Otter Point Woods

Forest Management Plan

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Contents

INTRODUCTION

Otter Point Woods encompasses approximately 30 acres of forest, wetlands, and open habitat located along the northeast shore of Otter Lake in Portage Township, Houghton County, Michigan (Figure 1). Rexx and Maria Janowiak purchased an initial property in August of 2016 to be used primarily for recreation and wildlife habitat. Additional acreage was acquired in September of 2018. This plan is a guiding document that details their vision for the property and record its conditions.

The property is located in Section 12, Township 52 North, Range 34 West, Portage Township, Houghton County, Michigan. Appendix 1 contains the legal descriptions of the four parcels that make up the property.

Property Map

Figure 1. Property location on the northeast side of Otter Lake, Portage Township, Houghton County, Michigan.

Management Goals

The primary goals for the property are:

- Maintain the health of the forests, wetlands, and natural ecosystems on the property.
- Provide high-quality habitat for diverse wildlife species with an emphasis on waterfowl.
- Enhance opportunities for hunting, foraging, and other forms of recreation.
- Protect and maintain water quality.
- Maintain a trail network for access.

PROPERTY HISTORY

The property and surrounding area looks very different today than it did in the 1840s when the Government Land Office first surveyed it; in fact, much of the Otter Point Woods property did not exist at all prior to the mid-1900s.

Historical survey maps show the original course of the Sturgeon River, which flowed westward toward the north end of Otter Lake before curling to the north and connecting with the Otter River downstream from the lake. The Sturgeon River was separated from Otter Lake by only a very narrow strip of land. During the late 1800s and early 1900s, much of the region was logged heavily. This included the Sturgeon River watershed and surrounding area, and logs from this area were floated down the Sturgeon River to a sawmill located in Chassell.

During this time, the thin strip of land between the Sturgeon River and Otter Lake may have been built up into a levee and reinforced to maintain the river channel (Norcross 1983). Around 1913, however, the Sturgeon River breached the levee and rerouted directly into Otter Lake. This resulted in both the Otter and Sturgeon River waters entering Otter Lake and leaving through the same outlet on the north end of the lake. Increased flows scoured the outlet of Otter Lake and dropped the overall water level by 3-5 feet, and the slower water movement in the lake allowed sediment from the Sturgeon River to accumulate in Otter Lake.

The deposition of sediment into Otter Lake became problematic relatively quickly. Sediment filled in one of the best fishing areas and a substantial delta formed at the mouth of the Sturgeon River, covering more than 50 acres by the mid-1950s (Daily Mining Gazette 1958). In the 1970s, the Otter River dam and diversion project was implemented to reduce spring flooding, eliminate silt deposition, and control the lake level in Otter Lake (Norcross 1983). The Sturgeon River was redirected into a diversion canal, which altered its course for a second time; the new (and current) channel is located farther east than the original, natural channel and runs through a continuous river channel rather than through Otter Lake. A dam was also added to Otter Lake to maintain a higher lake level that was intended to be more similar to what it had been prior to the levee breach.

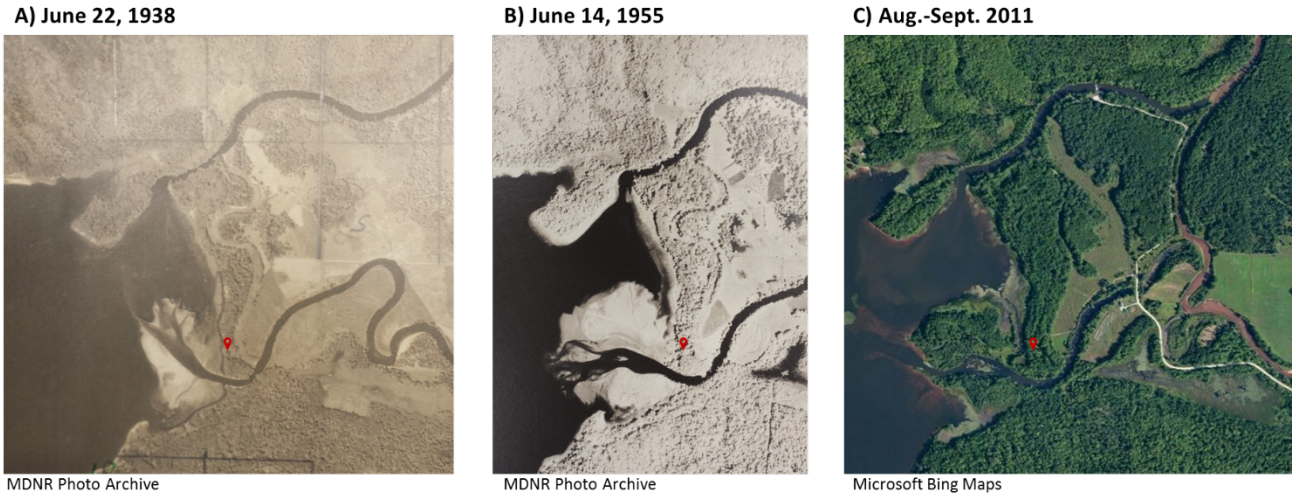

Figure 2. Aerial images from three different periods. Red pin shows the approximate location of the cottage. (A) Photo from 1938: original channel of the Sturgeon River can be seen just east of the property, and black marker traces the original shoreline of Otter Lake prior to sediment deposition. (B) Photo from 1955: original channel of Sturgeon River is still visible and accretion has expanded considerably. (C) Photo from 2011: rerouted location of Sturgeon River diversion is visible on east side of Myllyla Road and accretion has stabilized.

The Otter Point Woods property is located at the center of this dramatic change in hydrology (Figure 2). Approximately three acres of the property is situated on the shore of Otter Lake in the thin strip of land that separated the lake from the original channel of the Sturgeon River. The southern edge of this parcel is formed by the second course of the Sturgeon River which was created by the historic levee breach. This parcel was purchased in the early 1900s, presumably for a recreational property, and the cottage was built along the shore of Otter Lake around 1920 (Figure 3). The area to the west, approximately 18 acres, is accreted land that was formed from the sediment deposited by the Sturgeon River during the period where it ran into the lake from circa 1913 until the 1970s. Much of the accretion is low-lying wetland, the area of which varies based on the level of Otter Lake.

Figure 3. Photo of the cottage in 1958 from the Daily Mining Gazette*. The cottage was built in the early 1920s on the shore of Otter Lake. Image from the Michigan Technological University Archives and Copper Country Historical Collections.*

Natural Features

Climate

Average Temperature and Precipitation

The regional climate is characterized by cold winters and summers that remain relatively cool. Average precipitation is about 28 inches, which is distributed throughout the year and heaviest during September and October (US Climate Data). Lake-effect snowfall from Lake Superior is common during the winter months, with the local airport weather station receiving 208 inches per year on average. Snowfall is highly variable across the region due to lake-effect snow; however, Otter Point Woods is outside of the strongest lake-effect zones and typically receives less snow than what is reported at the local weather station.

Average climate data from the Houghton County Airport in Hancock, MI, which is located approximately 20 miles north of the property (Source: US Climate Data):

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average high (°F)	22	25	33	47	61	70	75	74	65	51	38	26
Average low (°F)	9	9	17	29	39	48	54	54	46	36	25	14
Average total precip (in)	2.6	1.4	1.6	1.9	2.5	2.6	2.5	2.4	3.5	3.0	2.1	1.9
Average snowfall (in)	69	31	19	8	1	0	0	0	0	5	22	53

Growing Season

The average growing season is 147 days, based on data from the nearest weather station. The average date of last freeze (32°F) is May 10 and the average first frost day is October 5 (NCEI). These dates, however, mean that there is a 50% chance of frost occurring after May 10 and also before October 5 in any given year. Based on historical data, there is a 90% probability that a freeze will not occur after May 24 or before September 19, which provides a more conservative estimate for planting frost-sensitive plants. The plant hardiness zone for the area is 5a, which indicates an average winter minimum temperature of -15 to -20°F (USDA ARS).

Landform, Hydrology, and Soils

Landform & Hydrology

The Keweenaw region has a rich and complex geologic history (Rose). The Keweenaw Fault and its associated highlands run in a southwesterly-northeasterly direction about 10 miles west of the property. The rocks in these formations are the result of lava flows from more than a billion years ago. To the east of the fault, where the property is located, the bedrock is made of Jacobsville Sandstone (Jerome 2006). This reddish sandstone formed in river and lake environments between 540-1,100 million years ago as the older rocks eroded (Baumann 2010). More recently (in a relative sense), an uneven layer of glacial till was deposited across the region when the glaciers receded about 10,000 years ago (Doonan, Hendrickson, and Byerlay 1970). The hills surrounding Otter Lake are made of glacial till, while the lower-lying areas are floodplains associated with the Otter and Sturgeon Rivers (Jerome 2006).

