

Forest Stewardship Plan

2017-2027



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**Green Timber
Consulting Foresters, Inc.**
ACHIEVING YOUR LAND MANAGEMENT GOALS.

Forest Stewards
 **Guild**



Landowner Information		Plan Writer / Land Manager Information	
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Property Information			
Total Acres: 410	Forested Acres: 398	Acres to be Managed: 402.5	
Property Legal Description			
Parcel 1 T. 55N – R. 35W SW ¼ NE ¼; Section 11 Stanton Township, Houghton County, MI 40 Acres; ~38 Acres Forested	Parcel 2 T. 55N – R. 34W N ½ N ½ SE ¼; Section 11 Hancock Township, Houghton County, MI 40 Acres; ~30 Acres Currently Forested	Parcel 3 T. 54N – R. 33W NE ¼ SE ¼; Section 24 & T. 54N – R. 32W NW ¼ SW ¼; Section 19 Torch Lake Township, Houghton County, MI 80 Acres; 80 Acres Forested	
Parcel 4 T. 54N – R. 36W N ½ NE ¼; Section 29 Stanton Township, Houghton County, MI 80 Acres; 80 Acres Forested	Parcel 5 T. 53N – R. 35W SE ¼ SE ¼; Section 34 Portage Township, Houghton County, MI 40 Acres; 40 Acres Forested	Parcel 6 T. 52N – R. 35W Portions of SE ¼; Section 17 Elm River Township, Houghton County, MI 50 Acres; 50 Acres Forested	
Parcel 7 T. 50N – R. 36W E ½ SE ¼; Section 6 Laird Township, Houghton County, MI 80 Acres; 80 Acres Forested			
Signatures of Approval			
Landowner:  Fred Clark (Executive Director)		Date: 9/13/2017	
Plan Writer  Rexx A. Janowiak (Senior Forester)		Date: 9/15/2017	
DNR Service Forester:		Date:	

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Statement of Purpose & Plan Structure

This Forest Stewardship Plan was developed to guide the management activities on lands owned by The Forest Stewards Guild in Houghton County, Michigan. All of these parcels are enrolled in The Nature Conservancy's Forest Stewardship Council Group Certificate. This plan is intended to guide activities on the property for the next ten years and should be reviewed and revised as needed.

This plan provides an overview of forest types, soils, land management history and other components of the landscape and outlines the conservation targets, planned silviculture methods, and general management direction for each parcel.

The Forest Stewards Guild (Guild) is a private, 501c(3) nonprofit conservation organization with members across the country. The Guild practices and promotes responsible forestry as a means of sustaining the integrity of forest ecosystems and the human communities dependent upon them. The Guild engages in education, training, policy analysis, research, and advocacy to foster excellence in stewardship, support practicing foresters and allied professionals, and engage a broader community in the challenges of forest conservation and management.

The Guild has a commitment to 'working forest lands' as a conservation strategy. Using this strategy, we hope to achieve a balance of sustaining jobs and managing timber while improving the diversity of native species in forested communities and enhancing the quality of water and soil resources. There is much to learn regarding this type of conservation and these properties will be used as demonstration sites.

Planning process

The Forest Stewards Guild employed an intern from Michigan Technological University, Russell Lipe, to work with Green Timber Consulting Foresters, Inc. of Pelkie, MI in conducting an inventory of the properties and developing this plan. This effort was overseen and reviewed by several staff members of Green Timber Consulting Foresters, Inc. namely Management and Planning Director, Mike Schreiber. Stephen Handler of the Northern Institute of Applied Climate Science also involved with the development and review of this plan. Michael Lynch of the Forest Stewards Guild led the final review and submission. Minor revisions to this plan were made in 2018 as part of the Guild's enrollment in The Nature Conservancy's (TNC) Forest Stewardship Council Group Certificate. These changes were made by Guild staff in consultation with Tina Hall and Fran Price at TNC and Chris Burnett at the Upper Peninsula Land Conservancy. Several previous plans for the region were used to inform the planning process as well as consultation and feedback from conservation partners and the research community.

Landowner's Forest Management Goals and Objectives

Goals

- Provide a foundation to build and expand on our work promoting sustainable forestry and forest conservation in the Upper Peninsula of Michigan.
- Maintain, restore, and enhance the biological diversity, water quality, and ecological integrity of the managed parcels and the broader landscape context through long-term, sustainable, forest management practices.
- To provide a laboratory for learning and research for students and faculty at Michigan Technological University.
- To demonstrate silvicultural and forest practices that balance ecological, social, and economic values.
- To demonstrate application of climate adaptation best practices in partnership with the Northern Institute of Applied Climate Science.

Objectives

- Enhance the diversity of species and age classes in primary forest types and incorporate Structural Complexity Enhancement (SCE) into silvicultural practices and forest management.
- Generate regular net income from management.
- Consider risks and opportunities from climate change within each parcel and develop management actions to address priority risks.
- Meet the requirements of Michigan's Commercial Forest Program and Forest Stewardship Council (FSC) certification.
- Develop plans and begin active management activities by Fall 2017.

Forest Management Principles

An important component of achieving the management goals on this property involves adhering to the following set of management principles when conducting any management activities. The principles are grouped by categories. Specific objectives for the various forest types on the property are presented later in the plan.

Legal Requirements

- Ensure all activities meet or exceed all legal and regulatory requirements.

Protecting soil and water resources

- Ensure that all activities meet or exceed the State of Michigan's Best Management Practices (BMPs).
- Assess potential impacts of all management activities on soil and water resources before conducting those activities.
- Ensure that roads do not degrade water quality of streams and/or wetlands or modify sheet flows of water.
- Utilize the existing road network when possible rather than constructing new roads and close or improve roads that are found to have negative impacts on water resources.
- Improve or maintain existing road stream crossings to meet or exceed BMPs and regional regulations.

Forest characteristics

- Silviculture should mimic the natural disturbance patterns of the landscape (such as those patterns caused by fire, windthrow, drought, and native disease).
- Consider regional landscape goals when prescribing management activities.
- Promote native species composition of forests that are appropriate for the site and that reflect ongoing climate change species transitions, using the best available scientific information.
- Promote levels of standing and down coarse woody debris where appropriate.
- Promote age and structural diversity across the forested landscape where appropriate to represent a range of seral stages.

Protection of wildlife and natural communities

- Consult with Michigan Natural Features Inventory before conducting activity in areas identified as Element occurrences (rare species or exemplary natural communities).
- Assess proposed harvest sites for rare species and other wildlife considerations (vernal pools, cold water streams, raptor nests, etc.) before conducting harvests.
- Minimize negative impacts of harvests on wildlife, understory vegetation, and soils by limiting all harvest activities to frozen ground conditions or periods of dry

weather when soil conditions are suitable for minimizing impacts of harvest operations. In some cases, ground scarification may be prescribed to enhance seedling establishment.

Research

- Partner with academic institutions and other public and private forest land managers to incorporate practical, forest management-related research questions into harvests and management activities on the property.

Property management

- Identify all property boundaries before beginning any management activity and consult with the adjacent landowner if a discrepancy is discovered or no existing survey evidence is present.
- Maintain a system of documentation to track all management activities on the property.
- Support local economy directly by hiring local loggers, and indirectly by allowing access for hiking, bird watching, fishing, and hunting.
- Encourage use of the property for experimenting with forest ecology research.
- Be a responsible landowner in the community by developing good working relationships with adjacent landowners, recreational enthusiasts, and community organizations.

Compliance with Michigan's Commercial Forest Program

This management plan has been prepared to satisfy the requirements of Michigan's Commercial Forest Program. Under the Commercial Forest Program, all landowners are required to:

- Manage the property for commercial timber production.
- Have a written forest management plan.
- Certify that the forest management plan is in effect.
- Allow public access (foot only) for hunting and fishing.

The law prohibits other activities on the land such as agriculture, grazing, and industrial, residential, resort, or commercial activities.

Landowner permission to hunt or fish is not required. Although commercial forest landowners must allow access for the purposes of hunting and fishing, landowners retain private property rights. Access to commercial forest land by motor vehicle, or for activities other than hunting and fishing, is at the discretion of the landowner.

In addition to the above requirements, the Guild will be responsible for adhering to the following procedures pertaining to the management of this property:

1. **Cutting notification.** Prior to any timber harvest, the form “Notification Prior to Cutting, Harvesting, or Removal of Forest Products from Commercial Forest Land” will be submitted to the Department of Natural Resources (DNR). The completed form should be accompanied by a detailed map that a DNR forester can use to visit and evaluate the site. This form should be submitted well in advance of the proposed harvest.
2. **Sand/Gravel extraction.** If sand or gravel is to be extracted from the property, the form “Application to Remove Sand and/or Gravel from Commercial Forest Land” will be submitted to the DNR. No sand or gravel pit may exceed 5 acres in size.
3. **Management plan updates/revisions.** The current plan covers a 10-year period. At the end of this period an updated management plan will be submitted to the DNR. If any changes are proposed for the management of the property before the end of this 10-year period, an amendment to the current plan will be submitted to the DNR.
4. **Sale/transfer of land.** If any portion of this property is sold or transferred to a new owner, the form “Notification of Ownership Change” will be submitted to the DNR within 30 days of the transfer of title.

Compliance with Forest Stewardship Council Certification

This management plan has been prepared to satisfy the requirements of third-party certification as specified by the Forest Stewardship Council (FSC). To achieve FSC Forest Management certification, the Guild must contract with an FSC-accredited Certification Body or join a Forest Management Group Certificate. In either case, the forest is audited to FSC's Forest Management standards. The Guild has chosen to become part of The Nature Conservancy's Group Certificate.

In the United States, the FSC US Forest Management Standard (v1.0) was formally recommended by the FSC-US Board on May 25, 2010 and approved by FSC International on July 8, 2010. This National Standard pertains to forest management in the continental 48 states of the United States (FSC U.S.).

To maintain FSC Forest Management certification, a landowner must demonstrate a commitment to the ten principles and 57 Criteria that apply to FSC-certified forests around the world. A description of the ten principles follows, and a full version of the FSC U.S. Forest Management Standard v1.0 can be found at: <https://us.fsc.org/download-box.189.htm>.

PRINCIPLE #1: Compliance with Laws and FSC Principles - Forest management shall respect all applicable laws of the country in which they occur, and international treaties and agreements to which the country is a signatory, and comply with all FSC Principles and Criteria.

PRINCIPLE #2: Tenure and Use Rights and Responsibilities - Long-term tenure and use rights to the land and forest resources shall be clearly defined, documented and legally established.

PRINCIPLE #3: Indigenous Peoples' Rights - The legal and customary rights of indigenous peoples to own, use and manage their lands, territories, and resources shall be recognized and respected.

PRINCIPLE #4: Community Relations and Worker's Rights - Forest management operations shall maintain or enhance the long-term social and economic well-being of forest workers and local communities.

PRINCIPLE #5: Benefits from the Forest - Forest management operations shall encourage the efficient use of the forest's multiple products and services to ensure economic viability and a wide-range of environmental and social benefits.

PRINCIPLE #6: Environmental Impact - Forest management shall conserve biological diversity and its associated values, water resources, soils, and unique and fragile ecosystems and landscapes, and, by so doing, maintain the ecological functions and the integrity of the forest.

PRINCIPLE #7: Management Plan - A management plan — appropriate to the scale and intensity of the operations — shall be written, implemented, and kept up to date. The long-term objectives of management, and the means of achieving them, shall be clearly stated.

PRINCIPLE #8: Monitoring and Assessment - Monitoring shall be conducted — appropriate to the scale and intensity of forest management — to assess the condition of the forest, yields of forest products, chain of custody, management activities and their social and environmental impacts.

PRINCIPLE # 9: Maintenance of High Conservation Value Forests - Management activities in high conservation value forests shall maintain or enhance the attributes which define such forests. Decisions regarding high conservation value forests shall always be considered in the context of a precautionary approach.

PRINCIPLE # 10: Plantations - Plantations shall be planned and managed in accordance with Principles and Criteria 1-9, and Principle 10 and its Criteria. While plantations can provide an array of social and economic benefits and can contribute to satisfying the world's needs for forest products, they should complement the management of, reduce pressures on, and promote the restoration and conservation of natural forests.

Compliance with Forest Stewards Guild Principals

This management plan has been developed in the spirit of, and guided by, the principals of the Forest Stewards Guild. The Guild envisions the establishment of forestry that is ecologically, economically, and socially responsible as the standard for professional forest management, from coast to coast. More specifically the principals of the Guild are as follows:

1. The well-being of human society is dependent on responsible forest management that places the highest priority on the maintenance and enhancement of the entire forest ecosystem.
2. The natural forest provides a model for sustainable resource management; therefore, responsible forest management imitates nature's dynamic processes and minimizes impacts when harvesting trees and other products.
3. The forest has value in its own right, independent of human intentions and needs.
4. Human knowledge of forest ecosystems is limited. Responsible management that sustains the forest requires a humble approach and continuous learning.
5. The practice of forestry must be grounded in field observation and experience as well as in the biological sciences. This practical knowledge should be developed and shared with both traditional and non-traditional educational institutions and programs.
6. Our first duty is to forests and their future. When confronted with circumstances that threaten the integrity of the forest and conflict with the Mission and Principles of the Forest Stewards Guild, members must respond through education, advocacy, or where necessary, disassociation. Guild membership signifies a commitment to the highest forest stewardship ethic.

General Property Description

Location

The property described in this stewardship plan is composed of seven parcels totaling 410 acres (398 currently forested). These parcels are scattered throughout Houghton County in the Stanton, Hancock, Torch Lake, Portage, Elm River, and Laird townships (Figure 1). The majority of the forested area is northern hardwoods, with some smaller stands of aspen, oak, and mixed conifer on a few of the parcels. Refer to page 2 for complete legal descriptions. All parcels are in the Commercial Forest program.

