Natural Community Surveys of Thunder Bay Island



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Prepared For: Huron Pines

October 31, 2026
Report Number 2026-23

Michigan Natural Features Inventory

MICHIGAN STATE UNIVERSITY | Extension

Suggested Citation: Cohen, J.G., J.M. Lincoln, S.M. Warner, and H.D. Enander. Natural Community Surveys of Thunder Bay Island. Michigan Natural Features Inventory, Report Number 2026-23, Lansing, MI. 58 pp.

Cover Photo: Alvar, Thunder Bay Island. Photo by Joshua G. Cohen.

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Land Acknowledgement: We collectively acknowledge that Michigan State University occupies the ancestral, traditional, and contemporary Lands of the Anishinaabeg – Three Fires Confederacy of Ojibwe, Odawa, and Potawatomi peoples. In particular, the University resides on Land ceded in the 1819 Treaty of Saginaw. We recognize, support, and advocate for the sovereignty of Michigan's twelve federally-recognized Indian nations, for historic Indigenous communities in Michigan, for Indigenous individuals and communities who live here now, and for those who were forcibly removed from their Homelands. By offering this Land Acknowledgement, we affirm Indigenous sovereignty and will work to hold Michigan State University more accountable to the needs of American Indian and Indigenous peoples.

As ecologists, we further acknowledge that Indigenous peoples and their cultural practices were and are integral to the healthy, functioning natural ecosystems that we strive to understand and conserve. The definition of natural communities presented in this report recognizes this fact.

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Acknowledgements

This project was funded by Huron Pines through a grant from the National Fish and Wildlife Foundation - Sustain Our Great Lakes program. We are grateful to Amber Hubbard and Samantha Nellis for sponsoring this project. In addition, Amber assisted with natural community surveys. We are grateful to Bill Parsons and Derek Hartline with the Little Traverse Bay Bands of Odawa Indians Natural Resources Department for providing transport to Thunder Bay Island and assisting with natural community surveys. We also thank Dan Braden and the Thunder Bay Island Lighthouse Preservation Society for providing transport to the island and stewardship of the island's cultural resources. We are grateful to the Bureau of Land Management (BLM) and the Charter Township of Alpena for allowing access to the study sites and for their ongoing stewardship of these public lands. Numerous current and former Michigan Natural Features Inventory (MNFI) staff contributed to this work including Mike Penskar, Michael Monfils, Katelyn Brolick, Sarah Carter, Debra Richardson, Rebbeca Rogers, and Kraig Korroch.



We are indebted to Huron Pines and Little Traverse Bay Bands of Odawa Indians for facilitating surveys of Thunder Bay Island. We conducted natural community surveys on Thunder Bay Island in 2026 in concert with Amber Hubbard from Huron Pines and Bill Parsons and Derek Hartline with the Little Traverse Bay Bands of Odawa Indians Natural Resources Department. Photos by Joshua G. Cohen.





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Introduction

Thunder Bay Island is one of more than 32,000 islands that occur across the Great Lakes and in the connecting channels (Henson et al. 2010). Great Lakes islands provide critical habitat for native biodiversity and support rare and endemic natural communities. Many of the islands within this diverse assemblage are remote, difficult to access, and challenging to survey due to lack of infrastructure and rugged terrain. Despite limited access, these islands face a variety of threats to native biodiversity and rare taxa including establishment and spread of invasive plant and animal species, the impacts of climate change (Preisser et al. 2026). However, within these unique geographies biodiversity data is limited or outdated, which hinders effective management and decision-making.

Thunder Bay Island was last evaluated by Michigan Natural Features Inventory (MNFI) scientists over 45 years ago back in 1981. To address this information gap, Huron Pines contracted MNFI to conduct natural community surveys on Thunder Bay Island in 2025 and 2026. This report provides updated information on the condition, composition, and distribution of natural communities to inform biodiversity conservation and stewardship planning on Thunder Bay Island.