The property has been, and continues to be, strongly influenced by the annual occurrence of large spring floods occurring within the watershed. The land was much different prior to European settlement, when the Sturgeon River flowed adjacent to the shore of Otter Lake. At that time, the Sturgeon River flowed through the property, and ~18 acres of land didn't even exist (see Property history section). Around 1913, the Sturgeon River was diverted into Otter Lake along what is now the south edge of the parcel (Norcross 1983). This change resulted in the accumulation (accretion) of sediment where the Sturgeon River entered Otter Lake. Approximately 18 acres of the property are the result of sediment accretion that occurred from approximately 1913 until the early 1970s when the Sturgeon River was re-diverted to enter the Otter River downstream from Otter Lake (Norcross 1983).

Soils

The entire property occurs within a floodplain, and seasonal flooding in the spring has long been the primary driver of soil conditions on this property. This section summarizes soil survey data provided by the USDA Natural Resources Conservation Service (Figure 4).

Sturgeon-Arnheim-Pelkie Complex (137a): A little over half of the property—about 16.7 acres or 55%—has soils of the Sturgeon-Arnheim-Pelkie complex (unit 137a). These soils are found west of the original (pre-1913 course of the Sturgeon River and includes much of the accreted land. This soil complex is made of three different soil components that are present in varying quantities across the landscape and described below. All three soils types are found on floodplains and flat ground (slopes 0-3%). Soils in this complex are acidic, having a pH of 5.6.

- The Sturgeon component is most common (47% of the type, although coverage on the property is undetermined) and consists of coarse-silty alluvium over sandy alluvium. Soils are somewhat poorly drained. Soils are flooded (not ponded) occasionally, with seasonal water saturation during April and May. Organic matter is about 4% near the surface. Soils with this type are associated with the habitat type *Acer-Viola-Osmorhiza* (*Circaea-Impatiens* phase; AVO-CI).
- The Arnheim component is also fairly common (25% of the type) and is poorly-drained hydric soil with parent material consisting of loamy alluvium. This hydric soil type is subject to frequent flooding and ponding, with soils saturated to the surface during much of the year (all months except June through September). Organic matter is about 15% near the surface.
- The Pelkie component is least common (20% of the type) with well-drained soils consisting of sandy alluvium. Soils are flooded (not ponded) occasionally. During April and May, soils may be saturated at a depth of 2 feet.

Organic matter is about 5% near the surface. Soils with this type are associated with the habitat types *Acer-Osmorhiza-Caulophyllum* (AOC) and *Acer-Viola-Osmorhiza* (AVO).

Arnheim Silt Loam (37): The remainder of the accretion—about 3 acres or 10% of the property—has soils classified as Arnheim silt loam (unit 37). This soil type is found on the north and east sides of the accreted (i.e., flood-deposited) lands. This is the same Arnheim soil type described above that is found on floodplains. Soils with this type are associated with the habitat type *Acer-Viola-Osmorhiza* (*Circaea-Impatiens* phase; AVO-CI).

Pelkie Loamy Very Fine Sand (38A): The portion of the property east of the original (pre-1913) course of the Sturgeon River—covering almost 10 acres or 32% of the property—is classified as Pelkie Loamy Very Fine Sand (1-6% slopes). This soil type is similar to the one described above that is found on floodplains and is moderately well-drained and subject to occasional flooding. Soils with this type are associated with the habitat types *Acer-Tsuga-Dryopteris* (ATD) and *Acer-Viola-Osmorhiza* (AVO).

Figure 4. Map of soil units.

Management Considerations

Roads & Trails

The property is accessed from Myllyla Road, a county road leading to a public boat landing, through a private drive that leads to the cottage. From the cottage, the primary woods road runs southward to the old river channel, then turns at a right angle, and runs more-or-less westward to a loop near the western edge of the property and the Point (Figure 4). Vehicles can use this primary road after soils dry in the spring until snow accumulates in the fall and winter. Several smaller trails provide access to other parts of the property, although these trails are only accessible for foot access and off-road vehicles.

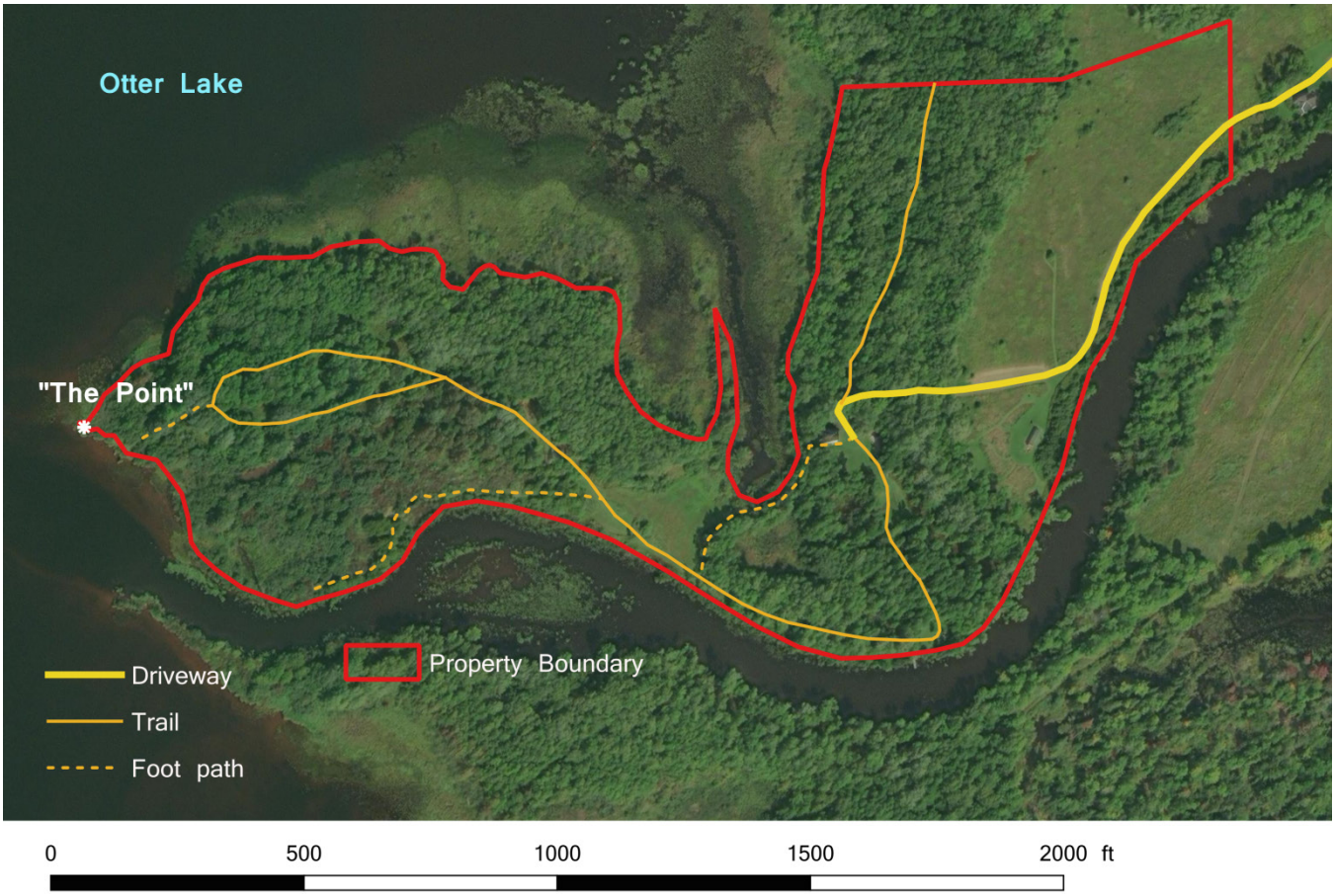

Figure 4. Location of current trails and footpaths.

Forest Products and Benefits

The primary management goals for this property relate to sustaining ecosystem processes, enhancing biodiversity and wildlife habitat, and providing recreational opportunities. Because of these ownership goals, along with the current and near-term condition of the forests, the commercial production of timber is not anticipated. Non-commercial forest products that will likely be derived from the forests and other ecosystems on the property include: firewood, wild game, and berries, mushrooms, and other edible plants.