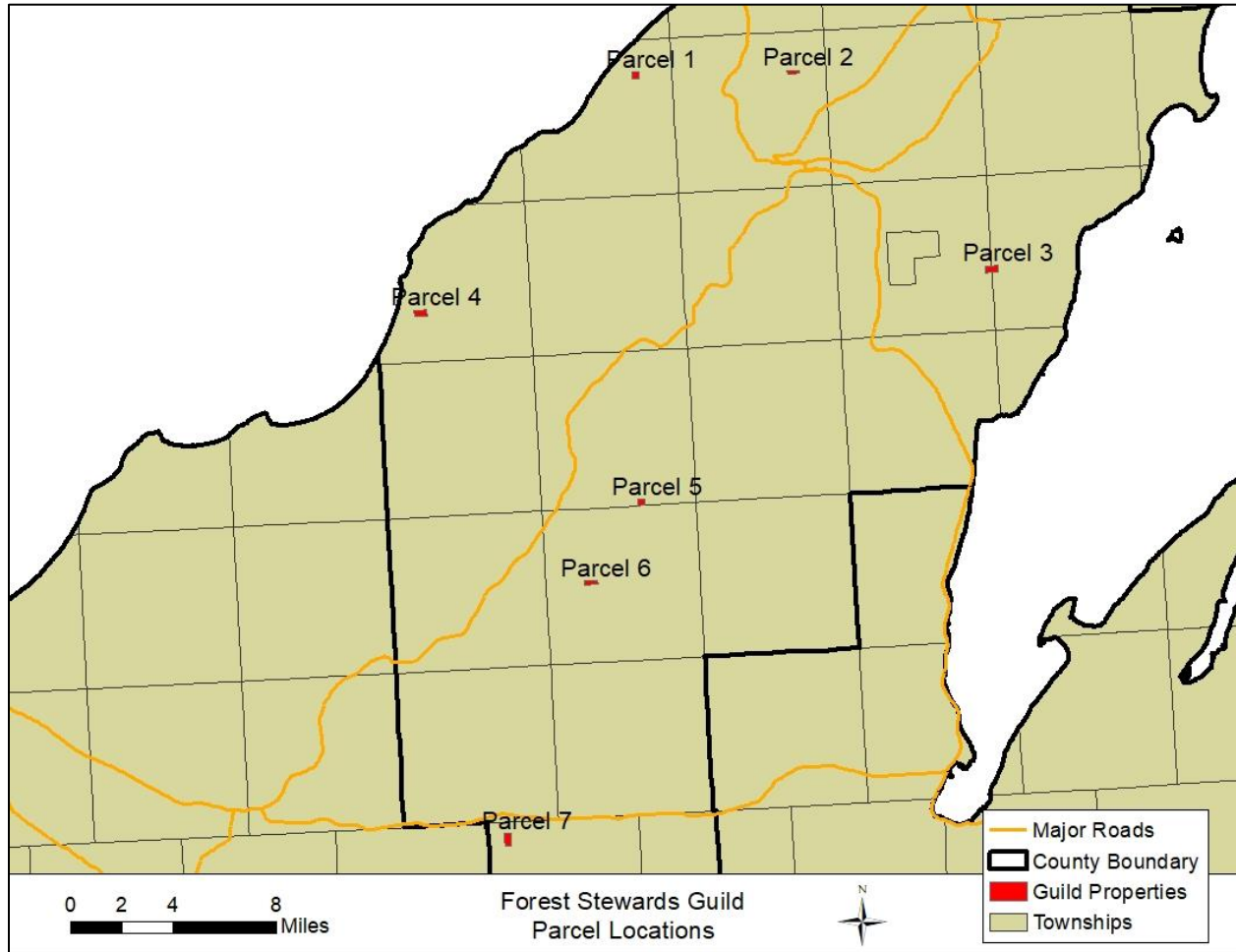


Figure 1. Distribution of Forest Stewards Guild parcels in Houghton County, Michigan.

Land Ownership History

The Forest Stewards Guild acquired these parcels in 2016 from Forests for the Future (EIN 383090845) of Harbor Springs, MI upon the dissolution of this charitable organization. The ownership and land management history of these properties prior to their acquisition from Forests for the Future is unknown. The properties were likely to have first been heavily logged, along with much of the region, in the late-1800s, with intermittent harvests thereafter. At least one of these parcels was then fenced and experienced some degree of grazing history. Some of these properties may also contain legacies from the region's copper mining boom.

Forests for the Future

Forests for the Future (FFF), and the forestland accumulated and protected by FFF, were the dream and life's work of Fred A. Prince, Jr. The love Mr. Prince had for trees and the natural world, combined with his business prowess, allowed him to begin to accumulate parcels of forestland in the 1950s. Most the tracts he collected were in Michigan's UP and the northern third of the Lower Peninsula. The parcels ranged in size from 40 to 160 acres, and most of them were forested with northern hardwoods.

He accumulated these holdings either by purchasing tax-forfeited properties or by direct purchase (often from the State of Michigan). All were then enrolled under Michigan's Commercial Forest Act. During this time, Mr. Prince also studied forest management techniques, especially the techniques researched and promulgated by the U.S. Forest Service.

The primary purpose of FFF was to preserve the parcels as a healthy, productive forest, demonstrating to other owners of small tracts that forestland can be managed sustainably and does not have to be fragmented or developed. A secondary purpose was to promote sound and sustainable silvicultural practices that can be utilized by small landowners. More specifically, the Articles of Incorporation of FFF state it is organized for charitable, educational, and scientific purposes, to include the following:

1. To promote and operate a system of forest management using various accepted management practices, primarily single-tree selection and timber stand improvement to improve overall forest health and productivity.
2. To maintain demonstration and research forests and to provide educational, scientific, and management information to private forest owners and the forest industry as to the benefits of this silvicultural system.
3. To preserve the natural setting and appearance of hardwood forests while maintaining their aesthetic, recreational, and wildlife values; thereby, demonstrating the concept of forests in balance with the growing need for high-quality forest products.
4. To own, maintain, and manage parcels of forest property and to accomplish the above purposes and goals of the corporation.
5. To make distributions to organizations that qualify as EXEMPT under section 501(c)(3) of the Internal Revenue Code, or the corresponding section of any future federal tax code.

Socio-Economic Setting

The parcels identified in this plan consist of vacant timberland in Houghton County. Houghton County is in the Upper Peninsula of Michigan along Lake Superior and is dominated by dense forests and numerous lakes and waterways. Logging and forest-related products are the primary industries in the region, and a large percentage of people work in the region's forests. Many communities rely on jobs in pulp mills, sawmills, and veneer mills, in addition to the generations of families that have made their livelihoods logging.

Since the mid-twentieth century, recreation and tourism have also had a major economic influence. The seemingly endless forests, shorelines, and rivers provide visitors with a sense of solitude and relaxation in the region. The spring brings fisherman to the region's streams and lakes for trout, walleye, and other cold-water fish. The summer draws campers, hikers, and paddlers to enjoy cooler temperatures provided by the moderating effects of Lake Superior. The forests and lakes supply excellent hunting in the fall. Given the large percentage of public and commercial

forestlands, hunting has grown into a large industry. The Great Lakes also affect the winter weather with a seasonal snowfall of up to 300 inches attracting snowmobilers and skiers.

The major cities in this region are all situated on the shores of Lake Superior. Marquette and Houghton depend on easy access to the Great Lakes for shipment of natural resources extracted from the region. Today, these cities have grown into contemporary centers for health, education, banking, and shopping. Marquette and Houghton have state universities and provide post-secondary education to some 20,000 students, collectively. Marquette is home to Marquette General Hospital, which provides the region's only Level II trauma center.

The transportation infrastructure in the region is dependent on U.S. Highways 41, 45, and 141, and Michigan State Highways M-26, M-28, and M-38. Virtually all of the U.S. and state highways in the region are two-lane roads with infrequent passing lanes. There are considerable opportunities for shipping goods via railway in the region, and most cities have railway access. Houghton and Marquette are centers for shipping on Lake Superior, and all have taconite shipping facilities, as well as those for grain and other minerals.

Soils

There are 24 different soil map units represented on the Guild's Michigan properties. Details on the soils can be found in the individual parcel descriptions. Each parcel description will highlight what soils can be found on each tract, along with a unique numerical code. Using the unique soil identification number, detailed reports such as the hazard for off-trail erosion, windthrow hazard, suitability for use of harvesting equipment, suitability for log landings, and suitability for haul roads can be found at <https://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx>.

One of the most important factors regarding soils in relation to forest management is drainage characteristics and the ability to support overall forest management activities. Suitability for haul roads captures most of the characteristics of concern in forest operations. The primary soil characteristics affecting the suitability of an area for construction of haul roads are slope, surface rock fragments, soil stickiness, sandiness, strength, depth to a restrictive feature, frequency of ponding, and depth to a water table.

The ratings are both verbal and numerical. A rating of "well suited" (rating index = 0) indicates few or no restrictions affecting forest management activities. A rating of "moderately suited" (rating index > 0 and < 1.0) indicates one or more restrictions may cause some difficulty in construction of haul roads and subsequent forest operations. A rating of "poorly suited" (rating index = 1.0) indicates one or more limitations make the construction of haul roads and forest operations environmentally questionable and very difficult, or costly.

Haul road soil suitability has a close correlation to both landforms and dominant forest types across the ownership. Stable, well-suited soil types are generally associated with the northern hardwood stands found on the properties while poorly drained organic soils are generally associated with the lowland conifer stands.

Due to the limitations of the poorly drained soils, any harvesting activity in or near wetland soils will be limited to frozen ground conditions. To meet the objectives of protecting sensitive soils and maintaining the natural hydrology of wetlands across the Guild properties, prior to harvesting there must be a careful evaluation of the potential impacts of winter activities on each site. To protect both soils and aquatic resources, no-harvest zones adjacent to streams and wetlands will be established prior to harvests, within which there will be no harvesting or equipment operation that might result in the exposure of bare mineral soil. To minimize soil compaction during harvesting operations in the upland hardwood forests, landings will be carefully located along existing roads or clearings and new road construction will be avoided.

Property Management

Green Timber Consulting Foresters, Inc. (www.greentimberforestry.com/#) of Pelkie, MI leads the management of the Guild's Houghton County properties. This consulting firm works closely with Forest Stewards Guild staff and contractors to implement the vision of the forest management plan.

Existing Infrastructure

Structures

There is no evidence that structures ever existed on any of these parcels. The Guild has no intention to develop structures on the property through the duration of this plan.

Roads

All the parcels that comprise this property have some degree of road access. Although direct access from public roads is available to several of the parcels, others will require access through privately owned land. For these properties, Green Timber Consulting Foresters, Inc. will obtain a road use agreement during pre-harvest planning. The access road network includes publicly maintained county and township roads as well as private forest roads and a variety of smaller two-track and skid trails. The road system for each parcel is shown on the detailed property maps later in this plan. In cases where private landowners access their property on private roads through Forest Stewards Guild land, the Guild requires a road use agreement.

Leases

None of these properties have any active leases and the Guild does not plan to grant any for the duration of this plan.

Mineral Rights, Sand, and Gravel Pits

It is unknown who owns the deep ore mineral rights on the Guild's parcels, but it is very likely they are owned by a third party. It is also likely the reserved rights to gas and oil

are also owned by a third party. This is the usual case in Michigan's Upper Peninsula, and forest management operations are rarely hampered by this situation. All other "surface" minerals such as sand, gravel, and stone are owned by the Guild and may be developed and used as regulated by the Commercial Forest Program.

With respect to sand and gravel operations, the Guild is not actively extracting any sand or gravel from the property. There may be small, abandoned borrow pits adjacent to roadways that were used by the previous owners.

Public Use of the Property

The Forest Stewards Guild desires that the public be able to access and enjoy this property for any low-impact activity, so hunting, fishing, hiking, birdwatching, and general nature study on the property are welcome. Camping and the use of motorized vehicles are not allowed on the property. Hunting blinds and tree stands are allowed only if they are entirely portable, do not damage trees or vegetation, and shall be removed within 7 days of the close of each season. Cutting of trees, limbs or brush to improve visibility around blinds is prohibited. Stands or blinds found on the property after hunting seasons have closed will be removed.

Non-Timber Forest Products

Currently the only known non-timber forest products being harvested from the property are occasional fish and game which are lawfully harvested by private individuals during the state and tribal-regulated hunting and fishing seasons. There are other potential non-timber forest products on the property such as wild berries, mushrooms, and sugar maple trees capable of providing sap for maple syrup. However, the Guild has no intention to harvest any non-timber forest products from the property unless there is interest in demonstrating silvicultural methods that are suitable for promoting such products. If the opportunity arises for the harvest of non-timber products, the impacts on the ecosystem would be carefully assessed and an amendment to this management plan would be written before beginning any harvest.

Cultural Site and Artifact Considerations

There are no known sites of special cultural significance on the property. If the Forest Stewards Guild or contracted land managers discover any archeological sites on the property, they will contact the local tribe as well as the Office of the State Archeologist before proceeding with management activities in the immediate area.

American Indian Considerations

There is one federally acknowledged tribal government, the Keweenaw Bay Indian Community, near the property. At the time of writing this plan, formal contact has been initiated with the tribe via letter (Exhibit 2). It is the intention of the Guild to share the final and accepted management plan with the tribe for comment.

Relevant Laws

In 2007, the State of Michigan and five Michigan Indian Tribes (including the Keweenaw Bay Indian Community) signed the 2007 Inland Consent Decree (Michigan Department of Natural Resources, 2009). This agreement affects the vast majority of the property which is enrolled in the Commercial Forest Program. The agreement allows tribal use of Commercial Forest lands for hunting and fishing for personal consumption, outside of the standard seasons and regulations of the Michigan DNR. The Guild recognizes and respects the rights this agreement provides to the tribal members and will not interfere with their ability to exercise those rights on this property. As of 2018, there is very little evidence of tribal use any time of year on the Guild land.

The Native American Graves Protection and Repatriation Act (NAGPRA) is a Federal law passed in 1990. NAGPRA requires that the Guild report any burial sites that are found on the property to the local tribal contacts.

Contact information:

Keweenaw Bay Indian Community, Natural Resources Department, 14359 Pequaming Road, L'Anse, MI 49946, Phone: (906) 524-5757

Public Input

As a small land owner in the region the Guild has no formal public input mechanism but is listed in the publicly available parcel data and has a public website. Any comments submitted to the Guild through its website or other mechanisms will be considered ahead of any action on the properties.

Water Quality and Aquatic Habitat

Protection of water quality and aquatic habitat across the parcels is a priority for all management activities. There are a number of water bodies and aquatic habitats within and near the parcels. A primary management consideration is to protect these ecosystems – in all cases – as well as opportunities for enhancement of ecological values associated with these systems.

There is evidence that even careful selection harvesting in northern hardwood forests may impact adjacent aquatic stream habitats and their invertebrate populations (Huckins & Burgess, 2004). Special attention will be given to this issue when designing harvest plans. At a minimum, Michigan BMPs (MI DNR and DEQ 2009) will be strictly adhered to throughout all management activities. However, in most cases BMPs will be exceeded by establishing timber sale boundaries that end at least 100 feet from streams with a defined stream bed and bank, and other waterbodies such as ponds and lakes. This protocol will provide maximum protection to the stream channel and waterbody as no harvesting or equipment will be permitted outside of the sale boundary. In effect, this practice creates a minimum 100-foot no-cut and no-equipment Management Zone around all such streams and waterbodies. Other features, such as intermittent streams with no defined bed and bank, vernal pools, and other ephemeral wetlands, may be

included within a sale boundary. However, they will be buffered with a minimum 100-foot no-cut and no-equipment management zone. Limited activity within the 100-ft buffer zones is acceptable where there is little chance of significant soil disturbance, no chance of water sedimentation, and only select trees are being removed.

To help determine whether the no-harvest management zone should extend beyond the 100-foot minimum, a property-wide riparian management zone will be established within 300 feet of any waterbody or wetland. Within the riparian management zone, further consideration and determination of appropriate management activities must occur. Attributes such as soil composition, slope, and aspect will be conducted. A tool that will guide this assessment is the most recent Michigan BMP document with its guidance for determining site-specific riparian management zone minimum widths. To minimize potential of sedimentation and damage to soils, no harvesting operations will take place on slopes greater than 30%, regardless of the slope's proximity to a water feature.

Threatened and Endangered Species

The conservation of the biological diversity is central to the organizational mission of the Guild. All management activities on the property will be carefully evaluated to determine the potential impacts on biodiversity, rare species, and natural communities.

A search of the Michigan Natural Features Inventory (MNFI) was conducted by Gary Willis of the Michigan DNR in April of 2017. According to the MNFI there are no known threatened or endangered species present on any of the parcels. However, a potential northern goshawk (*Accipiter gentilis*) and nest were observed by Russel Lipe in Parcel 7 during a field inspection of the property. More information on goshawks can be found below.