A natural community is defined as an assemblage of interacting plants, animals, and other organisms that repeatedly occurs under similar environmental conditions across the landscape and is predominantly structured by natural processes rather than modern anthropogenic disturbances such as timber harvest, hydrological alteration, and fire suppression. Indigenous peoples have been integral to Michigan's landscapes, with many natural community types shaped by native land tending practices such as cultural burning, seeding, planting, and harvesting of plants, wildlife, and fish (Cohen et al. 2015, Cohen et al. 2025). This cultural stewardship has been responsibly implemented with sophistication and care at seasonally appropriate times (Kimmerer and Lake 2001, Stewart 2009). MNFI's natural community classification recognizes 80 natural community types in Michigan. Protecting and managing representative natural communities is critical to biodiversity conservation, since native organisms are best adapted to environmental and biotic forces with which they have evolved over the millennia.

The primary goal of this project was to collect new data for natural communities to provide natural resource managers and planners with accurate,



Alvar, Thunder Bay Island. Thunder Bay Island was last surveyed by Michigan Natural Features Inventory in 1981. Photo by Joshua G. Cohen.

detailed, standardized baseline information on the current status of ecosystems on Thunder Bay Island that can help guide biodiversity stewardship and restoration and ongoing planning efforts. Qualitative surveys in 2025 and 2026 assessed the integrity, classification, and delineation of natural community occurrences and detailed the current vegetative structure and composition, ecological boundaries, landscape and abiotic context, threats, management needs, and restoration opportunities associated with each site. This baseline information is critical for facilitating site-level decisions about biodiversity stewardship; prioritizing protection, management and restoration; monitoring the success of management and restoration; and informing landscape-level biodiversity planning efforts. This report summarizes the findings of MNFI's natural community surveys and also presents a prioritization of stewardship and monitoring of the natural communities documented on Thunder Bay Island.



Figure 1. 1938 aerial imagery of Thunder Bay Island.



Figure 2. Natural community surveys were conducted in 2025 and 2026 on Thunder Bay Island.

Methods

Study Area

Thunder Bay Island is located in Thunder Bay in Lake Huron, approximately 3 km to the northeast of North Point, near Alpena (Figures 1 and 2). Thunder Bay Island is approximately 0.5 km wide at its widest and 2.5 km long on the north-south axis, for a total area of approximately 215 acres (87 ha). The bedrock under Thunder Bay Island consists of limestone from the Middle Devonian Period, as part of the Traverse Group that was deposited approximately 390 million years ago in a shallow marine environment (Milstein 1987). The topography of Thunder Bay Island is flat to gently sloping. The islands and mainland coasts of Thunder Bay were the historical home to Anishinabek peoples (Native Americans in Michigan Genealogy Research Center 2008).

Thunder Bay Island is the outermost island in a group of islands connected to the north point of Thunder Bay by a shallow bank of numerous rocks, most of which are submerged. A light tower was constructed in 1832 to warn mariners of these dangerous reefs extending from the island. This is one of the oldest light stations in Lake Huron. In the mid-1800s, a fishing village was established on Thunder Bay Island to take advantage of this reef system and associated fishery. At its peak, the fishing village supported over one hundred and sixty people with thirty-one fishing boats that harvested over twelve thousand barrels of fish each year. When that settlement was abandoned, some villagers relocated to nearby Sugar Island, which is approximately 1 km west of Thunder Bay Island (Alpena Area Convention and Visitors Bureau n.d.). Localized logging within the boreal forest on Thunder Bay Island and Sugar Island reached its peak during this time. The southern third of the island is part of Alpena Township. The northern two-thirds of Thunder Bay Island is owned and managed by the Bureau of Land Management whose mission is to sustain the health, diversity, and productivity of public lands for the use and enjoyment of present and future generations. Currently, access to the island is mostly limited to the U.S. Coast Guard, Bureau of Land Management staff, and members of the Thunder Bay Island Preservation Society.

Field Survey Prioritization

The MNFI natural community classification system was used as the classification framework for this survey effort (Cohen et al. 2015; Cohen et al. 2025) and nomenclature of plant species follows Michigan Flora Online (Reznicek et al. 2011). Prior to field surveys, MNFI ecologists conducted GIS analysis and aerial photo interpretation to identify potential survey targets including both previously delineated natural communities and potential undocumented natural communities. To assist with delineation, multiple series of aerial imagery and spatial data layers were evaluated: this included historic (Figure 3), contemporary, natural color, color infrared, and hillshade imagery, and circa 1800 vegetation. Two high-quality natural communities were known from