Firewood will be cut in most years within a portion of the bottomland hardwood forest, with an emphasis on removing ash trees that are susceptible to the emerald ash borer and diversifying stand structure and species composition (see

bottomland hardwood management description for details). Firewood will be cut during drier times of the year and in more accessible locations in order to reduce potential damage to soil and water resources.

Various trees, shrubs, and herbaceous plants will be favored when presents and also planted across the property to increase biodiversity, improve wildlife habitat, and increase opportunities for foraging. Plant selection will be based on desired characteristics or products (e.g., acorns, berries, fruits, medicines), suitability for site conditions, and the long-term ability of the plant to persist on the site under changing conditions; some species for consideration are listed in Appendix 3. Where plantings occur, attention will need to be given to potential challenges from competing vegetation (especially overstory shade and reed canarygrass in the understory) as well as herbivory from animals such as white-tailed deer and beaver. Landscape fabric, tree shelters, or fencing may be necessary for some species and locations.

BIODIVERSITY

Wildlife

One of the primary management goals of this property is to provide habitat for diverse plant and animal species, with an eye toward on improving habitat for waterfowl. Management on the property will protect and enhance wildlife habitat whenever possible and practical. Several actions will promote habitat for a wide array of species, including birds, small mammals, reptiles, amphibians, insects, and invertebrates:

- Retaining large trees, either as snags (dead trees) or standing live (wildlife trees), to provide nesting and perch locations, cavities for dens and nests, and decaying wood for insects that can be eaten by other animals. Larger wildlife trees are often more beneficial because they take longer to decay and have the capacity to support larger wildlife.
- Large down logs, also called coarse woody debris, also serve as homes for a variety of wildlife species. The rotting wood contains insects and many invertebrates, which are an important component of the food chain. Down logs can provide dens for raccoons, foxes, and small mammals, and 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.
- Brush piles have many of the same benefits as large trees and down logs, providing a rich source of decaying wood for insects and other invertebrates. Brush piles can emulate the conditions found in a dense forest, and salamanders and snakes can use the dark, moist conditions. Animals can use brush piles to hide from predators, which may encourage rabbits and many bird species.
- Edge habitat occurs at the transition between two distinctly different cover types, most often the transition between forests and clearings. Trees growing along the edge of the forest form very dense crowns that extend low on the tree trunk, which 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 these areas provide. The areas of this property where the forest borders the field or water are examples of excellent edge habitat.
- Native and beneficial plant species support natural communities. Native plant species that are suitable to local conditions and help achieve management goals will be favored in most circumstances. Non-native plant species that are non-invasive and suitable for current and future conditions will be introduced when these species are expected to provide additional benefits to promoting diversity, improving wildlife habitat, and helping maintain forest ecosystem processes.

Rare Species & Habitats

The property includes a variety of important habitats, all of which are wetland natural communities heavily influenced by Otter Lake and Otter River during at least some parts of the year. These habitats can be grouped into a few broad categories the classification from the Michigan Natural Features Inventory (MNFI):

- **Emergent and submergent marshes** are herbaceous plant communities in shallow to moderately deep water and would include areas on the property dominated by cattails, horsetails, and pond lilies.

- **Northern shrub thickets** are shrub-dominated wetlands (tag alder is most common) found mainly along streams but also lakes and beaver floodings.
- **Floodplain forests** are common in the bottomlands of third-order and larger streams that are subject to seasonal flooding and dominated by species including green ash and silver maple.
- **Inland lakes** include a variety of near-shore and open-water aquatic habitats at various depths.

These communities present on the property are not rare or of notable ecological importance at a state or local level (i.e., not forests of recognized importance or designated areas of high conservation value). At the same time, the property provides habitat for a wide range of plant and animal species, including some that are relatively uncommon. Of the rare species that may be present on the property (see Appendix 2 for a full list), the bald eagle and common loon are conspicuous and have been observed on Otter Lake. Bald eagles are especially common on the north end of the lake and occasionally fly over the property or down the channel of the former Sturgeon River. Bitterns have been heard near the cottage, and the American bittern and the least bittern are two bird species that may be found in the area. Blanding's turtle, wood turtle, and box turtle are other conspicuous species that may be present and should be looked for.

Climate & Carbon

Climate Change Adaptation

Forests are always changing and responding to new conditions. At the same time, the climate is changing in ways that humans have never experienced before, resulting in rising temperatures and shifts in seasonal precipitation patterns (Janowiak and others 2014). Past and future climate changes in Michigan's western Upper Peninsula include:

- Temperatures have risen more than 1.4°F since the late 1800s, with the greatest warming occurring in winter (more than 2°F increase). By the end of this century, average annual temperatures are projected to increase another 2-9°F, increasing both the length of the growing season and the frequency of extremely hot days.
- Annual precipitation has increased by 2 inches during this time, and the heaviest rainfall events have increased. Additionally, warmer temperatures will result in more rain than snow.
- A longer growing season, warmer temperatures, and more variable summer rain are likely to increase summer moisture stress leading to potentially harmful droughts.
- As the climate continues to change, conditions are expected to become less favorable for some northern tree species, while tree species that are more common farther south may benefit from warmer conditions, such as oaks and hickories.

Climate change will not affect all forest species, communities, and parts of the landscape in the same way. Additional stress will amplify some threats that forests already face, such as invasive species, insect pests, forest diseases, and deer browse. Species and forest types that are more tolerant of disturbances may have less risk from climate change, and forests with greater diversity (species, genetic, and structural diversity) may also have less risk. Land owners can choose different actions to resist change, boost resilience, or even encourage change, depending on their goals and tolerance for risk (Swanston and others 2016). Management on this property is heavily focused on enhancing tree species diversity and promoting tree species and communities that may be better-adapted to future climate conditions; details are provided in the descriptions for individual stands and in the adaptation plan that was prepared for this property (Appendix 4).

Forest Carbon

Ensuring that forests can adapt to climate change will also help ensure that forests continue to remove greenhouse gases from our atmosphere. Forests and natural ecosystems play a vital role in the earth's carbon cycle, as trees and plants remove carbon dioxide from the atmosphere and store it in biomass (trunks, branches, foliage, and roots) and soils. Sustainable forestry practices can increase the ability of forests to absorb and store atmospheric carbon while enhancing other ecosystem services, such as soil and water quality. Harvesting and regenerating forests can also result in net carbon sequestration in wood products and new forest growth.

Ensuring ecosystem health and productivity is a critical first step to maintaining the carbon benefits of these natural systems. Impacts resulting from from forest insects and diseases (particularly emerald ash borer; see next section), invasive species, and climate change may pose significant challenges to maintaining forest cover—and therefore ecosystem carbon stocks—across much of the property. For this reason, management actions during the next 10+ years will emphasize forest regeneration and tree planting in portions of the forest that are at the greatest risk as a measure to restore and maintain forest cover and sequestration over the long term.

Forest Health

There are a few issues on this property that may negatively affect ecosystem conditions and create challenges to meeting the management goals. Because the management of this property is focused on creating a variety of habitat conditions, many ecological processes that might slow tree growth, impact timber production, or cause occasional mortality are of less concern than if management were focused on providing quality timber.

Forest Insects and Diseases

There are many insects that affect trees, and these can be beneficial (e.g., pollinators), neutral, or harmful to trees and the overall ecosystem. There are also many diseases that affect trees, although diseases are always harmful to some extent. While there are several insects and diseases that could affect the health of individual trees on the property, the emphasis on natural ecosystem processes, wildlife habitat, and recreation (rather than timber production) means that a certain amount of damage from insect pests and diseases can be tolerated as long as forests and other ecosystems are able to carry out their primary functions.

For example, the **white pine tip weevil** (*Pissodes strobi*)can damage the primary leader of white pine trees growing in open conditions; while this leads to slower growing trees with a more crooked form, this may not be a substantial problem if white pine are planted primarily to provide a conifer component to bottomland hardwood forests. This is also the case with other diseases that have the potential to affect white pine, such as **white pine blister rust** (*Cronartium ribicola*). Similarly, **Dutch elm disease** (*Ophiostoma ulmi*) causes the eventual death of elm trees. While it may not be possible to maintain elm trees to a large size on the property, elm can still provide an important role in lower and middle portions of the forest canopy.