If any threatened or endangered species are identified on the property, forest management will be adjusted to ensure that the habitat of such species is conserved. The changes to forest management will depend upon the species identified, the degree to which they make use of the property, and the species' habitat needs. Professional botanists and wildlife biologists may be consulted to perform surveys for the presence of such species; however, this work is beyond the scope of a forest management plan. More information about the MNFI is available online at [www.http://mnfi.anr.msu.edu/](http://mnfi.anr.msu.edu/)

Douglas Hawthorn

Although not known to be on the property, Douglas hawthorn, *Crataegus douglasii*, has been reported in sections to the south of Parcel 2. This small treelike shrub is most abundant in western North America but small disjunct populations are also found in the Great Lakes region along forest borders and in open areas such as forest clearings, shores, and rocky outcroppings. In Michigan, the shrub has been listed as a Special Concern species and is best represented in the Keweenaw Peninsula. If this species is ever observed on the property, it will be documented and steps should be taken for the species protection and conservation.

Northern Long Eared Bat

The northern long-eared bat (NLEB), *Myotis septentrionalis* is one of several Michigan bats whose populations are at great risk from a fungus called *Pseudogymnoascus destructans* that causes a condition known as "white nose syndrome" where fungal mats grow on the bats as they hibernate. Bats often wake from hibernation to scratch the fungus off, consuming their energy stores. Many of these bats ultimately either starve or freeze when they attempt to go outside in search of additional food. Incredible numbers of bats have died throughout eastern North America from this fungus as the moist conditions of caves and underground mines where bats overwinter coupled with their dense crowding create the ideal environment for disease transmission.

In an effort to protect bats, the Fish and Wildlife Service set forth a set of rules that pertain to activities in close proximity to bat habitat. These rules focus on protecting bats during their breeding season in order to maximize the likelihood that the bats that do reproduce are able to successfully raise offspring. Although forest management typically has little to no direct negative impact on bats, any activity that may damage the entrance to mines or degrade maternal roosting habitat is thought to be detrimental to bats. The following rules are in place governing forest management near known bat occurrences:

- Rule 1: Activity occurs more than 0.25 miles from a known, occupied hibernaculum.
- Rule 2: Activity avoids cutting or destroying known, occupied roost trees during the pup season (June 1–July 31).
- Rule 3: Activity avoids clearcuts (and similar harvest methods, e.g. seed tree, shelterwood and coppice) within 0.25 miles of known, occupied roost trees during the pup season (June 1–July 31).

Parcel 2 is in the heart of a former copper mining area and there are several old mine entrances located within a mile or less the property. Parcels 5 and 6 are in remote areas where there may also have been some mining or mineral exploration. The most recent data on roost tree and hibernaculum locations should be referenced before any forestry activities are undertaken.

Northern Goshawk

The northern goshawk is a species of Special Concern in the State of Michigan. Goshawks are most sensitive to disturbance between egg-lay in late-March and the end of August when the young can hunt for themselves. Additionally, goshawks typically return to the same nest year after year, so if identified, it is important to maintain the nest tree and those trees around it to protect this habitat. Timber harvesting should be avoided in close proximity to the nest tree, and no harvesting should occur near the tree during the nesting period. If any timber is to be harvested near the nest, a no-harvest zone should be installed extending approximately one tree-length from the nest tree. For instance, if the trees average 90 feet in height, the no-harvest zone should extend 90 feet from the nest tree.

Wildlife Habitat

In addition to the Element Occurrences of rare species on the property, habitat needs of more common wildlife species will be considered during specific harvest operations. Prior to harvest, existing locations of habitat features such as vernal pools, large snags, cavity trees, and raptor nests will be documented. These locations will be incorporated into the site planning.

Buffer areas will be identified around vernal pools and raptor nests. At a minimum, the existing management guideline for species such as Bald Eagle, Red-shouldered Hawk and Northern Goshawk will be followed. Potential cavity trees and large mast-producing trees will be retained. One goal of harvest activities will be to increase the abundance of many habitat features associated with late successional forests, including snags, coarse woody debris, and cavity trees.

The Guild parcels likely support a wide variety of migratory birds, many of which breed and raise young in spring and early summer. Limiting harvests to dry late summer months (late July – September) or frozen-ground winter months will prevent direct negative impacts on the reproductive success of these birds. Encouraging development of structurally diverse forest characteristics should also benefit some migratory bird species including declining bird species identified in the Partners in Flight Bird Conservation Plan.

Natural Disturbance and Past Conditions

A primary management goal on these properties is to promote biodiversity by encouraging the development of forest characteristics that are appropriate for, and/or under-represented on, the landscape. While we tend to look to the past when considering restoration and conservation goals, it will also be important to consider the latest thinking on climate vulnerability and risk and the impacts of non-native invasive species.

Natural Disturbance

Prior to large-scale harvesting of the forests in this region in the late 1800s, the primary sources of natural disturbance were windthrow, fire, insect damage, and beaver activity. Fire and insect infestations were probably more common on the drier pine sites while small patches of windthrow were likely common within the hardwood, mixed hardwood conifer, and lowland conifer forests (Price, 1994).

These disturbance regimes have a shaping effect on the landscape's successional pathways and the distribution of successional classes. In general, for the ecological systems that experienced frequent, natural, stand-altering disturbances, such as jack pine forests, there would have been a greater proportion of early-stage successional classes. Conversely, in ecological systems with relatively rare stand-altering disturbances, late successional classes would have been more prevalent. For example, it is estimated that roughly 80% of pre-settlement northern hardwood/hemlock forests would have been in a late successional class (LANDFIRE, 2005).

Past Conditions

Our understanding of historical forests suggests that forests in the region today differ significantly from forests prior to the late-1800s when widespread timber harvesting began. Based on an analysis of Government Land Office line tree data, and based on Government Land Office vegetation maps, there do not appear to be dramatic patterns of forest conversion on the property from one forest type to another over the past 150 years. Rather, the changes appear to be related to the structural and compositional diversity of the forests.

Climate Change Stressors

The Earth's climate has changed over the past century, and these changes are expected to continue. The following section is a quick summary of observed and projected climate change and impacts to forests (Janowiak et al. 2014; more information at www.forestadaptation.org). Specifically, in northern Wisconsin and western Upper Michigan, some of the changes that have already been observed include:

- Annual temperature has increased by 1.4 °F over the past century
- Winter temperatures have increased by more than 2 °F over the past century
- Annual precipitation has increased by more than 2 inches, particularly in the spring and fall.
- Heavy rainfall events (3+ or more inches) have become much more frequent
- Lake ice break-up, leaf-out, and bird migration dates are shifting earlier into the spring
- Fall killing frosts are occurring later.

Climate change is projected to continue, although there will always be uncertainty in long-term projections. The best available science supports the idea that temperatures will increase across all seasons in northern Wisconsin and western Upper Michigan over the next century. Projected change is on the order of 2 to 9 °F by the end of the century, with winters likely to continue warming faster than other seasons. Precipitation is projected to increase up to 1 inch during winter and about 1 to 3 inches in spring by the year 2100. The greatest uncertainty exists for summer precipitation, with slight increases or large decreases possible. There may be greater moisture stress in summer and fall, because higher temperatures will lead to greater water loss from evaporation and transpiration.

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 insect pests and diseases. Generally, boreal tree species are expected to decline, and temperate or southern species are expected to be favored; see species tables found at <http://tinyurl.com/SpeciesClimateModel>. 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.

Confronting the challenge of climate change presents opportunities for forest managers and landowners to plan ahead, assess risk, and ensure that the benefits forests provide are sustained into the future. Landowners will naturally have different risk tolerance, and different management opportunities and constraints for how they might respond to climate change risk. These factors will help determine the most appropriate actions to prepare for climate change. Different adaptation actions can be used to resist change, boost resilience, or actively encourage change. Choosing a range of actions may be appropriate for many landowners, depending on their values and site-specific risks or opportunities.

A few models have been developed that predict the change in suitable habitat for certain species in response to climate change ([http://tinyurl.com/SpeciesClimate Model](http://tinyurl.com/SpeciesClimateModel)). Species found on Forest Stewards Guild properties that are generally predicted to benefit from climate change (or experience neutral effects) are: basswood, ironwood, black cherry, eastern hemlock, red oak, and white ash. Other factors, such as invasive species, may prevent species from responding well. For example, emerald ash borer killing many ash trees on the landscape or hemlock woolly adelgid killing hemlocks. Some species present that are predicted to decline due to climate change are: balsam fir, aspen, sugar maple, black and white spruce, white pine, paper birch, and yellow birch. Maintaining species diversity is one of the best ways to mitigate the effects of climate change, so a forested area doesn't become completely unsuitable for all of the species present.

Soils that are sandy and well-drained don't hold much water and put the parcel at greater risk of drought. Decreasing the overall stocking can reduce the amount of water needed to support the vegetation growing there, better adapting the site to potential climate change effects.

Invasive Species, Forest Pests, and Pathogens

Several non-native invasive species pose a significant threat to forests in the Upper Peninsula of Michigan. The robust tourism industry and regional/national importance of the timber products industry makes the transport and establishment of non-native populations both more likely and difficult to control.

Harvesting activities and ATV use present the largest risk of spreading invasive plant species into the forest. Dense populations of high-risk species, such as garlic mustard, invasive honeysuckle, or glossy buckthorn, can prevent natural regeneration of native forest tree, shrub, and herbaceous species. To date, none of these highest-risk species been found on the CRs. To reduce the occurrence of non-native invasive plant species, the annual monitoring visits will include inspection for the presence of terrestrial and aquatic invasive plants in high-risk areas, including recent harvest sites and sites with recent road work. Special attention will be given to "A List" and "B List" species for the appropriate ecoregion designated in Meeting the Challenge of Invasive Plants published by the Michigan DNR. (www.michigan.gov/documents/dnr/Invasives_strategy_final_289799_7.pdf) or a similar update.

In the event any seeding is required to stabilize slopes or roadways, timber sale contracts will specify that only weed-free mixes of non-invasive species will be used and that contractors adhere to the guidance on seeding in the “BMP’s Sustainable Soil and Water Quality Practices on Forest Land (www.michigan.gov/documents/dnr/IC4011_SustainableSoilAndWaterQualityPracticesOnForestLand_268417_7.pdf) published by the Michigan DNR.

There are not currently any significant forest pest or disease outbreaks on this property. Below are a few of the species that pose a threat to the most common forest types found on the property. In general, these forests will be managed to maintain healthy and diverse forests that should make these forests as resilient as possible if these threats arrive. Monitoring of at-risk species will be done periodically to watch for signs of decline. If an outbreak of any of these species is detected it must be reported to the Pest Response Program Specialist with the Michigan Department of Agriculture Rural Development at 1-800- 292-3939.

Asian long-horned beetle

The Asian long-horned beetle (ALB) is an invasive insect that targets hardwoods, especially maples. Adults lay eggs beneath the bark, and when the larvae hatch, they feed on the living tissue inside. This can eventually prevent the host tree from moving nutrients and water, causing it to die. When the larvae mature into adults, they emerge from the tree, leaving a hole the width of a pencil. This pest is currently not found in Michigan, but is in neighboring Ontario and Ohio. Trees should be monitored for unusual decline, especially if ALB is found in the state at some point. <https://tinyurl.com/ALB-APHIS>

Emerald ash borer

The emerald ash borer (EAB) is another invasive insect from Asia and currently infests trees in Michigan. As its name suggests, it targets ash trees. EAB’s life cycle is similar to ALB. An adult lays eggs on the bark, the larvae hatch and burrow into the tree to feed on living tissue, then they mature and exit through a D-shaped hole. None of the ash on the property appeared to be infested, but EAB is present in the area, and those trees should be monitored for signs of decline. www.emeraldashborer.info/

Eutypella canker

This canker is the result of a fungal infection that affects maple trees. It manifests itself as a large callus of necrotic tissue surrounded by wood healing around it. The canker negatively affects the overall health of the tree, and also drastically decreases the value of the most valuable logs. Infected trees should be removed from the forest or at a minimum, be cut and placed canker down. <https://tinyurl.com/eutypellaUMN>

Hemlock woolly adelgid

Hemlock woolly adelgid (HWA) is another invasive insect from Asia. In the US, it targets primarily eastern hemlock, western hemlock is more resistant. HWA is a very small insect that feeds on the base of hemlock needles. As the insects feed, they produce a white fluff that provides protection. This is one of the best ways to locate an infestation. HWA can kill these important wildlife trees of any size. Hemlocks are generally long-

lived and large in size, adding structure to the forest and providing key winter habitat for species like deer. <https://tinyurl.com/HWA-USDA>

Oak wilt

Oak wilt is a fungus that infects and can kill all oak trees, but red oaks are especially susceptible. It is spread by beetles that bore into the trees to feed on sap and bark, as well as through root grafts of close trees. Spores of the fungus can also be carried by the wind and infect trees through wounds from pruning, careless logging practices and wind damage. To prevent the spread of the disease, care should be taken to avoid wounding oaks in any way between April 15 and July 15. This includes holding off on harvesting and pruning. <https://tinyurl.com/OakWiltMSU>

Sugar maple borer

The sugar maple borer is a native beetle that targets only sugar maple. It doesn't usually kill the trees itself, but it can partially girdle the trunk and kill branches, decreasing the crown size and overall fitness of the tree. The biggest concern is usually the value of the wood, since the more valuable bottom log is generally the one impacted. Maintaining high vigor trees is the best way to minimize damage from this insect. <https://tinyurl.com/SugarMapleBorerUSDA>

Herbicides and Bio-control agents

Widespread application of herbicides or bio-control agents, such as post-harvest treatment or pest control, is not desired by the Guild. The local use of herbicides or bio-control agents to control non-native plant species may be considered on a case by case basis if the non-native species poses a significant threat to the conservation values of the property and no other feasible method of control is available. Use of herbicides or bio-control agents will only be considered if they can be applied with minimal negative impacts on native flora and fauna and aquatic habitats. Prior to any herbicide or bio-control application, the designated property manager will notify the Guild to ensure the use conforms with the Guild's policies and FSC requirements.

Fire Management

Wildfire is a natural form of disturbance in the landscape of the Upper Peninsula. Although not common in hardwood dominated forests found on the Guild parcels, wildfires do occur in upland fir/spruce forests as well as in peatlands and lowland conifers during periods of drought. As a natural part of the ecological processes that shape the landscape, fire is not considered to be a threat to the conservation values of this property. However, given the property interests of neighboring landowners and individuals, as well as the legal mandate of the Michigan DNR to suppress wildfires, the Guild recognizes the reality that wildfires may need to be confined or controlled by the DNR.

High Conservation Value Forests

Guild and TNC staff, with reference to Michigan Natural Features Inventory (MNFI) data, used the Forest Stewardship Council's High Conservation Value Forest Assessment Template (FSC-US HCVF) to conduct an initial assessment to identify and map HCV areas. Using this system, no HCVFs were identified on the property. This initial assessment is in no way to be considered final. As the Guild and the land manager continue routine assessment and monitoring of the property, further reviews of Natural Heritage program data, and input is received from regional experts, the HCVF assessment may change. More information on HCVF can be found here: <https://us.fsc.org/preview.fsc-us-hcvf-assessment-framework.a-190.pdf> A summary of the assessment criteria used on the Guild parcels is presented below.

