
- Reznicek, A.A., E.G. Voss, and B.S. Walters. 2011. *Mertensia paniculata* (Aiton) G. Don. Michigan Flora Online. University of Michigan. Web. Available at: <https://www.michiganflora.net/species.aspx?id=2498> [Accessed March 31, 2020].
- Voss, E.G., and A.A. Reznicek. 2012. Field Manual of Michigan Flora. University of Michigan Press, Ann Arbor, MI. 1008 pp.



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