Emerald ash borer (*Agrilus planipennis*) is an imminent threat on the property due to the large proportion of ash in the bottomland hardwood forests. The pest is known to be present in Houghton, MI, which is about 13 miles from the property. In 2018, nearby landowners <2 miles to the west and 5 miles to the east reported woodpecker damage on ash trees consistent with the presence of emerald ash borer, suggesting that the insect is very close, if not already present on the property. Symptoms have not yet been observed on the property or immediately adjacent parcels. The larvae of this non-native insect feed on the inner bark of ash trees, disrupting the flow of carbohydrates. Trees die relatively quickly after infestation; forested stands can go from healthy to near-complete mortality in 6 years (Knight, Brown, and Long 2013). Although the insect will eventually cause complete mortality to affected areas, the mortality of individual trees may be slower for larger trees in dominant and co-dominant crown positions, trees located on wet (hydric soils), and trees that were healthy and free of other health issues prior to infestation (Knight, Brown, and Long 2013). The insect is estimated to spread at a rate of 0.5 mile per year (MDNR 2012), which suggests a high likelihood of infestation and mortality within the foreseeable future (if it has not already occurred). Management of the bottomland hardwood forest (described below) details activities to reduce the ash component of forest stands and increase tree species diversity in advance of tree dieback and mortality.

Invasive Plant Species

Reed canarygrass (*Phalaris arundinacea*) poses the greatest management challenge of any plant species that is currently present on the property. This aggressive, cool-season grass is widespread across the property in open areas and along trail edges. It is also common in the forest understory in some parts of the property, particularly farther west on the property. Reed canarygrass is a major threat to the ecological integrity of wetland ecosystems by outcompeting other

plants, homogenizing habitat structure, and altering hydrology, nutrient cycling, and carbon storage (WDNR). The grass is a prolific colonizer of open and disturbed sites and spreads by seed, stem fragments, and rhizomes. There is some confusion about whether this grass species is native to the region; it is suspected that non-native varieties or crosses of native and non-native varieties have contributed to the species' heightened aggressiveness (USFS).

This species is notoriously difficult to control. Although several options are available (e.g., mowing, burning, herbicides, tree planting), treatments typically need to be repeated for several years to restore native vegetation (WDNR). In the near term, management at Otter Point Woods will likely focus on restricting the expansion of reed canarygrass to new areas. Reed canarygrass is well-poised to expand into areas where the forest canopy cover is reduced; areas containing substantial amounts of ash are most likely to have forest canopy removed either through forest harvest in advance of emerald ash borer or from actual pest mortality. When possible, managing light conditions is the most effective way to reduce reed canarygrass expansion. Reed canarygrass may need to be controlled around tree plantings to reduce competition with the desired species; mowing is probably the most effective control method in these situations, particularly when it is timed to limit seed development. Targeted use of herbicides or other control methods may be necessary in some instances (WDNR).

Beyond this, there are currently few issues with invasive plant species on the property. Many non-native species are present on the property (such as clover, plantain, lilac, black walnut), but these species do not have invasive characteristics. Species of potential concern are:

- **Non-native honeysuckle** (*Lonicera* spp.) plants appear to have been established for quite a long time in some places. Several (~10) large shrubs have been found dispersed across the property. These plants appear in isolated locations as large shrubs and do not seem to be expanding quickly.
- **Japanese barberry** (*Berberis thunbergii*) is likely present in isolated locations on the property. A few individual plants were found and treated (cut and basal application of herbicide) west of the field. It may be present on the north end of the property, and several large patches are present nearby on adjacent parcels to the north. Many plants are established in full shade along an old road, with heavy seed production occurring in the fall.
- **Boxelder** (*Acer negundo*) is a native species common to the bottomland forest type present across much of the property. However, the species is sometimes considered invasive because of its ability to outcompete more desirable vegetation (IPAUS). Cut trees can stump and root sprout, so it may be necessary to apply herbicide to the stump of cut trees or kill sprouts through repeated cutting or burning with a propane torch (eXtension).

There are many invasive species that have been identified in the Upper Peninsula (KISMA) and these species are often spread when their seeds become attached to a hiker's boots or clothing and then fall off in another location. Given the low landscape position of the property and commonality of flooding, it is likely that high water levels are a key driver of seed movement for invasive plant species. For example, Japanese barberry is most common in or immediately adjacent to the low-lying and flood-prone areas in original channel of the Sturgeon River (i.e., where the river flowed prior to 1913), while honeysuckle plants seem to be common along sandy river banks. Even with control of existing invasive species, the property's location within the watershed may make it vulnerable to future invasions of these and other invasive plants that may be introduced upstream. **Common buckthorn** (*Rhamnus cathartica*) and **glossy buckthorn** *(Frangula alnus*) are important species of concern, as these species are present elsewhere in the western U.P. and would be highly competitive on the property given the soil and site conditions.

Invasive plants will be monitored to ensure that existing populations do not spread and to detect new plant species that may be of concern. If the plant cannot be identified, a forest scientist, ecologist, or botanist should be contacted to identify the plant, determine if it is native or non-native and make recommendations for its removal, if necessary. Invasive plant species will be removed with mechanical or, if necessary, chemical treatments, with appropriate precautions taken to protect soil and water resources.

Wildfire and Fire Management

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 location of outdoor fires. Camp fires and brush fires may require a burn permit depending upon the time of year and weather conditions. The Michigan DNR website provides daily assessments of fire danger and whether burn permits are necessary (MDNR).

Special Sites and Features

There are no known significant natural or cultural features on the property.

Management Plans By Unit

Management Unit Map

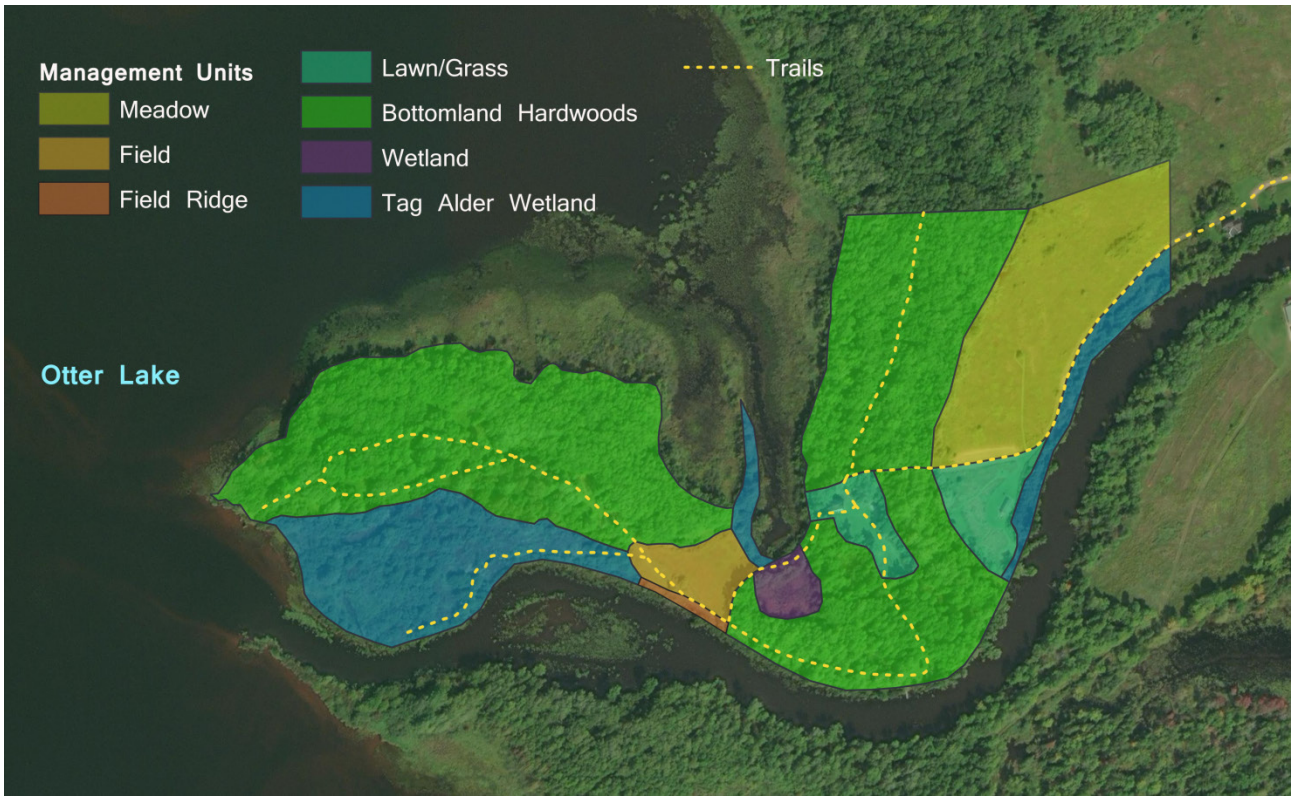

Figure 5. Approximate distribution of management units across the property. Note that fine-scale differences in plant communities are not able to be differentiated at this spatial scale; as a result, management units are more heterogeneous than mapped.