Description and Approach of HCV Area Identification

The Nature Conservancy's method to define and meet the HCV requirement within the FSC Group Certificate follows the four-phased approach of assessment, consultation, inventory, and monitoring as outlined in the Standard and applied as follows.

In conjunction with Guild staff, and with reference to Michigan Natural Features Inventory (MNFI) data, TNC staff embarked on a process to identify and map HCV areas. The HCV framework includes the following six categories:

HCV 1: Forest areas containing globally, regionally or nationally significant concentrations of biodiversity (e.g., endemism, endangered species, refugia)

1.1 There are no legally protected or managed areas on the properties.

1.2 There are no areas that would be considered concentrations of biodiversity on the properties.

Key resources: MNFI database

Total Acres of HCV 1 Areas: 0

HCV 2: Forest areas containing globally, regionally or nationally significant large landscape level forests, contained within, or containing the management unit, where viable populations of most if not all naturally occurring species exist in natural patterns of distribution and abundance

Essentially all the forests in this area, have been logged or cleared several times. As such, there are no large roadless areas or areas that lack a history of human disturbance.

2.1 No large, roadless areas are known to occur on the property. The property is fragmented by old roads, and almost all of it has been harvested at one point or another.

2.2 There are no large landscape scale forests that are significant at the ecoregional scale.

Key resources: Consultation and Mapping

Total Acres of HCV 2: 0

HCV 3: Forest areas that are in or contain rare, threatened or endangered ecosystems

3.1 No Type 1 or Type 2 old-growth.

3.2 Again, no roadless areas are known to occur on the property due to prior management activities.

3.3 There are no threatened or endangered ecosystems on the property

Total Acres of HCV 3: 0

HCV 4: Forest areas that provide basic services of nature in critical situations (e.g., watershed protection, erosion control)

4.1 These properties are not critical in terms of providing a source of drinking water.

4.2 Same as above.

4.3 There are no significant wetlands or floodplains on the properties.

4.4 While erosion is always a concern, the HCV buffers mentioned above and riparian buffers address those concerns. There are no areas on Guild lands that would be considered critical to prevent erosion, landslides, avalanches, etc.

Total Acres of HCV 4: 0

HCV 5: Forest areas fundamental to meeting basic needs of local communities (e.g., subsistence, health)

5.1 Guild lands would not be considered fundamental to meeting basic needs of local communities.

Total Acres of HCV 5: 0

HCV 6: Forest areas critical to local communities' traditional cultural identity (areas of cultural, ecological, economic or religious significance identified in cooperation with such local communities)

6.1, 6.2 Guild lands would not be considered as fundamental to traditional cultural identity in the area.

Total Acres of HCV 6: 0

Consultation with appropriate experts for the purposes of this assessment

For the purposes of this assessment and more generally, TNC staff regularly consults with biologists from the MNFI and the State Historic Preservation Office, and relevant tribes.

Approach to Managing HCV Areas

N/A

Monitoring HCV Areas

Every 10 years, when the management plan is revisited, there will be a check-in to see if any HCVs have developed during that time.

Nearby HCV Areas

The Guild reviewed the Michigan DNR Western Upper Peninsula Regional State Forest Management Plans to determine if the State had identified any high conservation value areas near the Guild parcels. The only Management Area close to a Guild parcel was the Central Houghton Management Area and the State did not identify any high conservation value areas or ecological reference areas in that management area (Figure 2). The State did identify an area of possible Type 1 or Type 2 Old-growth northwest of Highway 26 but did not provide any further information on this site in their plan.

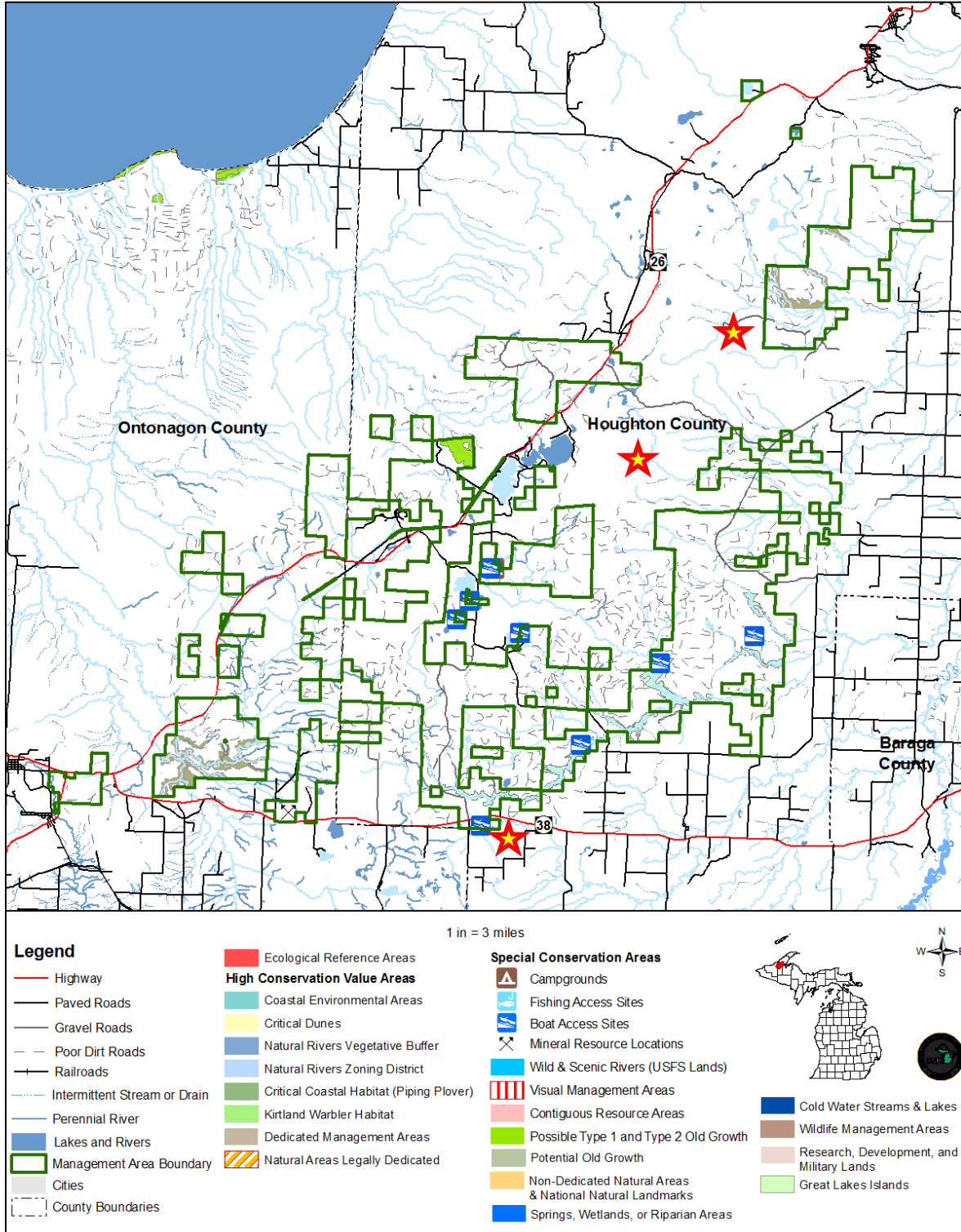


Figure 2. Map of the Central Houghton management area in the Michigan DNR Regional State Forest Management Plan showing the special resource areas in proximity to Guild parcels 5, 6, and 7 (shown with red and yellow stars).

Forest of Recognized Importance

None of the parcels are located within a Forest of Recognized Importance (FORI); however the large white pines in Parcel 3 form a unique feature that provides structural diversity and wildlife habitat. The dense patches of hemlock, like those in Parcel 5, are also very important wintering habitat for deer.

Representative Sample Areas

No Representative Sample Areas (RSA) have been identified at this time. As management continues, a further inventory and identification of potential representative sample areas will take place and a matrix of representative sample areas will be completed.

Forest Resource Inventory

Inventory Data:

During May and June 2017 an inventory was conducted on all the parcels of land covered by this management plan to determine the unique characteristics of each forested stand. These characteristics were then used to develop the forest management recommendations detailed later in this plan. The inventory consisted of measuring a total of 82 variable radius points using a 15 basal area factor prism. The points were laid out on a variable grid determined by parcel size and forested acreage. Tree information that was collected on each point consisted of species, DBH, sawlog height and quality, and pulp height. This information was then used to determine the volume of standing timber and reported on the property level to ensure ample sample size and data reporting accuracy. Parcel level data has been calculated but due to sample size per parcel, parcel volumes are not reported in this plan. However, this parcel level data was used as a guideline for making the forest management recommendations at the parcel level.

Table 1. Forest resource inventory summary (Percent Error at a 90% Confidence Level)

Reporting Category	Mean/Acre Results	Total Property Results			Percent Error
		Lower Limit	Mean	Upper Limit	
Number of Trees	218.8	N/A	N/A	N/A	9.0%
Basal Area (ft ²)	121.5	N/A	N/A	N/A	5.4%
Pulpwood/Boltwood (cords)	23.1	8,547	9,182	9,816	6.9%
Sawtimber/Veneer (Scribner mbf)	3.92	1,356	1,561	1,766	13.2%
Total Tons	831.0	33,177	35,549	37,920	6.7%

Table 2. Forest resources by species across the seven Guild parcels.

Species Composition	Total Pulpwood/ Boltwood (cords)	Total Sawtimber/ Veneer (Scribner mbf)	Total Tons - All Products	Trees Per Acre	Basal Area Per Acre
Hard Maple	2,925	687	13,355	74.2	41.7
Soft Maple	2,913	438	10,034	68.7	37.3
Yellow Birch	936	108	3,573	28.9	12.4
White Birch	25	0	67	1.8	0.4
Basswood	101	62	529	1.5	2.0
Black Ash	127	26	497	1.7	1.1
White Ash	24	30	263	0.7	0.9
Red Oak	374	123	2,360	6.8	5.5
Elm	23	0	67	0.0	0.2
Ironwood	124	0	394	8.8	2.0
Aspen	522	0	1,361	4.6	4.4
Eastern Hemlock	554	0	1,528	5.7	6.2
White Pine	112	88	583	0.9	2.2
Balsam Fir	287	0	672	13.3	3.7
White Spruce	26	0	49	0.4	0.4
Cedar	109	0	216	0.8	1.1
Totals	9,182	1,561		35,548	218.8

Forest Cover Type Summary

Based on the recent inventory work, the property has been delineated into stands based on general forest cover types. The table below presents a summary of cover types across the property. Nearly all the property has some degree of northern hardwood forest mixed with various other forest types.

Management objectives for each of these cover types varies by parcel and is explained in the Parcel Summaries and Silvicultural Recommendations section.

Table 3. Cover type summary based on assessment by Green Timber Consulting Foresters, Inc.

General Cover Type	Parcel							Total Acres	% of Total
	1	2	3	4	5	6	7		
Northern Hardwood - Hemlock				79	34	23	13	149	36%
Northern Hardwood	39	3				27	67	136	33%
Northern Hardwood - Pine			65					65	16%
Oak – Northern Hardwood		14						14	3%
Mixed Lowland Conifers			7		6			13	3%
Northern Hardwood – Oak		9						9	2%
Aspen			8					8	2%
Non-Forested Wetland		6		1				7	2%
Non-Forested Clearing	1	4						5	1%
Lowland Hardwoods		4						4	1%
Total	40	40	80	80	40	50	80	410	

General Silvicultural Treatment Descriptions

This section provides an overview of the silvicultural treatments that are recommended in this plan.

Individual Tree Selection (ITS)

Individual tree selection preserves the variation of age and size classes for uneven-aged management. This is achieved by removing single trees that are dispersed throughout the stand, from all species and merchantable diameters. This treatment mimics small-scale disturbances, like natural mortality and isolated windthrow. 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. If harvesting is done properly, and no severe disturbances occur, this process can be repeated every 15 to 20 years without the need to completely reinitiate the stand.

Trees should be selected for removal based on the characteristics below, in the Order of Removals. The goal is to reduce the average basal area to between 70 and 90 square feet per acre. This allows loggers to maneuver, protects the remaining trees from strong winds, and promotes recruitment into the overstory.

General Order of Removals

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. **Release crop trees** - A crop tree is a tree which is capable of producing a grade 2 or better sawlog, with low chance of decreasing in grade prior to the next harvest. Cut poorer quality competitors to provide crown growing space around 40-60 crop trees per acre in order to promote 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.

Using an order of removals helps to ensure uniform tree selection throughout the stand. This will help the stand continue to grow in a relatively predictable fashion while providing a range of other benefits, including wildlife habitat, water quality preservation and carbon sequestration. In areas where the timber is lower in quality, or where a higher diversity of regeneration is already established, small gaps of one-fourth to one-half acre in size should be created in order to allow sunlight to reach the forest floor and stimulate the growth of species besides sugar maple. In stands managed for oak, gaps should be larger, between one-half acre and one full acre.

Individual Tree Selection (ITS)/Gap Selection

Adding gap selection to an ITS treatment can increase the structural diversity of the stand, horizontally and vertically. The gaps created will allow pockets of trees to grow that are different from the stand around them. The gaps will contain shorter and more closely spaced trees until they mature. Individual tree selection generally only favors the regeneration of shade tolerant species, such as sugar maple. Adding gap selection can help to promote mid-tolerant species regeneration by providing more light to the forest floor. Larger gaps can be used to promote more shade intolerant species. These methods mimic small to mid-scale disturbances common in northern hardwoods forests, like natural mortality, windthrow, and forest pests.

Trees can be selected following the previous Order of Removals as well, but gaps should be focused in certain areas. In areas where the timber is lower in quality or where a higher diversity of regeneration is already established, small gaps of one-fourth to one-half acre in size should be created in order to allow sunlight to reach the forest floor and stimulate the growth of species besides sugar maple. In stands managed for oak, gaps should be larger, between one-half acre and one acre. Mature individuals of mid-tolerant species should be left as seed trees near gaps, as well. To allow for the regeneration of less shade tolerant species, the average residual basal area should be lower than a normal ITS treatment, between 60 and 80 square feet per acre. Tops should be scattered in the gaps to protect regeneration from deer browse.

Clearcut

Clearcutting is an even-aged treatment that favors shade-intolerant species. All pole and saw sized trees in the treatment area are removed, leaving regeneration. Aspen is especially receptive to this treatment due to its ability to sprout from its roots. All stems with a diameter greater than two inches should be removed. This prevents shading of the new regeneration, but also keeps some structure in the stand following harvest. Loggers should leave any snags and existing coarse woody debris, provided they don't pose any danger to operations. Tops should be scattered around the cut area to protect regeneration from deer browse. Clearcutting is not very aesthetically pleasing, but leaving existing regeneration will allow the stand to return to a forested look more quickly.

Patch Clearcut

Similar to gap selection, patch clearcuts open up parts of the stand so more sunlight reaches the ground, but they are generally larger areas than gaps. Larger openings allow for the regeneration of species that are either very intolerant to shade or more slowly growing, therefore needing less competition to survive to maturity. This treatment is only being prescribed on one of the smaller stands, so clearcut patches should be around one acre in size, alternating with one acre patches of uncut forest. As with the full clearcut, all stems with a diameter greater than two inches should be removed. Tops should be scattered around the cut areas to protect regeneration from deer browse.