Global / State Conservation Status Rank Combination	Ecological Integrity Assessment Rank			
	A Excellent Integrity	B Good Integrity	C Fair Integrity	D Poor Integrity
G1S1, G2S1, GNRS1, GUS1				
G2S2, GNRS2, G3S1, G3S2, GUS2				
GUS3, GNRS3, G3S3, G4S1, G4S2, G5S1, G5S2, any SNR				
G4S3, G4S4, G5S3, G5S4, G5S5, GNRS4, GNRS5, GUS4, GUS5				
Red Shading = Natural Community Survey Targets				

Figure 3. Decision matrix to determine natural community survey targets (NatureServe 2002; Rocchio et al. 2018). See Appendix 1 for definition of State and Global Ranks.

Thunder Bay Island and included boreal forest and limestone bedrock lakeshore.

The targets for the natural community assessments were prioritized based on the rarity and estimated integrity of the preliminarily delineated natural communities using the Natural Heritage sampling prioritization principal. This prioritization principal emphasizes that natural community survey efforts should be focused on the rarest and highest quality natural communities (Figure 3) (NatureServe 2002; Rocchio et al. 2018). Rarity is determined by evaluating a natural community's conservation status both at the state and global levels (i.e., S and G Ranks) (Appendix 1). Integrity is determined by employing Natural Heritage methodology, which considers three factors to assess a natural community's ecological integrity or quality: size, landscape context, and condition (Faber-Langendoen et al. 2008).

Field Survey

A qualitative, plotless sampling design was employed to survey natural communities on Thunder Bay Island. MNFI ecologists evaluated each natural community type through meander surveys. These surveys involved investigating unique aerial signatures, traversing topographic variation, and visiting noticeable vegetation zones and soil moisture types. A GPS unit in tracking mode was used during the meander surveys to create a record of routes taken within the surveyed natural community polygons. Prioritized communities (rare community types and high-quality examples of any community type) received more survey effort than common and degraded communities. According to Natural Heritage methodology, if a site meets requirements for ecological condition, landscape context, and size (MNFI 1988), it is categorized as a high-quality example of that specific natural community type, entered into MNFI's database as an element occurrence, and given a letter rank of A to D – excellent to poor – based on how well it meets the above criteria. Throughout this report, a documented occurrence of a high-quality natural community at a specific location is referred to as an "element occurrence" (EO). Ecological field surveys were conducted during the growing season to evaluate the condition and classification of the sites. To assess natural community size and landscape context, a



For each high-quality natural community element occurrence, MNFI ecologists compiled comprehensive plant species. Limestone bedrock lakeshore, Thunder Bay Island. Photo by Joshua G. Cohen..

combination of field surveys, aerial photographic interpretation, and Geographic Information System (GIS) analysis was employed.

The ecological field surveys involved:

a) compiling comprehensive plant species lists to be summarized in a floristic quality index and noting dominant, co-dominant, and representative species

b) estimating percent coverage of prevalent or key overstory and understory species

c) describing site-specific structural attributes (e.g., vegetative zonation, vegetative strata, and coarse woody debris) and ecological processes (e.g., windthrow, wildfire, water level fluctuation)

d) measuring tree diameter at breast height (DBH) of representative canopy trees and aging canopy dominants (where appropriate)

e) analyzing soils and recording representative soil texture, pH, and depth

f) describing hydrology (e.g., noting high water marks, indicator vegetation, and soil mottling)

g) noting current and historical anthropogenic disturbances (e.g., trails and logging)

h) evaluating potential threats to ecological integrity (e.g., invasive plant species) with an emphasis on recording geospatial locations of invasive plant infestations

i) ground-truthing aerial photographic interpretation using GPS (Garmin units and Samsung Tablets were utilized)

j) taking digital photos and GPS points at significant locations

k) surveying adjacent lands to assess landscape context

l) evaluating the natural community classification and mapped ecological boundaries

m) determining the ecological integrity of mapped high-quality natural communities by assigning element occurrence ranks

n) noting stewardship and monitoring needs and restoration opportunities



A qualitative, plotless sampling design was employed to survey natural communities on Thunder Bay Island. Alvar, Thunder Bay Island. Photo by Joshua G. Cohen.