Bottomland Hardwood Forest

Description

Bottomland hardwood forests cover approximately 17.4 acres in two separate areas. These are floodplain forests that are generally dominated by green ash and silver maple. Green ash is the dominant tree species (greater than 50% of overstory) in some parts of the property, especially the south. Elsewhere, green ash and silver maple are mixed together. Across the entire property, American elm and boxelder are common associates, although many elm trees have recently died (likely due to an outbreak of Dutch elm disease). Tag alder and, to a lesser extent, willow are common along woods edges. A patch of balsam poplar is present about midway between the field and the point on the west end of the property.

Management Objectives

The management objectives for these forests are:

- Maintain forested conditions (avoid forest loss) across the 17 acres of bottomland forests by proactively addressing impending ash mortality from the emerald ash borer.
- Reduce the dominance of green ash to less than 30% of the forest canopy in anticipation of the emerald ash borer by harvesting ash trees for firewood on approximately 10 acres.
- Retain and promote the growth of tree species that may be suitable for future conditions, including silver maple (currently present on the property).

- Plant diverse tree and plant species in harvested areas (up to 5 acres) to supplement forest regeneration, emphasizing areas where ash is currently most abundant.
- Identify and retain large trees that may serve as cavity trees for wildlife.
- Maintain the existing trail network for access.

Planned Management

Management in the bottomland hardwood forests will generally focus on reducing the ash component and increasing the proportion of other tree species. Emerald ash borer is not yet known to be present on or near the property, but infestation seems imminent given the proximity of symptomatic forests (less than 2 miles to the west and 5 miles to the east). Further, reed canarygrass is widespread in the understory in these stands and will be at a competitive advantage where the canopy is opened, either through tree harvest or mortality from the emerald ash borer.

Because of the potential for a "double-whammy" where tree mortality caused by emerald ash borer increases the ability for reed canarygrass to be a dominant and problematic ground cover, trees will be harvested with consideration to maintaining some overstory shade. Ash species will be favored for removal as individual trees or small groups/patches. Harvest areas will be prioritized in areas nearest the cottage, road, and trails in order to minimize risks to human safety, prevent property damage, reduce trail maintenance (i.e., clearing fallen trees), and take advantage of greatest access. Trees will be harvested by the landowners for firewood. Although tree harvests will be relatively low in intensity and occur when the site is relatively dry and accessible, consideration should be given to avoiding damage to soils and water resources.

Silvicultural guidance developed by the Wisconsin Department of Natural Resources suggests aiming for a species composition of less that 20% ash when conditions allow (WDNR 2018). The high proportion of ash in many areas coupled with a lack of regeneration and potential competition from reed canarygrass means that insect-caused mortality could push these forests into a "degraded" condition. Silvicultural systems that are best-suited to the site conditions are (WDNR 2018):

- Shelterwood harvests that retain 50-75% of vigorous dominant and codominant trees in order to create understory conditions for the establishment and survival of desirable tree species. Site preparation may be needed to control competing vegetation, such as reed canarygrass.
- Group/patch selection harvests that create canopy openings (0.1 to 0.5 acre for group selection and 0.5 to 2.0 acres for patch selection) to encourage the establishment of new cohorts within harvested areas. Larger openings may allow for greater competition from undesirable vegetation.

The harvested areas should be periodically monitored for successful regeneration. Desirable species for natural regeneration would include silver, red, and sugar maple with silver maple being the most likely to establish based on the current conditions and seed source. Less desirable tree species would include boxelder, ash species, or tag alder, and these may be controlled if necessary by cutting. An increase in reed canarygrass would also be undesirable; control of reed canarygrass is difficult but options exist for mowing, burning, herbicides, and tree planting and could be implemented if the grass is impeding adequate regeneration (WDNR 2018).

Supplemental tree planting may also be used to further diversify the bottomland hardwood forest and help ensure closed canopy conditions. Species for planting would be selected based on suitability for the site, as well as an expectation that the tree species would be adapted to future conditions of a further warmed and more variable climate (see Appendix 3: Suitable Plant List). Shrubs and brambles may also be planted to enhance wildlife habitat or provide opportunities for foraging.

Many wildlife species nest in trees, including wood ducks. Ideal nesting trees for wood ducks are greater than 11 inches in diameter and have developed large, deep cavities that are far above ground (VCE 2009). Some large trees, particularly silver maple, can be retained to allow these trees to larger sizes. Where potential cavity trees are in a codominant canopy position, releasing trees from competition may allow them to increase size.

Trails will be maintained through periodic mowing. Clover or other herbaceous or grass species may be interplanted within existing trails to improve conditions for many desired wildlife species.

Field & Field Ridge

Description

The field is near the center of the property and is about 0.8 acre in size. In the past, the field has been sown with various crop and forage plants (e.g., grains, clover) to provide food for wildlife and facilitate hunting.). A slight "ridge" along the south edge of the field borders the old river channel and covers an area about 0.1 acre in size. The field includes a mix of grasses, sedges, and herbaceous plants and is mowed or tilled periodically to maintain open conditions. The northern edge of the field, particularly the northeast corner, is lowest in elevation and transitions to a wet area containing reed canarygrass, sedges, and willows. Two "weed islands" are present in the middle of the field where willow trees and rough terrain have prevented mowing. A row of boxelder trees used to grow in the higher spots between the field and the old river channel, but many of these trees have been removed.

Management Objectives

The management objectives for the field are:

- Plant 10+ oak trees on the ridge between the south edge of the field and the old river channel to provide additional food sources for wildlife.
- Plant shrubs and other suitable plants along the edges of the field and on the field ridge to increase structure and edge habitats and to provide additional food sources for wildlife.

Planned Management

The field may be planted with one or a mix of annual plants and used as a food plot to attract wildlife, particularly waterfowl. Cereal crops, such as wheat, oats, or barley, are easy to grow and will be likely crops to grow during the first few years of experimentation. Various perennial clover species may also be planted in some areas. Although tilling or disking or tilling may be needed to create conditions for planting. Herbicides will not be used to control vegetation in the field unless necessary; if used, consideration will be given to products suitable for wetlands and the timing of application. Soil disturbance will occur during the late spring after soils have dried sufficiently to avoid compaction or other damage. Vegetation will be maintained through the winter and until the following spring to reduce the potential for soil erosion.

There was a row of boxelder trees on the ridge at the south edge of the field along the bank of the old Sturgeon River, and these trees were cut down. Various oak species will be planted in this location following complete removal of the boxelder sprouts and site preparation. Once established, the oaks will provide edge and perch habitats for some birds and other animals, as well as be an important source of hard mast for waterfowl and other wildlife.

TAG ALDER WETLANDS

Description

Tag alder is common across the property in low areas and along the shoreline, with some larger areas that are predominantly tag alder shrublands. Red-osier dogwood is also common in many of these areas. Scattered individual plants of nonnative honeysuckle are scattered amongst the tag alder south of the main access road going to the Point. About 5 acres of the property is wetlands dominated by tag alder and associated shrubs.

Management Objectives

The management objectives for the tag alder wetlands are:

- Maintain a vegetative buffer along shorelines to protect water quality, with preference for species other than reed canarygrass.
- Maintain a variety of age classes of tag alder and shrubs across the property.

Planned Management

Relatively little management in planned in tag alter wetlands. Across the property, small areas of tag alder may be removed to increase access to the lake or to reduce competition for planted trees. In the larger area of tag alder south of the main trail to the Point, patches of tag alder may be cut in order to regenerate younger habitat.

OTHER WETLANDS

Description

Several wetlands are present on some portions of the property, particularly along the northern shoreline and at the head of Lunker Bay near the cottage. A small "pocket wetland" of cattails about 0.5 acres in size is present to the south of the cottage within the bottomland hardwood forest. It is hard to determine the area of wetlands dominated by cattails and other non-woody (e.g., rushes, emergent and submergent plants) vegetation due to fluctuating lake levels and gradual transitions to other ecosystem types.