Species Removal

This treatment designates specific species to be harvested throughout the stand. This allows species that are underrepresented in the stand to remain and potentially regenerate more easily, providing greater diversity. The harvest removes only merchantable trees, so the regeneration of any removed species remains. All trees of the designated species with a diameter greater than four inches should be harvested.

Habitat Improvement

Sometimes, it is desirable to leave a mature stand alone and not harvest it. This can allow old growth characteristics to develop, like very large trees and lots of coarse woody debris. These aren't necessarily good for timber production, but can greatly benefit wildlife. Old growth forests also store a lot of carbon. In the stand where habitat improvement takes place, no harvesting will occur. Instead, artificial tip-ups, one per acre, will be created along the edge to supplement the coarse woody debris present and not disturb the interior of the stand. Trees selected for tip-up creation will be at least 12 inches in diameter and have poor form.

Other Silvicultural Considerations

Operating Restrictions – The landowner requests that all harvesting in northern hardwoods forest be shortwood operations.

Aesthetics – The aesthetics of these stands is not one of the primary concerns of the landowners. While these lands are open to the public, many are away from public view and most people in the area do not have a problem with forest management. The landowners primarily want sustainable, ecological forestry and loggers should take care not to damage the residual trees and should spread slash and tops so they are not in large piles.

Coarse Woody Debris – Dead trees in the form of snags and down dead wood provide valuable structure to a forest. Those largest in size provide the most value. Hollow snags provide a sheltered location for nests and dens, and provide habitat for many insects, which then provides a food source for many animals. Down dead wood

provides similar benefits, and also a substrate for regeneration. Species such as hemlock and yellow birch often rely on these “nurse logs” for less competitive seed beds and added nutrients from the decaying wood. During harvest, these features should be left undisturbed, if possible, only removing them if they pose threats to operator safety or greatly limit maneuverability.

In addition to leaving existing dead wood features, some stands should have more woody debris added to improve the structure of the stand. Some stands will have recommendations to create artificial tip-ups or leave some larger, low-value logs or cull sections on the ground. Also, in stands where group selection is recommended, tops should be piled in the gaps to protect future regeneration from deer browse.

Best Management Practices – Best Management Practices (BMPs) are guidelines published by the State of Michigan to protect Michigan’s water resources from non-point source pollution and erosion while working on forest land. BMPs are now called “Sustainable Soil and Water Quality Practices on Forest Land” and the document is online at <http://tinyurl.com/MichiganBMPs>. BMPs include proper location and construction of logging roads, the use of riparian management zones, installation of culverts and other stream crossings, proper use of pesticides and other chemicals, and site preparation for planting. BMPs also include the proper seasonal timing of activities to minimize the spread of insects or disease. Any forest management activities should minimize soil erosion near wetlands and surface water.

Regeneration – To maintain sustainable and repeatable harvesting in these parcels, loggers should be instructed to avoid areas of vigorous regeneration whenever possible while operating. Skid trails should be routed around these areas. In large gaps, tops should be piled to protect regeneration.

Complexity, Diversity, and Heterogeneity – Traditional timber management focuses on managing for high quality timber that will provide the largest economic benefit. In the Lake States, this often also provides excellent ecological services, however, many stands are healthy and well stocked, but consist of only a few species and are very homogeneous structurally. Often, these stands are harvested before complexity and diversity can develop. This plan advocates for using a more ecology-based silvicultural approach that tries to balance the desire for economic timber production with creating a more natural forested environment. This involves using management techniques that mimic natural processes to develop rich complex forests.

The first step is to allow trees to get larger. Older trees can provide more habitat to be used by a wide range of species. As trees age, they generally get larger, develop more complex crowns and bark, and get defects like cavities and fissures. All of these features create a variety of unique conditions that can be utilized by many plants and animals. Unfortunately, these features are not always the best for timber production and take additional time to form, but managing to create them will benefit the ecosystem.

Letting trees die is another important factor in creating complex forests. Often the trees that are declining in quality are removed during harvest to get the economic value from

them before they die. If some of them are instead allowed to die, provided they aren't causing health issue for the trees around them, they add great structure to the stand. Hollow snags can be used as nests or dens, and provide food sources for insects and insect-eating wildlife. Decaying logs on the ground can provide cover for small animals, food sources like snags, and regeneration substrates for species like hemlock or yellow birch.

It's important to note that while the above features are important on their own, how they are distributed in the forest matters too. Having large trees isn't great if that's all you have. It's best to have a wide range of diameters that includes large trees. The same goes for dead wood components. Having varied sizes and decay classes gives a wider range of choices for organisms to find what suits them best. Also, having any one feature evenly distributed will be less beneficial than clumps and gaps, in creating a heterogeneous stand.

To manage forests in this way, most techniques rely on mimicking natural successional processes and disturbances, which generally result in increased diversity. Gaps, from single trees to an acre or larger in size, open the canopy and allow species less tolerant of shade to grow. Varying the size and spacing of the gaps will provide conditions for a wider range of species and create a matrix of varying ages and sizes. However, a stand might already be so homogenous that there is no diversity in the seed source. In this case, under planting may be desired to increase species richness. To add more structure to forests, deliberately killing trees can be used to supplement dead wood components. There are a few ways to create snags: letting old trees die, girdling at varied heights, or cutting off the crown are all valid. A mix of these methods can space out when the tree will actually die. That way, the forest has different stages of decaying wood features that don't all decompose at once. The same goes for down dead wood. Logs can be left on the ground, and varying sizes will decay at different rates.

Harvest Plan

This harvest plan is intended to serve as a guide to management activities on the Guild's Houghton County parcels for the next ten years (2017 – 2027). It is important to note, the individual stands and acreages associated with this plan may fluctuate and change from year-to-year based on current stand conditions, invasive species outbreaks, and market conditions. In developing a harvest plan, the Guild is making a commitment to the 'working lands' approach to conservation and regulations of the Commercial Forest Program. It is likely this first ten-year period of management will be focused primarily on maintenance and/or restoration of species and structural diversity in upland hardwood stands that have been managed at varying intensities for many decades. Over time, as the forests gradually shift to a late-seral, saw-log dominated forest, the focus of management is also expected to shift. Initially restoration of forest health and forest structure will move to the sustainable management of the saw-log resource in a manner that derives economic benefit while protecting the ecological integrity and unique features of these forests. In all cases, it is the desire of the Guild to optimize the use and marketing of produced forest products. Both the Guild and the forest manager will

continually evaluate emerging markets and opportunities for product diversification, if those products are consistent with management objectives. It is important to note that a portion of the stands on the property will not see a first harvest until after the life of this management plan (Table 4).

Table 4. Summary of treatments recommended by Green Timber Consulting Foresters by parcel and stand.

Stand	Acres	Treatment Description	Year	Reevaluate
1-1	11.7	Individual Tree Selection/Group Selection	2024-26	2034
1-2	28.0	Individual Tree Selection/Group Selection	2024-26	2034
1-3	1.1	No Active Management	N/A	2027
2-1	14.2	Individual Tree Selection/Group Selection	2020-22	2030
2-2	9.3	Individual Tree Selection/Group Selection	2020-22	2030
2-3	2.9	Individual Tree Selection	2020-22	2030
2-4	3.8	Individual Tree Selection	2020-22	2030
2-5	3.4	No Active Management	N/A	2027
2-6	5.6	No Active Management	N/A	N/A
2-7	0.6	No Active Management	N/A	N/A
3-1	63.8	Individual Tree Selection	2020-22	2030
3-2	5.9	Species Removal Harvest	2020-22	2030
3-3	8.0	Clearcut	2020-22	2030
4-1	79.4	Individual Tree Selection	2022-24	2032
4-2	0.8	No Active Management	N/A	N/A
5-1	33.7	Individual Tree Selection	2018-20	2028
5-2	6.0	Patch Clearcuts	2018-20	2028
6-1	23.3	Individual Tree Selection	2018-20	2028
6-2	28.1	Individual Tree Selection	2018-20	2028
7-1	66.8	Individual Tree Selection/Group Selection	2020-22	2030
7-2	13.1	No Harvest/Habitat improvement	2020-22	2030

Harvest Summary by Year

The summary of stands and acres of potential harvest areas by year are shown in Table 5. This plan was derived from the recent forest inventory and forester observations conducted by Green Timber Consulting Foresters in the summer of 2017. It is important to note the initial inventory was 82 plots and routine operational inventories may slightly alter harvest planning. Table 5 details the individual stand I.D. number and approximate acreages planned for harvests in two-year windows of opportunity. A two-year window was chosen because the process of timber sale proposals, timber sale set-up, timber sale contracting, and final harvest of a timber sale, rarely occurs in one year. Detailed stand information which outlines the specific harvest areas summarized in Table 5 can be found in the Parcel Summaries section and the associated maps.

Table 5. Planned treatments by year.

Year	Stand	Acres	Treatment Description	Reevaluate
2018-20	5-1	33.7	Individual Tree Selection	2028
2018-20	5-2	6.0	Patch Clearcuts	2028
2018-20	6-1	23.3	Individual Tree Selection	2028
2018-20	6-2	28.1	Individual Tree Selection	2028
2020-22	2-1	14.2	Individual Tree Selection/Group Selection	2030
2020-22	2-2	9.3	Individual Tree Selection/Group Selection	2030
2020-22	2-3	2.9	Individual Tree Selection	2030
2020-22	2-4	3.8	Individual Tree Selection	2030
2020-22	3-1	63.8	Individual Tree Selection	2030
2020-22	3-2	5.9	Species Removal Harvest	2030
2020-22	3-3	8.0	Clearcut	2030
2020-22	7-1	66.8	Individual Tree Selection/Group Selection	2030
2020-22	7-2	13.1	No Harvest/Habitat improvement	2030
2022-24	4-1	79.4	Individual Tree Selection	2032
2024-26	1-1	11.7	Individual Tree Selection/Group Selection	2034
2024-26	1-2	28.0	Individual Tree Selection/Group Selection	2034
N/A	1-3	1.1	No Active Management	2027
N/A	2-5	3.4	No Active Management	2027
N/A	2-6	5.6	No Active Management	N/A
N/A	2-7	0.6	No Active Management	N/A
N/A	4-2	0.8	No Active Management	N/A

Annual Growth

The Guild utilized regional FIA growth data along with the 2017 forest inventory data to calculate annual growth. Table 6 gives a rough estimate of annual growth in relation to the proposed annual harvest across the 398 treatment acres over the ten-year span of this management plan. This is a very rough, and likely over estimate, of annual removals. It should be noted that the 398 acres slated for treatment during this plan will include a variety of silvicultural treatments, with a range of intensities including non-harvest actions, as well as in-stand exclusions for riparian, steep, and wet areas where no removals will occur.

Table 6. Calculation of annual growth on Guild parcels

Description	Value
Total cordwood volume	9,182
Total acres	398
Average cordwood volume per acre	23.1
Average annual increment at 2.5%* growth rate (cords)	230
Projected 10-year annual harvest @ 4 cords per acre	159
Projected percentage of annual growth	69%

*2.5% growth is based on FIA data for all Michigan forest types as reported in the following USFS reports: Michigan's Forest Resources 2004 - Resource Bulletin NC-255, and Michigan's Forest Resources 2007 - Research Note NRS-28

Parcel Summaries and Silvicultural Recommendations

This section includes summaries of each parcel based on the inventory work done by Green Timber Consulting Foresters, Inc. in May-June 2017 and their silviculture recommendations. All stands receiving treatment within a parcel will be grouped together for sale when bid out to be harvested, even if receiving different treatments. The proposed management schedule is preliminary and stands identified for management will be reassessed at the time of harvest to development final harvest prescriptions.

Maps for each parcel are available in the companion maps document.

Parcel 1

General Information

Access: The entire parcel is accessible from Superior Shores Road/Little America Road on the western boundary. There is an open two-track road from the county road at the north end and another that is gated near the south end.

Boundaries: The north, east, and south boundaries are painted in blue. All four corners have monuments.

Forest Health: There are no current forest health concerns. A few spots of Eutypella canker were noticed. The native sugar maple borer may cause damage if it shows up in the future.

Invasive Species: No invasive species were noticed. Due to the primarily maple/hardwood composition, watching the spread of Asian long-horned beetle is advised. This pest has the potential to cause serious damage to the northern hardwood forest type if it is introduced here in the future. Climate change and the movement of firewood by humans are factors that may create opportunities for the Asian long-horned beetle to gain a foothold, however, absent these factors, it would take a long time for the beetle to arrive here on its own.

Water/Wetlands: There are no water features or wetlands on this parcel.

Wildlife: There was some evidence of deer (pellets and browse) throughout the parcel. Browse was minimal and there is still an abundance of Canada yew, a favorite of deer for winter food.

Other Notes: There was some old junk along the haul road just south of the opening, but no recent dumping was found on the property.

Soils:

Symbol	Soil Name	Percent Slope	Acres	Percent Area
21D	Keweenaw-Kalkaska complex	8-15	4.4	11%
96B	Liminga fine sand	1-8	35.6	89%
Totals			40	100%

- Keweenaw – This soil is well drained and has low available water storage. Site index for sugar maple on this soil is 61 feet at age 50.
- Kalkaska – This type of soil is somewhat excessively drained and has low available water storage. Site index for sugar maple on this soil is 64 feet at age 50.
- Liminga – This soil type is well drained and has low available water storage. On this soil, the site index for sugar maple is 60 feet at age 50.

Stands

Stand 1-1

Description: This stand is roughly 11 acres of northern hardwoods forest on the north part of the parcel. The dominant species are red maple and sugar maple, with some yellow birch. The understory contains those species as well as balsam fir and paper birch. A red pine stand across the road has led to some pine seeding in on the edge of the stand. There are also dense pockets of Canada yew present.

Wood/Fiber Production: The stand is type M9, or northern hardwoods with overstocked sawtimber. Basal area is currently around 120 square feet per acre. The stand had some evidence of harvest, but seems to have happened at least 20 years ago.

Stand 1-2

Description: This stand is about 28 acres of northern hardwoods forest on the south part of the parcel. The dominant species are red maple and sugar maple, with some yellow birch. The understory contains those species as well as balsam fir and paper birch. A red pine stand across the road has led to some pine seeding in on the edge of the stand. There are also dense pockets of Canada yew present. It is being considered a separate stand due to its lower density.

Wood/Fiber Production: This stand is type M8, northern hardwoods forest with well-stocked sawtimber. Basal area is currently around 75 square feet per acre. This stand has evidence of a more recent harvest, perhaps within the last five to ten years.

Stand 1-3

Description: This stand consists of about one acre in the center of the parcel and is currently non-forested. The opening is beginning to fill in as a result of natural seeding and the planting of 520 red oak, black cherry, and white pine seedlings in the spring of 2008.

Wood/Fiber Production: There is no wood or fiber production in this stand currently. The stand should be allowed to continue to undergo natural regeneration and supplemental planting.

Silvicultural Recommendation

These stands are on soils that can be operated on during summer. Still, operators should take care to minimize compaction and rutting, and the administering forester should step in to halt logging if these conditions occur.