Management Objectives

The management objectives for the other alder wetlands are:

- Maintain a vegetative buffer along shorelines to protect water quality, with preference for species other than reed canarygrass.

Planned Management

No active management is planned for cattail wetlands. Areas adjacent to these wetlands will minimize any potential impacts to these areas; for example, areas around wetlands will be buffered to reduce or firewood harvesting, tree removal, or other disturbances as appropriate.

Cottage Lawn/Grass and Associated Buildings

Description

The property includes a small cottage that was built around 1920 and has been maintained in good condition given somewhat limited and seasonal use by the previous owners. The cottage is positioned within a small clearing (<0.25 acre) that serves as a yard. A small shed (approximately 12 ft. x 12 ft.) and outhouse are nearby as permanent buildings and are in relatively good condition. The yard surrounding these buildings is about 0.5 acres in size and includes areas used to part vehicles. Outside of this area, an old sauna building is located about 500 ft. south of the cottage along the bank of the old river channel; it is in poor condition and not often used.

Management Objectives

The management objectives for the buildings and yard are:

- Maintain a seasonally-accessible, rustic "camp" cottage and associated outbuildings (i.e., shed, outhouse) to support recreational use of the property.
- Maintain an open yard surrounding the cottage for access and aesthetics, while also minimizing time and effort needed for maintenance.
- Revitalize existing and establish new gardens surrounding the house for herbs, vegetables, and other plants.
- Remove large trees that pose a hazard to buildings and property.

Planned Management

The open area will be largely maintained as open space and yard surrounding the cottage. Vegetables or other plants may be grown in this area, which receives full sun during much of the day and has relatively few competing plants beyond the lawn grasses. There are several large trees near the cottage and outbuildings, which could cause damage if they were to fall. Extreme wind poses a threat to these trees, which is exacerbated by their old age and large size. Several of these trees are also ash, which are susceptible to any future introduction of emerald ash borer. Yard trees will be evaluated for the potential risk of property damage, and professional removal (or minimally, felling) will be needed in the near future.

ORCHARD

Description

A small clearing (<0.25 acre) containing 5 apple trees is located slightly south of the cottage. This area has historically been mowed to maintain open conditions and grass, and the primary access road runs between the trees and through this opening. The apple trees are large and overgrown, with multiple dead limbs and areas containing bird peck holes. They are not known to produce apples (no blossoms or apples were observed in 2016), and the large size would make picking difficult if apples were produced. Raspberries are present along the brushy edges of the orchard.

Management Objectives

There are no specific management objectives for this area at this time.

Planned Management

This area will be evaluated for potential uses,

MEADOW

Description

The meadow is an abandoned field in the northeast corner of the property. About 4.5 acres is on the property, but this area extends to the north and east on adjacent properties across what had been a contiguous ownership. This area contains a wide diversity of grasses and herbaceous plants. Common milkweed, Canada goldenrod, raspberries, and the nonnative spotted knapweed are among the most conspicuous. In the absence of disturbance, tag alder has been encroaching into this area.

Management Objectives

The management objectives for the meadow are:

- Maintain 4+ acres of open (grass/herbaceous) habitat through mowing, tilling and planting, removing tag alder, or other activities. This may include tilling and planting to create designated food plots.
- Establish a large garden (<0.15 acre) in the southeast corner of the meadow.

Planned Management

A fenced garden will be installed in the southeast corner of the meadow for growing vegetables and perennial fruits (e.g., raspberries). The remaining area will be maintained in an open condition to provide habitat diversity. The major challenge will be to reduce and reverse the encroachment of tag alder into this area. Occasional mowing (occurring once every few years) in the late spring or early fall will help promote herbaceous perennial plants while reducing encroachment for woody plants. Tag alders that have already established may need to be mowed or cut down, or pulled from the ground.

TRAILER YARD

Description

This area is about 1 acre in size and includes the grassy areas south of the orchard that had been the mowed lawn and surrounding yard for a summer-used trailer (now removed). This area is open and contains some of the same plants that are found in the adjacent meadow in some areas, but has a much greater amount of grass on account of past mowing.

Management Objectives

There are no specific management objectives for this area at this time.

Planned Management

This area will be evaluated for potential uses, including a food plot, a forest garden, or a yard area for summertime RV use. In the meantime, this area will be mowed periodically to keep tag alder and trees from encroaching. Perennial shrubs may be planted along edges to improve habitat.

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APPENDIX 1: PROPERTY LEGAL DESCRIPTION

The Otter Point Woods property consists of the following 4 parcels:

1. A parcel of land situated in Government Lot 4 of Section 12, Township 52 North, Range 34 West, Portage Township, Houghton County, Michigan, described as follows: Commencing at the Northeast corner of Section 12, thence South 47° 07′ West 1502.20 feet to the Northeast corner of said parcel, the Point of Beginning; thence due West 173.75 feet; thence South 05° 07′ East 267.20 feet; thence South 44° 18′ West 179.50 feet to the Sturgeon River; thence south 67° 11′ East 193.74 feet; thence South 89° 08′ East a distance of 220.80 feet; thence North 50° 52′ East 182.60 feet; thence leaving the Sturgeon River on a course of North 57°45′ West 99.60 feet; thence North 42° 42′ West a distance of 105.72 feet; thence North 22° 42′ West 127.40 feet; thence North 29° 05′ West 125.12 feet to the Point of Beginning.
2. The WEST HALF (W½) of the former bed of the Sturgeon River in Government Lot 4 of Section 12, Township 52 North, Range 34 West, Portage Township, Houghton County, Michigan, WHICH ABUTS THE FOLLOWING DESCRIBED PARCEL on the East and which lies West of the center of the former river bed: A parcel of land situated in Government Lot 4 of Section 12, Township 52 North, Range 34 West, Portage Township, Houghton County, Michigan, described as follows: Commencing at the Northeast corner of Section 12, thence South 47° 07′ West 1502.20 feet to the Northeast corner of said parcel, the Point of Beginning; thence due West 173.75 feet; thence South 05° 07′ East 267.20 feet; thence South 44° 18′ West 179.50 feet to the Sturgeon River; thence south 67° 11′ East 193.74 feet; thence South 89° 08′ East a distance of 220.80 feet; thence North 50° 52′ East 182.60 feet; thence leaving the Sturgeon River on a course of North 57°45′ West 99.60 feet; thence North 42° 42′ West a distance of 105.72 feet; thence North 22° 42′ West 127.40 feet; thence North 29° 05′ West 125.12 feet to the Point of Beginning.
3. All that accretion lying west of a parcel of land situated in Government Lot 4 of Section 12, Township 52 North, Range 34 West, Portage Township, Houghton County, Michigan, which accretion is described as follows: Commencing at the Northeast corner of Section 12, thence South 47° 07′ West 1502.20 feet to the Northeast corner of said parcel; thence due West 173.75 feet along the North line of said parcel to the Northwest corner on the original shore line of Otter Lake and the Point of Beginning of the accretion; thence due West 1666.45 feet to the mouth of the Sturgeon River and the shore of Otter Lake; thence South 57° 17′ East 60.80 feet along the North side of the Sturgeon River; thence south 81° 40′ East 159.30 feet along the river; thence South 75° 27′ East 138.50 feet along the river; thence 46° 09′ East 306.50 feet along the river; thence South 57° 14′ East 145 feet along the river; thence North 71° 06′ East 138 feet along the river; thence North 58° 49′ East 107 feet along the river; thence 43° 53′ East 144 feet along the river; thence South 84° 11 East 270 feet along the river; thence South 56° 43′ East 345.25 feet along the Sturgeon River to the original shore line of Otter Lake; thence North 44° 18′ East 179.50 feet along the original shore line of Otter Lake; thence North 05° 07′ West 267.70 feet along the original shore line of Otter Lake to the Point of Beginning.
4. A parcel of land situated in parts of government lots 4 and 5, Section 12, Township 52 North, Range 34 West, Portage Township, Houghton County, Michigan, described as follows: Commencing at the northeast corner of said Section 12, then S 00° 03′ 01″ E, along the east line of said section 282.54 feet; then west 400.00 feet to the point of beginning; then S 00° 03′ 01″ E 272.42 feet to point being 25 feet from the water's edge on an immediate traverse line running along shore of the Sturgeon River; then the following two courses along said traverse line; S 47° 49′ 02″ W 256.90 feet; then S 22° 26′ 31″ W 682.53 feet to a point being 29 feet from the water's edge; then N 57° 45′ 00″ W 84.79 feet; then N 42° 42′ 00″ W 105.72; then N 22° 42′ 00″ W 127.40 feet; then N 29° 05′ 00″ W 125.12; then west 144.57 feet to a point being 14 feet from the water's edge on an intermediate traverse line running along the shore of Otter Lake; then following two courses along said traverse line; N 07° 06′ 55″ E 358.29 feet; then N 07° 54′ 35″ E 273.55 feet to a point being 27 feet from the water's edge; then S 87° 47′ 57″ E 431.03 feet; then N 70° 56′ 22″ E 355.39 feet to the point of beginning, parcel includes that area between the intermediate traverse lines and shorelines.