Stands 1-1 & 1-2

- Individual tree selection with group selection
- Summer harvest, 2024-26

These two stands will be combined for treatment. Individual tree selection will help to maintain diversity in the size distribution of the stand. Group selection should also be implemented in areas of dense regeneration of non-maple species, or around non-maple crop trees, to promote further diversity in the species composition of the stands. Gaps in these stands should be around one-half acre in size. The average residual basal area of both stands should be between 70 and 90 square feet per acre, but will be lower in and near gaps. Care should also be taken to avoid damaging the pockets of Canada yew, which provide compositional and structural diversity, as well as food for species like deer. If the yew begins to decline as a result of too much browse, it may be desirable to install deer excluding fences around it. In this stand, loggers should also try to leave around three lower value logs per acre, at least 12 inches in diameter, on the ground. This will improve the structure of the stand and provide habitat for insects, small mammals, and amphibians.

Stand 1-3

- No active management
- Reevaluate 2027

This stand is currently non-forested, with some regeneration filling in from planting and local seed sources. It is unlikely to be ready for harvest within the timeframe of this plan, but should be reevaluated at the end of the plan, in 2027. Supplemental planting should be considered if the stand is not adequately regenerating.

Parcel 2

General Information

Access: The parcel is accessible from Salo Road on the western boundary. There are currently no haul roads or trails into the property from Salo Road.

Boundaries: The northern boundary is partially painted in blue, from the road. The northwest and southwest corners appeared to be marked by wooden stakes.

Forest Health: No forest health issues were observed. Oak wilt has not yet been reported in Houghton County, but caution should still be exercised. It is recommended to not harvest in oak stands between April 15 and July 15 to prevent injuries that would allow the fungus-carrying beetle to infect trees.

Invasive Species: No invasive species were observed. There are some live ash trees in Stand 2, in the northeast corner, so they should be monitored for signs of emerald ash borer. Again, Asian long-horned beetle could cause issues in the future if it spreads to northern Michigan.

Water/Wetlands: The beaver pond/marsh in the southeast corner is considered a wetland according to the National Wetlands Inventory, so appropriate permits from the Department of Environmental Quality (DEQ) are required for filling, draining, or development. There is also a small stream flowing north from the pond. Crossing would be required to reach the majority of Stand 2-4. This would require a permit from the DEQ as well. More information about DEQ permits is available online at www.michigan.gov/jointpermit or by calling the Marquette, Michigan DEQ office at (906) 228-4853.

Wildlife: This parcel provides a variety of wildlife habitat. The pond provides habitat for many birds including sandhill cranes, which were observed to be nesting there. Of course, beavers have made it their home as well. The beaver activity creates a wet area to the north which provides excellent amphibian habitat. Evidence of deer was found, especially in the lower, wet stand. The oaks provide a great hard mast source for many types of animals, as well.

Other Notes: This parcel was pastured in the past, which is part of the reasoning for all the ironwood in the stand. There was some dumping on the property, but nothing recent. The dumping consisted of an old wash machine, tires, and tin cans.

Soils:

Symbol	Soil Name	Percent Slope	Acres	Percent Area
27	Histosols and Aquepts, ponded	0-1	7.5	19%
52B	Allouez gravelly silt loam	1-8	7.0	18%
103B	Montreal-Net complex	0-8	13.9	35%
107B	Kalkaska-Waiska sands	0-8	11.6	29%
Totals			40	100%

- Histosols and Aquepts – These soils are very poorly drained with very high available water storage. This soil type is generally not forested and has no site index.
- Allouez – This soil type is well drained with very low available water storage. For sugar maple, this soil has a site index of 65 feet at age 50.
- Montreal – This soil is moderately well drained with very low available water storage. This soil has a site index of 63 feet at age 50, for sugar maple.
- Net – This soil is somewhat poorly drained and has low available water storage. Site index for red maple on this soil is 60 feet at age 50.
- Kalkaska – This type of soil is somewhat excessively drained and has low available water storage. Site index for sugar maple on this soil is 64 feet at age 50.
- Waiska – This soil is excessively drained with low available water storage. Site index for sugar maple is 61 feet at age 50.

Stands

Stand 2-1

Description: This stand is about 14 acres of oak type forest, with northern hardwoods components, in the northwest part of the parcel. The dominant species is red oak, with sugar maple and red maple as well. The understory contains the same species as the overstory, predominantly sugar maple, as well as ironwood and birch. There is an old dumpsite in this stand on the north of the old field, which is identified as Stand 4. Stand 1 contains mostly Kalkaska-Waiska sands and Allouez gravelly silt loam. The farthest east part of the stand also has some of the Montreal-Net complex.

Wood/Fiber Production: This stand is type Km9, oak forest with northern hardwoods and the size and stocking is classified as overstocked sawtimber. The basal area here is 100 square feet per acre.

Stand 2-2

Description: This stand is roughly nine acres of northern hardwoods forest, with an oak component, and is located south of Stand 1, in the southwest corner. The dominant species are sugar maple and red maple, with some red oak and basswood. The understory is primarily maple and ironwood. The main soils are the Kalkaska-Waiska sands and Allouez gravelly silt loam.

Wood/Fiber Production: The forest type here is Mk8, northern hardwoods with an oak component and the stocking level is classified as well-stocked sawtimber. Stand 2 has a basal area of 80 square feet per acre.

Stand 2-3

Description: Stand 3 is around three acres of young northern hardwoods located just west of the pond. The primary species is red maple, with scattered quaking aspen, and paper birch. The main soil here is the Montreal-Net complex, with parts of the eastern edge possibly getting into the ponded Histosols/Aquents.

Wood/Fiber Production: The stand is type M6, northern hardwoods with the size and stocking level classified as overstocked poletimber. The basal area is 135 square feet per acre.

Stand 2-4

Description: This stand is about four acres of lowland hardwoods in the northeast corner of the parcel. The dominant species are red maple, white ash, and ironwood. Some sugar maple and oak were present on the edge of this stand, but that is atypical for the site conditions. The understory contains the same species, mostly maple and ironwood. This stand contains the Montreal-Net complex soils.

Wood/Fiber Production: This stand is type E9, lowland hardwoods forest with overstocked sawtimber. The basal area of this stand is 180 square feet per acre.

Stand 2-5

Description: This stand is roughly three acres of old field that has a conifer mix establishing. Some of the immature trees there may have been planted to supplement the natural ones, but not in rows. The primary species there are white pine and white spruce, with some red pine. A few rock piles remain from when it was first cleared. The main soil is the Montreal-Net complex.

Wood/Fiber Production: This is a type Ps2, mixed pine with spruce, and moderately stocked seedlings. Basal area was not measured here, but is very low.

Stand 2-6

Description: This stand is close to six acres of non-forested wetland in the southeast corner of the parcel. It is an old beaver pond surrounded by marsh grassland. The primary cover is tag alder and various wetland grasses.

Wood/Fiber Production: The stand is type XL, lowland brush. There is no wood or fiber production in this stand. This area is important as wildlife habitat and for maintaining water quality; for this reason it should be protected from damage by timber harvesting and other activities.

Stand 2-7

Description: This stand is less than one acre of non-forested right-of-way. It runs along Salo Road on the western edge of the parcel.

Wood/Fiber Production: This stand is non-forested and has no wood or fiber production. It will be maintained by the Houghton County Road Commission to keep a clear right-of-way along Salo Road.

Silvicultural Recommendation

Soils on the eastern parts of this parcel are quite wet, so harvesting in stands 2-3 and 2-4 should be restricted to winter months. Stands 2-1 and 2-2 do not have these same restrictive soils and could be started in the summer. Due to the large oak component, however, harvesting should not take place between April 15 and July 15, to minimize the chance of spreading oak wilt. Operators should take care to minimize rutting and compaction, and the administering forester should step in to halt logging if these conditions occur.

According to the 1995 management plan there was a single tree selection harvest planned for the winter of 1998-1999. This was the most recent harvest on this property.

Stands 2-1 & 2-2

- Individual tree selection with group selection.
- Summer/Winter harvest, 2020-22.

These stands will be combined for treatment. Individual tree selection will help to maintain diversity in the size distribution of the stand. Many trees in this stand are growing in clumps that can be thinned. Group selection should also be implemented to maintain species diversity in the stands. Gaps in these stands should be one-half acre to

one full acre in size. Areas of non-maple regeneration should be targeted for release, especially any oak regeneration. The average residual basal area in these stands should be slightly lower than typical northern hardwoods, between 60 and 80 square feet per acre, to better suit species that are less shade tolerant. If it is possible to harvest these stands in the summer, the loggers should scarify the soil in the gaps for better regeneration.

Stand 2-3

- Individual tree selection.
- Winter harvest, 2020-22.

This stand is relatively homogeneous, but small, so individual tree selection should help diversify both the structure and composition. The small gaps will reduce competition, releasing understory trees to the canopy and allowing regeneration. Red maple, the primary species, is thought to do well with climate change due to its adaptability to diverse sites. Leaving this small stand as mostly red maple could help increase the climate resiliency of the parcel. The average residual basal area should be between 70 and 90 square feet per acre.

Stand 2-4

- Individual tree selection.
- Winter harvest, 2020-22.

This stand contains species diversity in the parcel that should be maintained. Individual tree selection will provide small gaps for suppressed trees to take advantage of, and release existing regeneration. The average residual basal area should be 70 to 90 square feet per acre. The soils in this stand are wet and poorly drained, so harvest should only occur during winter months, on frozen ground.

Stand 2-5

- No active management.
- Reevaluate 2027.

This stand is an old field with young regeneration. It is not likely that the stand will be ready for harvest within the plan's timeline. Reevaluation should take place in 2027. Supplemental planting may be considered to augment current regeneration.

Stand 2-6

- No active management.

This stand is likely to remain as a non-forested wetland for the foreseeable future and therefore should not have any active timber management within it. The stand should still be revisited as part of a monitoring protocol for all stands, to watch for any health or water quality issues.

Stand 2-7

- No active management.

This stand is a non-forested right-of-way maintained by the county and needs no active timber management within it. Monitoring here should be focused on invasive species, due to the proximity of Salo Road.

Parcel 3

General Information

Access: The parcel is accessed from a haul road off of Jacobsville Road. The haul road does not quite reach the eastern boundary but does run south of the parcel and meet a two-track road that cuts through the middle of the property, from south to north. The road coming from the east gets very wet and coming off of Jacobsville Road is a little rough. The haul road has two chains across it, but neither was locked when the property was visited in 2017. Prior to conducting timber harvests on Parcel 3, it is recommended that the deed be checked to determine what, if any, legal access routes exist. It may be necessary to obtain permission from neighboring landowners.

Boundaries: There is some blue flagging and paint on the north boundary and some blue paint on the southern boundary. Corners were marked at the southeast and midpoint of the southern boundary, on the section line.

Forest Health: No forest health issues were noticed. The hemlock trees in the forest here should be monitored for signs of hemlock woolly adelgid. There is also oak in the parcel, so strategies to prevent oak wilt should be employed as well.

Invasive Species: None were seen, but hemlock woolly adelgid and Asian long-horned beetle pose threats given the species present here.

Water/Wetlands: Much of the stand had standing water in vernal pools at the time of inspection in late spring. According to the National Wetlands Inventory, there is a stream crossing that would require a permit when coming up the trail to the east of the parcel. Also, much of the eastern side of the parcel appears to be a wetland. A permit would only be needed to fill, drain, or develop within it. Forests with wet soils such as this one are susceptible to serious rutting, erosion, and compaction. Areas like this should have harvests limited to the winter, when the soil is frozen.

Wildlife: There is lots of deer activity within the parcel. Many of the maple seedlings are browsed. Still, there are only small pockets of heavy browse and there is some hemlock throughout that hasn't been touched by the deer. There are also ruffed grouse present and wolf tracks were sighted. The oak trees provide a good source of hard mast.

Soils:

Symbol	Soil Name	Percent Slope	Acres	Percent Area
30B	Munising-Skanee complex	0-8	29.0	36%
31A	Skanee-Gay complex	0-3	3.7	5%
33B	Munising-Yalmer complex	1-8	8.7	11%
79B	Yalmer-Assinins complex	0-8	38.6	48%
Totals			80	100%

- Munising – This soil is moderately well drained and has low available water storage. Site index for sugar maple on this soil is 63 feet at age 50.

- Skanee – This type of soil is somewhat poorly drained with very low available water storage. For sugar maple on this soil, the site index is 60 feet at 50 years old.
- Gay – This soil is poorly drained and has moderate available water storage. On this soil, red maple has a site index of 51 feet at age 50.
- Yalmer – This soil is moderately well drained with very low available water storage. The site index for sugar maple is 61 feet at age 50.
- Assinins – This type of soil is somewhat poorly drained with moderate available water storage. Site index for sugar maple is 63 feet at 50 years old.

Stands

Stand 3-1

Description: This stand is about 65 acres of northern hardwoods with white pine throughout. It makes up the majority of the parcel. The dominant species are red maple, sugar maple, white pine, and red oak. The understory has the above species, as well as hemlock and balsam fir. Most of the regeneration is maple, but there is a lot of oak, white pine and hemlock. This stand contains all four soil types.

Wood/Fiber Production: This stand is type Mw9, northern hardwoods with white pine and the stocking is identified as overstocked sawtimber. The basal area is 135 square feet per acre and the stand was probably last harvested over 20 years ago.

Stand 3-2

Description: This stand is around seven acres of lowland conifer and lowland hardwoods. It is located along the southern boundary, east of the western edge. The primary species are balsam fir, hemlock, white spruce, and white pine, with some red maple. It has Munising-Skanee complex and Yalmer-Assinins sands for soil.

Wood/Fiber Production: The stand is type Qe9, lowland conifer with lowland hardwoods and the stocking is identified as overstocked sawtimber. The basal area is 150 square feet per acre. The last harvest here was probably over 20 years ago.

Stand 3-3

Description: This stand is eight acres of aspen forest. There is also some red maple, white pine, and balsam fir. The aspen is overmature and can be expected to begin to decline in vigor and quality. The soils here are Yalmer-Assinins sands.

Wood/Fiber Production: The stand is type A9, aspen forest with overstocked sawtimber. The basal area is 120 square feet per acre. This stand was probably last harvested over 20 years ago.

Silvicultural Recommendation

This parcel was very wet at the time of inspection in spring 2017. Due to this, a winter harvest is recommended to protect soils from rutting and compaction. Still, operators should take care to minimize damage, and the administrating forester should step in to halt logging if these conditions occur.

Much of this property doesn't appear to have been harvested in many years. The previous management plan had a harvest scheduled for 1998, but it doesn't appear that it was followed through.

Stand 3-1

- Individual tree selection.
- Winter harvest, 2020-22.

Individual tree selection should be used in this stand to maintain species diversity and forest structure. To protect unique features, such as the large mature white pine and red oak, those species should be excluded from harvest. Hemlock should also be retained. The residual basal area should be between 60-80 square feet per acre, allowing mid-tolerant species to regenerate.

Stand 3-2

- Species removal harvest.
- Winter harvest, 2020-22.

In this stand, a species removal harvest should be conducted to remove merchantable balsam fir, spruce, and red maple. This will allow existing regeneration, especially of hemlock and white pine, to be released. Tops should be put in the largest gaps to protect the regeneration from deer browse.

Stand 3-3:

- Clearcut.
- Winter harvest, 2020-22.