APPENDIX 2: RARE SPECIES LIST

The Rare Species Explorer tool from the Michigan Nature Features Inventory was used to identify rare plants and animals of interest. The tool was used to search for species that might be present across in Michigan's western Upper Peninsula for the following natural communities present on the property: palustrine (submergent marsh, emergent marsh), shrub (northern shrub thicket), palustrine forest (floodplain forest), and inland lake (all habitats). This provides an initial list of rare, threatened, or endangered species that might occur on the property or nearby in similar habitats.

Table: Rare plant species observed in Western Upper Michigan for natural communities found on the property.

Taxonomic Group	Common Name	*Scientific Name*	Inland lake	Marshes	Northern shrub thickets	Floodplain Forest
Flowering plants	Canadian milk vetch	*Astragalus canadensis*			X	X
	Slough grass	*Beckmannia syzigachne*		X		
	Narrow-leaved reedgrass	*Calamagrostis stricta ssp. stricta*	X	X		
	Floating marsh marigold	*Caltha natans*		X		
	Great northern aster	*Canadanthus modestus*			X	
	Large toothwort	*Cardamine maxima*				X
	Assiniboia sedge	*Carex assiniboinensis*				X
	Purple clematis	*Clematis occidentalis*				X
	Showy orchis	*Galearis spectabilis*				X
	Narrow-leaved gentian	*Gentiana linearis*		X	X	
	Hedge-hyssop	*Gratiola aurea*		X		
	Vasey's rush	*Juncus vaseyi*		X		
	American shore-grass	*Littorella uniflora*	X	X		
	Black twinberry	*Lonicera involucrata*			X	
	Swamp candles	*Lysimachia hybrida*				X
	Alternate-leaved water-milfoil	*Myriophyllum alterniflorum*	X	X		
	Farwell's water milfoil	*Myriophyllum farwellii*	X	X		
	Auricled twayblade	*Neottia auriculata*			X	X
	Small yellow pond lily	*Nuphar microphylla*		X		
	Pygmy water lily	*Nymphaea leibergii*		X		
	Ginseng	*Panax quinquefolius*				X
	Carey's smartweed	*Persicaria careyi*		X		
	Sweet coltsfoot	*Petasites sagittatus*			X	
	Canada rice grass	*Piptatherum canadense*		X		
	Alga pondweed	*Potamogeton confervoides*	X	X		
	Vasey's pondweed	*Potamogeton vaseyi*	X	X		
	Lesser Pyrola	*Pyrola minor*			X	
	Seaside crowfoot	*Ranunculus cymbalaria*		X		
	Macoun's buttercup	*Ranunculus macounii*		X	X	
	Lake cress	*Rorippa aquatica*	X	X		
	Satiny willow	*Salix pellita*		X	X	
	Torrey's bulrush	*Schoenoplectus torreyi*	X	X		
	Evening campion	*Silene nivea*			X	
	Awlwort	*Subularia aquatica*		X		
	Clinton's bulrush	*Trichophorum clintonii*		X		
Ferns/Fern Allies	Giant horsetail	*Equisetum telmateia*			X	
	Fir clubmoss	*Huperzia selago*		X		

Table: Rare animal species observed in Western Upper Michigan for natural communities found on the property.

Taxonomic Group	Common Name	*Scientific Name*	Inland lake	Marshes	Northern shrub thickets	Floodplain Forest
Birds	American bittern	*Botaurus lentiginosus*		X		
	Red-shouldered hawk	*Buteo lineatus*				X
	Common gallinule	*Gallinula galeata*		X		
	Common loon	*Gavia immer*	X	X		
	Bald eagle	*Haliaeetus leucocephalus*				X
	Least bittern	*Ixobrychus exilis*		X		
	King rail	*Rallus elegans*		X		
	Sharp-tailed grouse	*Tympanuchus phasianellus*			X	
Mammals	Moose	*Alces americanus*		X	X	
	Gray Wolf	*Canis lupus*			X	
	Eastern pipistrelle	*Perimyotis subflavus*			X	
	Slippershell	*Alasmidonta viridis*	X			
	Black sandshell	*Ligumia recta*	X			
Reptiles	Blanding's turtle	*Emydoidea blandingii*		X	X	X
	Wood turtle	*Glyptemys insculpta*			X	
	Eastern box turtle	*Terrapene carolina carolina*			X	
Insects	Pygmy snaketail	*Ophiogomphus howei*	X	X		
Snails	Campeloma spire snail	*Cincinnatia cincinnatiensis*	X			
	A land snail (no common name)	*Euconulus alderi*			X	
	Eastern flat-whorl	*Planogyra asteriscus*			X	
	Acorn ramshorn	*Planorbella multivolvis*	X	X		
Fingernail/Pea Clams	Giant northern pea clam	*Pisidium idahoense*	X			
	River fingernail clam	*Sphaerium fabale*	X			
Fish	Lake herring or Cisco	*Coregonus artedi*	X			

APPENDIX 3: SUITABLE PLANT LISTS

Tree species currently present on the property – Tree Atlas (Atlas) and LANDIS (Lan) model projections under two climate change scenarios for the end of the 21st century and additional notes regarding management.

	Low (PCM B1)		High (GFDL A1FI)		
Common name	**Atlas**	**Lan**	**Atlas**	**Lan**	**Additional comments**
American elm	▲		▲		Retain where present; Promote when possible
Balsam poplar	▼	●	●	▼	
Green ash	▼	●	▼	▼	Reduce in anticipation of EAB
Black walnut	▲		▲		Single tree; Consider planting
Black willow	▲		▲		
Boxelder	▲		▲		Reduce where nuisance
Eastern white pine	●	●	▼	▼	Retain where present; Consider planting to increase conifer component
Green ash	▼	▲	▲	●	Reduce in anticipation of EAB
Northern white-cedar	▼	●	▼	▼	Retain where present; Consider planting to increase conifer component
Red maple	●	▲	▼	▲	
Silver maple	▲		▲		May be able to collect samaras and plant elsewhere on property
Sugar maple	●	●	▼	▼	
White ash	▲	▲	▲	▲	Reduce in anticipation of EAB
White spruce	▼	▼	▼	▼	Retain where present

Tree species not currently present on the property for consideration for planting – Tree Atlas (Atlas) and LANDIS (Lan) model projections under two climate change scenarios for the end of the 21st century and additional notes regarding management.

	Low (PCM B1)		High (GFDL A1FI)		
Common name	**Atlas**	**Lan**	**Atlas**	**Lan**	**Additional comments**
American basswood	●	▲	▲	▲	
American hornbeam	▲		▲		
Bitternut hickory	▲	▲	▲	▲	
Black cherry	▲	●	▲	▲	Consider planting *Prunus* species for wildlife
Black locust	▲		▲		Would grow well, but avoid due to invasive characteristics
Black oak	▲	▲	▲	▲	
Blackgum			★		
Bur oak	▲	▲	▲	▲	
Chestnut oak	--		★		
Chinkapin oak	★		★		High-priority *Quercus* species to plant for wildlife
Common persimmon	--		★		
Eastern cottonwood	▲		▲		Could be a replacement species in ash forests
Eastern hophornbeam	●		▲		
Eastern redbud	▼		▲		

Flowering dogwood	★		★		
Gray birch	★		★		
Hackberry	▲		▲		
Honeylocust	★		★		
Mockernut hickory	★		★		
Northern red oak	▲	●	●	●	High-priority *Quercus* species to plant for wildlife
Osage-orange	★		★		
Paper birch	▼	▼	▼	▼	
Pignut hickory	★		★		
Pin cherry	●		▼		
Pin oak	★		★		
Red mulberry	▲		▲		
River birch	▲		▲		Aesthetically-pleasing; Consider planting near cottage
Sassafras	★		★		
Shagbark hickory	▲		▲		Common in floodplain forests in Vermont; Consider planting
Slippery elm	▲		▲		
Swamp white oak	●		▲		
Sweet birch	★		★		
Sycamore	★		★		Present in floodplain forests in Vermont; Consider planting
White oak	▲	▲	▲	▲	High-priority *Quercus* species to plant for wildlife
Wild plum	▼		▲		
Yellow-poplar	★		★		