This stand should be harvest by clearcut. The aspen trees in this stand are overmature and are not providing the same benefits a younger aspen stand could. Species like grouse use dense young aspen as cover for brood-rearing and as a food source. There are grouse in the parcel, so improved habitat would greatly benefit them. Clearcutting all species will allow for quick aspen regeneration through root sprouting. If possible, existing snags and other coarse woody debris should be left.

Parcel 4

General Information

Access: The parcel can be accessed from Heikkinen School Road and a seasonal road with a locked gate on it. From the seasonal road, a haul road goes south into the parcel. When the property was visited in Spring of 2017, Heikkinen School Road had some rough spots and was slightly washed out in some places. The haul road was pretty wet at the time of the property inspection, with standing water in a few places.

Boundaries: The northern boundary had blue flagging, and the south and east boundaries were painted blue.

Forest Health: Throughout Parcel 4, there were old mechanical wounds, low on the trees. They were sparse, and didn't seem to be causing much of an issue. There was also

some Eutypella canker, but not much. When the parcel is harvested, these two types of defect should be prioritized for removal.

Invasive Species: No invasive species were seen. There are some live ash trees, so they are at risk if emerald ash borer makes it to this parcel. Asian long-horned beetle could threaten the hardwoods, if introduced.

Water/Wetlands: The parcel is very wet overall, with standing water in the eastern and southern parts. The pond in the northeast and some spots along the eastern side are considered wetlands by the National Wetlands Inventory. Also, there is a stream running from east to west that would need to be crossed to reach the portion of the parcel to its south. This would require a permit from the DEQ to cross.

Wildlife: Signs of deer were observed. Hemlock provides food and wintering habitat for them. Grouse were heard drumming. There were also bear, coyote, and wolf tracks on the seasonal road. Waterfowl could use the pond, along with amphibians.

Soils:

Symbol	Soil Name	Percent Slope	Acres	Percent Area
12	Gay muck	N/A	0.8	1%
59B	Graveraet-Ocqueoc-Kalkaska complex	1-8	34.4	43%
131B	Graveraet-Misery complex	0-8	35.4	44%
137A	Sturgeon-Arnheim-Pelkie complex	N/A	0.1	0%
148B	Graveraet-Ocqueoc-Kalkaska complex, dissected	1-12	1.8	2%
148D	Graveraet-Ocqueoc-Kalkaska complex, dissected	8-35	7.5	9%
Totals			80	100%

- Gay – This soil is poorly drained and has moderate available water storage. On this soil, red maple has a site index of 51 feet at age 50.
- Graveraet – This soil type is moderately well drained and has low available water storage. Sugar maple has a site index of 60 feet at age 50 on this soil.
- Ocqueoc – This soil is moderately well drained with moderate available water storage. The only available site index data for this soil is quaking aspen, which was not found on this property. However, quaking aspen has a site index of 65 feet at age 50 for this soil which is a moderately high site index for this species.
- Kalkaska – This type of soil is somewhat excessively drained and has low available water storage. Site index for sugar maple on this soil is 64 feet at age 50.
- Misery – This soil is somewhat poorly drained and has very low available water storage. Red maple has a site index of 60 feet at age 50 for this soil.
- Sturgeon – This soil type is somewhat poorly drained and has moderate available water storage. Red maple has a site index of 65 feet at age 50 for this soil.
- Arnheim – This soil is poorly drained with high available water storage. White spruce has a site index of 38 feet at 50 years for this type.
- Pelkie – This type of soil is moderately well drained and has low available water storage. Sugar maple has a site index of 65 feet at age 50 for this soil.

Stands

Stand 4-1

Description: This stand is about 79 acres of northern hardwood forest with a hemlock component; it comprises the majority of the parcel. The primary species are red maple, sugar maple, yellow birch, and hemlock. There is also some basswood, balsam fir, and ash.

Wood/Fiber Production: The stand is type Mh9, northern hardwoods and hemlock forest, with overstocked sawtimber. The basal area is 113 square feet per acre in this stand.

Stand 4-2

Description: This stand is less than one acre of non-forested wetland in the northeast corner of the parcel. The primary vegetation is wetland grasses and some tag alder. There is also some cedar and other lowland conifers around the edge, outside of the parcel.

Wood/Fiber Production: The stand is type XL, lowland brush, and has no wood or fiber production. It is important to protect wetlands like this one from harvest due to their importance to wildlife and the water cycle.

Silvicultural Recommendation

This parcel was very wet at the time of inspection in spring 2017, especially the haul road in and the eastern side of the parcel. Harvest should be restricted to winter. Operators should still take care to minimize rutting and compaction, and the administrating forester should step in to halt logging if these conditions occur.

The last harvest occurred in the early 2000's, which removed much of the ash in the parcel. Some Eutypella canker was observed and there are some old mechanical wounds from past timber harvests located near the base of the trunk on some trees; there is not a significant amount of this damage and it is not a concern. These trees should be removed during future harvests.

Stand 4-1

- Individual tree selection.
- Winter harvest, 2022-24.

This stand should be harvested using individual tree selection. The treatment should help maintain structural diversity, and promote species diversity as well. Average residual basal area following the harvest should be 70-90 square feet per acre. In this stand, one tree per two acres, greater than 12 inches in diameter and having poor form and low value, should be made into an artificial tip-up. This will add more structure to the forest for habitat. Additionally, tip-ups expose mineral soil for a regeneration substrate and create microsites, with variable temperature and moisture that allow more diverse ground flora to grow.

Stand 4-2

- No active management.

This stand is likely to remain as a non-forested wetland for the foreseeable future and therefore should not have any active timber management within it. The stand should still be revisited as part of a monitoring protocol for all stands, to watch for any health or water quality issues.

Parcel 5

General Information

Access: This parcel is accessible by following a haul road which travels north from the Donken-Tapiola Road. The haul road is rough in some places and there is a gate on it a good distance before the road reaches the parcel. Some areas within the parcel are probably inaccessible with harvesting equipment due to slope.

Boundaries: The western boundary is painted with blue and the southeast corner is monumented.

Forest Health: No forest health issues were noticed. This parcel is susceptible to Eutypella canker and sugar maple borer due to the maple present.

Invasive Species: No invasive species were detected, but the parcel should be monitored for Asian long-horned beetle and hemlock woolly adelgid.

Water/Wetlands: There is a stream that winds through parts of the parcel. Permits should be acquired from the Michigan DEQ for any needed crossings. There is one existing crossing on the haul road near the south boundary. A second crossing will need to be installed approximately one-quarter mile before the road reaches the property. This crossing was removed when the neighboring landowner finished harvesting their property approximately two years ago.

Wildlife: The patches of hemlock provide important winter habitat for deer.

Soil:

Symbol	Soil Name	Percent Slope	Acres	Percent Area
47B	Ocqueoc-Halfaday complex	0-8	4.2	11%
98E	Frohling-Yalmer complex, dissected	15-60	12.7	32%
100A	Au Gres-Roscommon complex	0-3	12.1	30%
132D	Kalkaska-Alcona complex, dissected	8-35	11.0	28%
Totals			40	100%

- Ocqueoc – This soil is moderately well drained with moderate available water storage. Quaking aspen has a site index of 65 feet at age 50 for this soil.
- Halfaday – This soil is moderately well drained and has low available water storage. On this soil, sugar maple has a site index of 62 feet at age 50.
- Frohling – This soil type is well drained with very low available water storage. Sugar maple has a site index of 63 feet at 50 years old.

- Yalmer – This soil is moderately well drained with very low available water storage. The site index for sugar maple is 61 feet at age 50.
- Au Gres – This type of soil is somewhat poorly drained and has low available water storage. Red maple has a site index of 65 at age 50.
- Roscommon – This soil is poorly drained and has low available water storage. Quaking aspen has a site index of 74.
- Kalkaska – This type of soil is somewhat excessively drained and has low available water storage. Site index for sugar maple on this soil is 64 feet at age 50.
- Alcona – This soil is well drained and has high available water storage. Sugar maple has a site index of 61 feet at age 50 for this soil.

Stands

Stand 5-1

Description: This stand is about 34 acres of northern hardwoods with a hemlock component. The primary species are red maple, sugar maple, and hemlock. There is also some yellow birch, some red oak, and a few scattered aspen. This stand contains all of the soil types identified on this property.

Wood/Fiber Production: The stand is type Mh9, northern hardwoods and hemlock forest with overstocked sawtimber. The basal area is 140 square feet per acre.

Stand 5-2

Description: This stand is six acres of lowland conifer forest located in the southeast corner of the parcel. The primary species are cedar and balsam fir, with a few yellow birches. There was also a lone, very large, mature American elm in good health.

Wood/Fiber Production: The stand is type Q9, lowland conifer forest with overstocked sawtimber. The basal area is 150 square feet per acre.

Silvicultural Recommendations

This parcel contains some variable topography that may limit operability in some places. This property will likely only be operable during summer conditions due to the steep terrain and the remote location of the property. The ground can support a summer harvest if it remains dry. Operators should still take care to minimize rutting and compaction, and the administrating forester should step in to halt logging if these conditions occur.

There is no record of the last harvest on this parcel, but it must have been many years ago.

Stand 5-1

- Individual tree selection.
- Summer harvest, 2018-20.

This stand should be harvested using individual tree selection to maintain species and structural diversity. Average residual basal area should be between 70 and 90 square

feet per acre. In this stand, one tree per two acres that is greater than 12 inches in diameter, and has poor form and low value, should be made into an artificial tip-up. This will add more structure to the forest for habitat.

Stand 5-2

- Patch clearcuts.
- Summer harvest, 2018-20.

In this stand, the goal is to promote regeneration of cedar, which is not well represented across the ownership. Patch clearcutting should occur in areas with cedar regeneration while leaving mature cedar for seed trees. A matrix should be created that alternates three, one-acre clearcut patches with patches of forest. If the site can be harvested during dry ground conditions, getting some scarification on the site might help establish cedar and other shade intolerant species that need mineral soil.

Parcel 6

General Information

Access: Access to this parcel is available from Donken-Tapiola Road. There is a haul road that goes south from there to the parcel. The haul road is gated, with a lock, just off of Donken-Tapiola Road.

Boundaries: The north, east, and south boundaries were all painted blue, but no corner markers were seen.

Forest Health: No forest health issues were noticed, but Eutypella canker and sugar maple borer could be a concern in the future due to the species composition in the parcel.

Invasive Species: No invasive species were noticed, but the hemlock is at risk if hemlock woolly adelgid is introduced in the future. Also, the hardwoods are susceptible to Asian long-horned beetle, if introduced in the future.

Water/Wetlands: Bear Creek crosses the southwest corner of the parcel. A few places along the creek are considered wetlands by the National Wetlands Inventory. There are also a couple low spots that have perennial streams and vernal pools. A crossing is necessary to reach the southwest corner of the parcel, so the proper permit should be acquired from the DEQ.

Wildlife: There were signs of bear, deer, grouse, porcupine, and barred owl in this parcel. The dense patches of hemlock provide important winter habitat, especially for deer.

Soil:

Symbol	Soil Name	Percent Slope	Acres	Percent Area
98D	Munising-Yalmer complex, dissected	8-35	3.2	6%
130F	Munising-Alcona-Liminga complex, dissected	15-70	46.8	94%
Totals			50	100%

- Munising – This soil is moderately well drained and has low available water storage. Site index for sugar maple on this soil is 63 feet at age 50.
- Yalmer – This soil is moderately well drained with very low available water storage. The site index for sugar maple is 61 feet at age 50.
- Alcona – This soil is well drained and has high available water storage. Sugar maple has a site index of 61 feet at age 50 for this soil.
- Liminga – This soil type is well drained and has low available water storage. On this soil, the site index for sugar maple is 60 feet at age 50.

Stands

Stand 6-1

Description: This stand is about 23 acres of northern hardwoods with a hemlock component. The primary species are sugar maple and hemlock, with some yellow birch, red maple, and ironwood. The hemlock regeneration here is in very dense pockets.

Wood/Fiber Production: The stand is type Mh9, northern hardwoods and hemlock forest with overstocked sawtimber. The basal area is 120 square feet per acre.

Stand 6-2

Description: This stand is 27 acres of primarily northern hardwoods. The primary species is sugar maple, with some ironwood, red maple, and yellow birch.

Wood/Fiber Production: The stand is type M9, northern hardwoods with overstocked sawtimber. The basal area is 120 square feet per acre.

Silvicultural Recommendations

This parcel contains extremely variable topography that will limit operability in some places, especially in the western half. Conditions were wet during the time of inspection, which combined with the steep topography creates concerns about erosion. To minimize erosion, and other issues like compaction and rutting, harvest should take place under dry or frozen conditions. Operators should take care to minimize this kind of damage, and the administrating forester should step in to halt logging if these conditions occur.

Stands 6-1 & 6-2

- Individual tree selection with two small patch clearcuts.
- Dry or frozen harvest, 2018-20.

These stands should be combined for harvest. This stand should be harvested using individual tree selection to maintain species and structural diversity. Average residual basal area should be between 70 and 90 square feet per acre. Additionally, one tree per

two acres, greater than 12 inches in diameter and having poor form and low value, should be made into an artificial tip-up. This will add more structure to the forest, expose mineral soil for a regeneration substrate, and create microsites, with variable temperature and moisture that allow for hemlock and yellow birch regeneration and a generally more diverse ground flora. The operator should also not take trees that are already on the ground, unless necessary for operating.

Within these stands, there are two ½ to 1 acre areas where a small patch clearcut or large gap is recommended to promote the growth of established hemlock and white pine regeneration and provide opportunities for oaks and other shade intolerant species. One of the areas consists primarily of declining aspen 14 inches and above. The other area consists predominantly of balsam fir, white spruce and lower quality hardwood. Within each of these patches all stems 2 inches DBH and larger will be removed with the exception of any hemlock, cedar, white pine, red pine, red oak and elm that are present. Any standing dead or down trees will also be reserved.

If the site can be harvested during dry ground conditions, getting some scarification on the site might help other species compete with the dense sugar maple regeneration.

Parcel 7

General Information

Access: This parcel is accessible from Payter and Carlson Roads. There are some trails throughout that are grown over in some spots. A railroad grade cuts from the southeast corner to the northern boundary. A haul road runs along the north half of the eastern boundary.

Boundaries: The western boundary was flagged but unpainted, and the north boundary was painted. The southeast corner appears to have a monument across the road, where Payter and Carlson meet.

Forest Health: No forest health issues were observed. Due to forest type, the parcel is susceptible to sugar maple borer and Eutypella canker.

Invasive Species: No invasive species were noticed, but Asian long-horned beetle and hemlock woolly adelgid could pose threats if introduced.

Water/Wetlands: There is a stream the winds through the parcel which needs a DEQ permit to cross. There are also vernal pools throughout.

Wildlife: Signs of deer and porcupine were observed. The hemlock trees provide important winter habitat for several species of wildlife.

Soil:

Symbol	Soil Name	Percent Slope	Acres	Percent Area
59B	Graveraet-Ocqueoc-Kalkaska complex	1-8	1.1	1%
96D	Liminga fine sand	8-15	7.0	9%
148B	Graveraet-Ocqueoc-Kalkaska complex, dissected	1-12	2.7	3%
148D	Graveraet-Ocqueoc-Kalkaska complex, dissected	8-35	69.2	87%
Totals			80	100%

- Graveraet – This soil type is moderately well drained and has low available water storage. Sugar maple has a site index of 60 feet at age 50 on this soil.
- Ocqueoc – This soil is moderately well drained with moderate available water storage. Quaking aspen has a site index of 65 feet at age 50 for this soil.
- Kalkaska – This type of soil is somewhat excessively drained and has low available water storage. Site index for sugar maple on this soil is 64 feet at age 50.
- Liminga – This soil type is well drained and has low available water storage. On this soil, the site index for sugar maple is 60 feet at age 50.

Stands

Stand 7-1

Description: This stand is around 67 acres of primarily northern hardwoods. The primary species is sugar maple, with some yellow birch, red maple, and ironwood. Black cherry and northern red oak are more common in the southern portion of the stand.

Wood/Fiber Production: The stand is type M9, northern hardwoods with overstocked sawtimber. The basal area is 120 square feet per acre.

Stand 7-2

Description: This stand is 13 acres of northern hardwoods with a hemlock component. The primary species are sugar maple and hemlock. There are also some yellow birch, ironwood, and red maple.

Wood/Fiber Production: The stand is type Mh9, northern hardwoods and hemlock forest with overstocked sawtimber. The basal area is 120 square feet per acre.

Silvicultural Recommendations

This parcel is seasonally wet and should be harvested in winter on frozen ground. Operators should take care to minimize rutting and compaction, and the administrating forester should step in to halt logging if these conditions occur.

A single tree selection harvest was conducted in 2008-2009. This harvest removed high risk and low vigor trees while releasing crop trees. Oak trees were fully released and in some cases canopy gaps were created. There is an area in the southeast that was more like a shelterwood cut, due to the large amount of oak in this area. There was some under planting done in the spring of 2007, 2008, and 2009. Species planted were red oak, basswood, black cherry, and white pine.

Stand 7-1

Individual tree selection with group selection.

Winter harvest, 2020-22.

This stand contains species diversity in the parcel that should be maintained. Individual tree selection will provide small gaps for suppressed trees to take advantage of, and releases exiting regeneration. Group selection should also be implemented in areas of dense regeneration of non-maple species, or around non-maple crop trees, to promote further diversity in the species composition of the stands. Gaps in this stand should be around one-half acre in size. The average residual basal area should be 70 to 90 square feet per acre. Success of earlier plantings should be monitored and additional under-plantings considered.

Stand 7-2

No harvest/habitat improvement.

Winter, 2020-22.

This stand should be allowed to progress toward old-growth characteristics; no commercial harvest should take place in this stand. However, in an effort to create more structure, artificial tip-ups should be created within the stand, one per acre for a total of 13. These trees should be at least 12 inches in diameter, and be the trees with poorest form. These trees should be selected near the edge of the stand to allow the loggers to create the tip-ups without having to cut their way into the stand.

Records of Completed Treatments

Stand	Acres	Activity	Year	Notes
1-1	11.7			
1-2	28.0			
1-3	1.1			
2-1	14.2			
2-2	9.3			
2-3	2.9			
2-4	3.8			
2-5	3.4			
2-6	5.6			
2-7	0.6			
3-1	63.8			
3-2	5.9			
3-3	8.0			
4-1	79.4			
4-2	0.8			
5-1	33.7			
5-2	6.0			
6-1	23.3			
6-2	28.1			
7-1	66.8			
7-2	13.1			

Monitoring

The successful implementation of this Forest Stewardship Plan is dependent upon frequent monitoring by the landowner. The landowner or their agent (consulting forester) should walk the entire forest at least annually to inspect the forest for changes and to evaluate the success of earlier management activities. Monitoring for forest health issues should occur more frequently, at least two or three times a year to look for signs and symptoms of insects or disease during different seasons. Visiting all of the parcels multiple times a year may not be feasible for the landowner to do themselves and may be too expensive to hire a contractor to do. However, it may be possible to have students from Michigan Technological University to assist as part of class or a club.

The Guild also expressed interest in establishing permanent plots and collecting more data about ground flora, coarse woody debris, and other site characteristics. It may be possible to have students from Michigan Tech do some of this as well, as many classes have lab sections where this type of data is collected and interpreted. Items that could be monitored in this setting include:

- Difference in regeneration between stands with and without scarification.
- Health of any planted seedlings, particularly seedlings from southern seed zones or more southern species planted as part of the climate adaptation work.
- Effects of gap size on regeneration.
- Comparing the success of brush fencing or “cribbing” compared to deer fences or tree tubes.

Specific metrics will be developed closer to implementation. A table is included at the end of this plan to record notes and make modifications to this plan as needed.

Several levels and types of monitoring will be performed to ensure all management activities on the property are achieving the desired results. A summary of monitoring activities is presented in Table 7.

Table 7. Summary and timeline of monitoring activities.

Timeframe	Monitoring Activities			
Weekly (during harvest operations)	Inspection of harvest area by sale administrator			
Annually	Income and expense review	Harvest plan review	Pre-harvest cruise and planning	RSA and HCVF monitoring, MNFI review
Every 5 years	Review current imagery for landscape level changes including HCVF			
Every 10 years	Assess HCVF, RSA and element occurrences with heritage methodology	Complete cycle of routine forest inventory	Review data for progress towards desired future conditions	Refine and update management plan based on indicator data and updated goals/objectives

Monitoring Descriptions

Logger Performance

The forest managers will conduct a pre-harvest site visit with the logging contractor to discuss the details of the harvest and performance requirements. During active harvesting, the forest managers will conduct weekly timber sale site visits to ensure the logging contractors' activities are meeting the standards expected by the Guild. Logging contractors will also be required to provide a deposit refundable after the forest manager has completed the post-harvest timber sale assessment.

Expenses and Revenues

The forest manager should track time and expenses as part of an invoicing system. On an annual basis, the forest manager will compile a summary of expenses relating to the management of the property as well as a summary of the income generated from timber sales. Although it is not critical to have a positive balance in any given year, the long-term goal is to generate a profit from the timber sales in order to fund other conservation efforts conducted by the Guild.

Boundaries and Roads

As part of every timber sale and if applicable, property boundaries will be identified and marked with paint by the forest managers. If a new harvest takes place immediately adjacent to a property line, the adjoining landowner(s) will be notified. Guild staff or their designee may follow-up by posting boundary signs along such boundaries with private landowners as necessary. Road conditions, including road- stream crossings, will be monitored closely during harvest operations and during general property reconnaissance to identify areas of erosion or in need of maintenance or unauthorized use. Unauthorized use of decommissioned woods roads may be bermed or otherwise blocked.

Annual Meeting

An annual meeting with Guild staff and forest manager will be used to review the previous year's activities, including revenues, expenses, and success in achieving management goals. This meeting will provide an opportunity to evaluate the latest monitoring data, discuss the upcoming year's activities, and make any changes necessary to the management plan or other pertinent documents related to management.

Landscape Context

The property's contributions to landscape level conservation values will be assessed by a combination of reviewing new aerial imagery - when it is available - and by conducting ongoing operational inventory across the property. High resolution aerial imagery typically becomes available every 4-6 years from the State of Michigan. A review of this imagery will allow monitoring of any large-scale changes across the watershed, such as forest clearing or development on adjacent properties, or dramatic hydrologic changes to the surrounding open wetland communities.

RSA and HCVF

Annual monitoring of designated RSA and HCVF will be conducted by UPLC and forest managers. This periodic monitoring is intended to evaluate that ecological values are intact, and no new threats exist in the designated areas. The presence of invasive species or other non-native threats will need to be evaluated and management of the designated areas may be required as a result.

General Forest Management Implementation Protocol

Recommended forest management dates provided in this plan refer to a timeline for initiating implementation by contacting your consulting forester. These dates are determined by considering the current conditions of the forest and its anticipated growth rates. However timber markets, weather conditions and many other factors may impact the date in which a timber harvest actually occurs. It is important to note that in many cases, the timeframe from when a landowner contacts a consulting forester until the first tree is cut is often one to two years. This is due to the time it takes to schedule and implement the timber harvest layout, conduct any prescribed timber marking, and sign a contract with a logger. Additionally, once a contract is signed with a logger it will take them time to mobilize their harvesting equipment and begin the cutting. In most situations, a period of approximately three years is considered acceptable for the implementation of any recommended practice.

All stands receiving treatment within a parcel should be grouped together for sale when bid out to be harvested, even if receiving different treatments. Most of the stands are ready for harvest within the next ten years, and the suggested timeline reflects that. The primary strategy is to first harvest stands that are expected to decline in quality soonest.

Pre-Treatment Activity

Prior to the implementation of any treatment, the following details should be considered:

- Property boundaries should be checked or established if needed. This should be done either by or with the aid of a knowledgeable professional.
- Roads should be properly established or at least marked. This should be done either by or with the aid of a knowledgeable professional. If any roadwork near drainages or wet areas is required, the Department of Environmental Quality (DEQ) should be contacted at (906) 346-8300. The condition of roads should be documented, preferably with photographs, so that there is recourse if the roads are left in unacceptable condition following the completion of logging.
- Prescription implementation should be conducted either by or with the aid of a knowledgeable professional. If the prescription involves timber management, an experienced consulting forester should be involved.
- If treatment is implemented and income tax assistance is needed, Jim Burns with Burns Forestry Consultants (906) 364-3238 or Susan Metcalfe with Metcalfe Forestry (989) 348-3596 can be contacted.

Implementation of Timber Sale

The following should be done by or with the help of an experienced consulting forester. Timber sale preparation and administration work entails:

1. Establishing timber sale boundaries
 - a. Using blue tree marking paint along property boundaries **as needed**. Approximate property boundaries will be installed as needed to the satisfaction of the Landowner and all parties involved. These boundaries will be close to property lines but should in no way be considered exact property lines. If owner desires a boundary survey, a certified surveyor should be contracted.
 - b. Using red tree marking paint along timber sale boundaries
 - c. GPS all timber sale boundaries to determine acreages
2. Designating harvest areas and trees to be cut
 - a. Selection treatments (ITS and gap): Trees to be harvested should be marked with orange paint following the order of removals and gap creation guidelines in the prescription. Stands should be marked to reach the prescribed residual basal area.
 - b. Clearcut: All species within the stand area should be harvested, provided they are greater than two inches in diameter.
 - c. Patch clearcuts: Three one-acre patches should have boundaries painted in red and all species within should be cut. Only trees with a diameter greater than two inches should be removed.
 - d. Species removal: all designated species within the stand should be harvested. There is no need to mark trees for removal.
 - e. Habitat improvement: Stand boundaries should be painted in red and one tree per acre, near the edge, should be designated for tip-up creation and marked in yellow to indicate it is not to be taken out.
3. Inventory on all timber sale areas
 - a. Conduct an inventory to develop an estimate of the timber volume/value to be harvested.
4. Bid or negotiate the timber sale to obtain competitive stumpage prices with a reputable logging company.
5. Establish a "lump-sum" (gross payment) or "mill-scale" (pay as they cut) contract with a logging company requiring the following activities:
 - a. All roadwork needed for timber harvesting and removal operations
 - b. Harvesting of the designated trees
 - c. Processing of the wood products
 - d. Skidding of the wood products
 - e. Chipping of topwood (may be possible as desired)
 - f. Hauling of the wood products
6. Oversee the contract and logger throughout the duration of the contract to ensure quality work is being conducted through all operations onsite
 - a. Road Work
 - b. Tree Harvesting

Glossary of Forestry Terms

Basal Area- Measurement taken to evaluate forest density. Units expressed in square feet/acre. Represents the cross-sectional area of trees in the forest.

Canopy- The cover of branches and foliage formed collectively by the crowns of adjacent trees.

Co-dominant- Trees that are also in the overstory, usually right below the dominant trees.

Clay Soil- Soil class based on the size 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.

Crop Trees- Upper-crown residual trees of higher quality that will eventually form the final tree community at the time of stand maturity.

DBH- Diameter of individual trees measured at breast height (4.5 feet from the ground).

Ecosystem- The living and non-living components of an area that make up an environment.

Habitat Type- Particular ecosystem, which is classified based on soil type, forest type, and ground flora. Habitat types are used to help determine site management potential, limitations, and concerns.

Landscape Management- Consideration of the all the ecosystems within an area.

Loam- Soil that is made up of a mix of clay, silt and less than 50 percent sand particles.

Mature- The period of time that trees are fully developed and at their highest quality. The sized of the tree varies by species and site index.

Merchantable- Trees that are of a size and quality that can be harvested and sold.

Muck Soil- Soil type that is dark in color and fine in texture. It contains primarily well-decomposed organic material. It is poorly to very poorly drained and holds water throughout the year. This soil can be associated with wetlands.

Northern Hardwoods- A forest type including sugar maple, red maple, American basswood, yellow birch and white ash.

Old growth- An age class of a forest. Referring to a forest that is very old and unchanged by humans.

Over-mature- Trees that have grown beyond maturity and are beginning to decay.

Overstory- Trees within the forest forming the uppermost canopy layer.

Pole-sized tree- Usually immature or suppressed trees 6-12 inches in diameter (dbh).

Pre-Merchantable- Trees that are not of a size or quality to be harvested or sold

Pulp/Cord- A merchantable forest product measured in cords. One cord equals 128 cubic feet. Pulp logs are cut 100 inches long and must have a diameter of 4 inches or greater. They also must be reasonable straight and sound.

Regeneration- The smaller trees that establish on the forest floor

Release- Allow individual trees more room to expand their crowns. This increases tree production, health and vigor.

Residual- Forest volume or density after a timber harvest.

Sawlog-sized tree- Larger, usually older trees 12 + inches in diameter (dbh). These trees meet the minimum diameter specs. for sawlog products.

Sawtimber/MBF- A merchantable forest product measured in MBF (thousand board feet). One board foot equals 1ft by 1 ft by 1 inch.

Sandy Loam Soil- Soil class that is a little finer in texture than sand, containing some silt and clay mixed with sand.

Sandy Soil- Soil class based on the size of mineral fragments (0.05 - 2.0 millimeters in diameter). Sandy soils are considered to be coarse and well-drained.

Sapling- Small and young trees, 1 – 4 inches in diameter (dbh) and 6 – 20 feet tall.

Scarification- Lightly disturb forest floor to expose bare soil. Generally for the purpose of creating a seedbed for desired tree species that require such conditions.

Seedling- Small and young trees, less than 1 inch in diameter (dbh) and less than 5 feet tall.

Silt Soil- Soil class based on the size of mineral fragments (0.05 - 0.002 millimeters in diameter). Silt soils are considered to be fine but not as fine as clay. They are fair to poorly drained, meaning that they hold water during wet times of the year.

Site Index- A measure of productiveness based on the height of the dominant trees in a stand at a base age. Largely influenced by the soil composition and climate.

Stand- Land areas grouped together based on their forest and vegetative species structure, site quality, and current conditions. Stands are usually greater than 2 acres in size.

Succession- Refers to the natural evolution of a forest over time and can be measured by the species composition of the forest.

Tree Stocking- Term used to express the density of the trees in a forest.

Understory- Trees within the forest growing beneath the overstory.

Vernal Ponds- Pools of water that form in the forest during the wet seasons

Parcel Maps

Three maps are available for each parcel in a companion maps document:

1. Soils
2. Stands
3. Management Activities

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