Selected shrub species for possible planting

Species	Notes
Mapleleaf viburnum	Common on Otter River upstream of Otter Lake
Nannyberry	Common on Otter River upstream of Otter Lake
Red-osier dogwood	Already common on property; grows well
Flowering dogwood	
Serviceberry	
Wild grape	

APPENDIX 4: ADAPTATION PLAN

APPENDIX 5: 2019 PLANNED ACTIVITIES

2019 Planned Activities – High Priority

Area	Activity	Timing
Cottage	Have large ash and silver maple near cottage professionally cut down to remove hazard of property damage. Have tree tops chipped for mulch and remove/grind any stumps that are in the yard.	May-June
Meadow	Till and establish a new garden area that is roughly 60 feet by 100 feet in size. Install electric fence around garden area.	May-June
Bottomland hardwoods	Harvest ash trees for firewood across the property, focusing on areas near trails and with highest abundance of ash.	Anytime
Cottage	Establish herbs and perennial plants on east and west sides of cottage.	Late summer
Field ridge	Cut box elder stumps, and treat with herbicide to prevent sprouting if necessary. Plant 10+ oak trees on the ridge between the south edge of the field and the old river channel to provide additional food sources for wildlife. Plant additional shrubs and other suitable plants for wildlife.	April-June
Field, Field ridge, Bottomland hardwoods	Plant shrubs and other suitable plants along field edges and lake shorelines to increase structure and edge habitats and to provide additional food sources for wildlife.	Anytime
Meadow	Remove encroaching tag alder; Late fall mowing of 1/3 to 1/2 of area	Late summer-Fall

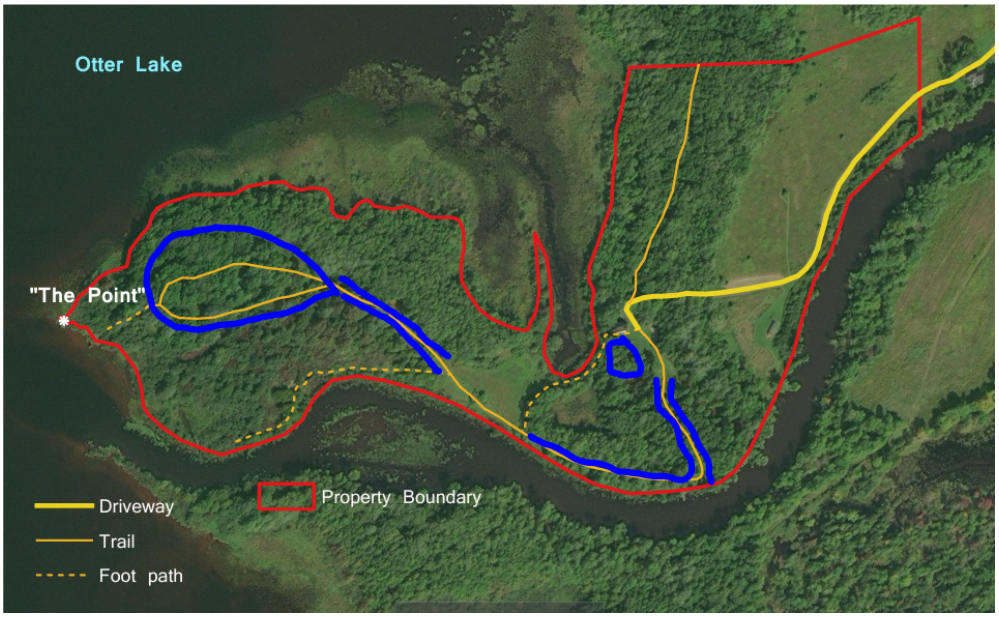

Figure 2019-1. Priority areas for removing ash trees.

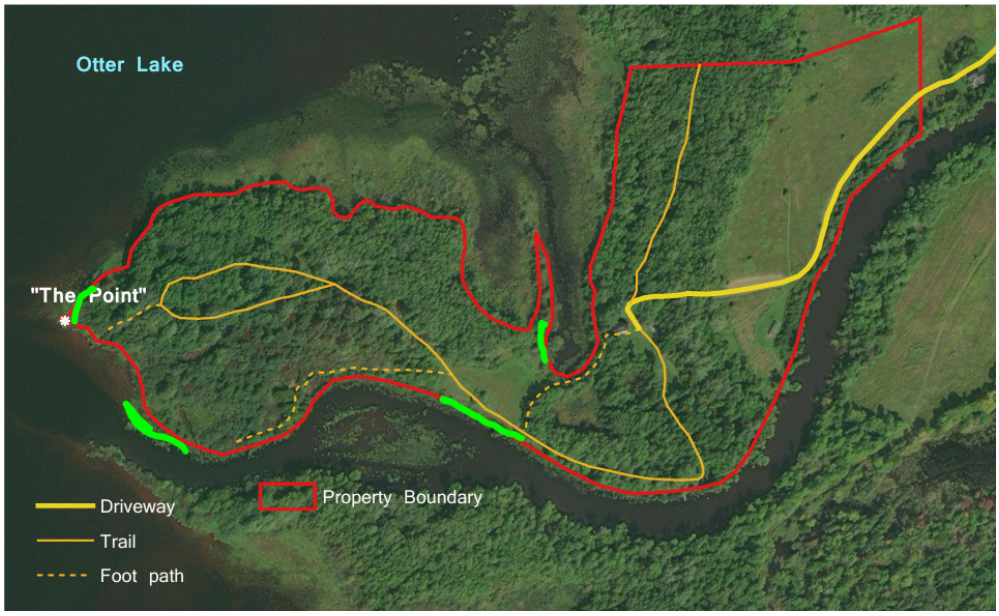

Figure 2019-2. Priority areas for oak planting.

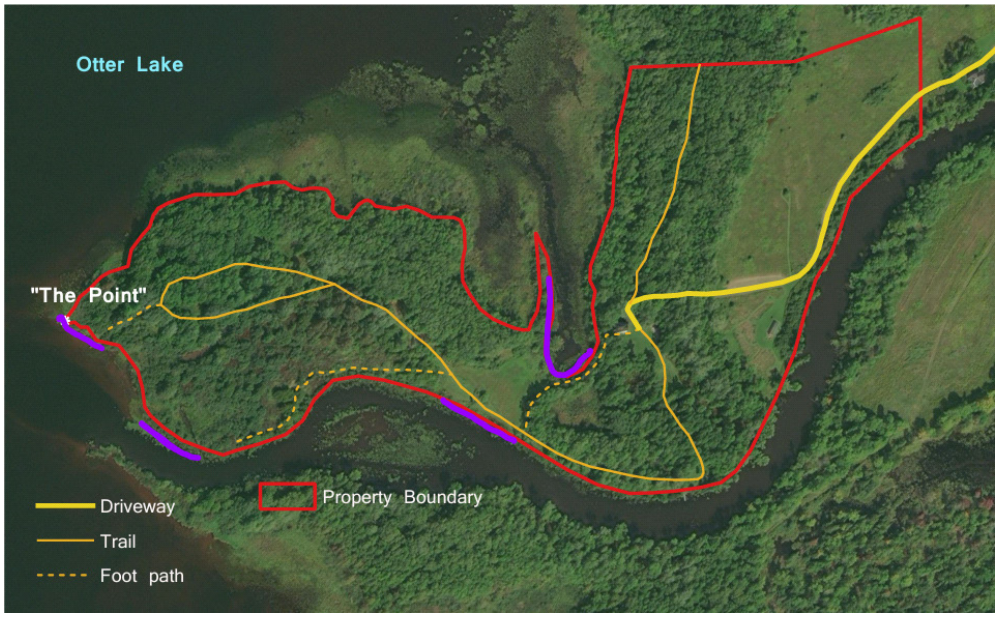

Figure 2019-3. Priority areas for shrub planting.

2019 Potential Activities – Lower Priority

Area	Activity	Timing
Driveway	Gravel approach to driveway; crown and ditch driveway	