Natural community surveys were conducted on Thunder Bay Island over the course of two field seasons. In 2025, surveys were conducted on September 10th. In 2026, surveys were conducted June 4th. Surveys were conducted by foot and were facilitated by Little Traverse Bay Bands of Odawa Indians staff, Huron Pines staff, and volunteers with the Thunder Bay Lighthouse, who provided logistical and nautical support. Prior to this survey effort, natural community surveys had been last conducted by MNFI staff on Thunder Bay Island in 1981.

Following completion of field surveys, the data were analyzed and transcribed to update or create element occurrence records in MNFI's statewide biodiversity conservation database (MNFI 2026). Tracks and GPS points collected during the field visits were transposed on aerial imagery to facilitate the generation of natural community boundaries for new element occurrences and update existing element occurrences. Data compiled from the field surveys were used to produce site descriptions, threat assessments, and management recommendations for each natural community element occurrence, which appear within the **Survey Results** section.

For each high-quality natural community, floristic data were compiled into the Universal Floristic Quality Assessment Calculator (Reznicek et al. 2014, Freyman et al. 2016) to determine the Floristic Quality Index (FQI) for each natural community element occurrence. The floristic quality assessment is derived from a mean coefficient of conservatism and floristic quality index. Each native species is assigned a coefficient of conservatism, a value of 0 to 10 based on probability of its occurrence in a natural versus degraded habitat. Species restricted to a specialized or undisturbed habitat are assigned a value of 10, implying the species has extremely strong fidelity to a specific habitat. Native species that are not particular or indicative of natural conditions are assigned a low value of 0 or 1. The coefficient of conservatism is determined by experts on the flora of a region, and so may vary for a given plant species from region to region. We employed a regionally appropriate FQA for Michigan (Reznicek et al. 2014). From the total list of plant species for an area, a mean C value is calculated and then multiplied by the square root of the total number of plant species to calculate the FQI. Michigan sites with an FQI of 35 or greater possess sufficient conservatism and richness that they are considered floristically important from a statewide perspective (Herman et al. 2001). Species lists for each natural community element occurrence are provided in Appendix 2. We provide a crosswalk of Anishinaabemowin or Ojibwe names to scientific and common names in Appendix 3 for all plant species observed on Thunder Bay Island that are listed in "Plants used by the Great Lakes Ojibwa" (Meeker et al. 1993).



Comprehensive plant lists were compiled for each high-quality natural community element occurrence. Alvar, Thunder Bay Island with scarlet paintbrush (*Castilleja coccinea*) in the foreground. Photo by Joshua G. Cohen.

Natural Community Stewardship Prioritization

MNFI developed a scoring matrix for natural community element occurrences to provide a framework for the prioritization of stewardship and monitoring. For this scoring matrix, we developed the following three indices: an ecological integrity index, a rarity index, and an invasive index (Figure 4). We used the element occurrence rank to develop the ecological integrity rank, with higher scores for higher-ranked element occurrences. The rarity index was developed by assigning a score for each natural community type's state rank and global rank (Appendix 1) and averaging the two scores. For both state and global ranks, higher scores were assigned to rarer types. For the rarity index, global ranks with a "U" modifier (i.e., boreal forest) were assigned the state rank score for global rank score. In addition, for global ranks with a "?" modifier (i.e., alvar), the numeric global rank was used to assign the global rank score. The invasive index was developed by calculating the average of an invasive threat severity index and a treatment feasibility index. The threat severity index was developed using knowledge of impacts of invasive plant species to natural community types and site-specific information gained during surveys on invasive infestations. Higher scores for the threat severity index correspond to increased degradation due to invasive infestation. The treatment feasibility index was derived by assigning a score to each natural community element occurrence based on the ease of treating the invasive species recorded within that site. Higher scores for the treatment feasibility index correspond to a greater likelihood of successful treatment and control of targeted invasive species. Each index was scored on a scale of 0 to 5. For each natural community element occurrence, the sum of the scores for the ecological integrity index, rarity index, and invasive index was calculated to sort the natural community element occurrences by their stewardship and monitoring prioritization score. Higher scores indicate a higher priority for stewardship intervention. The stewardship prioritization for the natural community element occurrences is presented in the **Stewardship and Monitoring Prioritization Results** section.

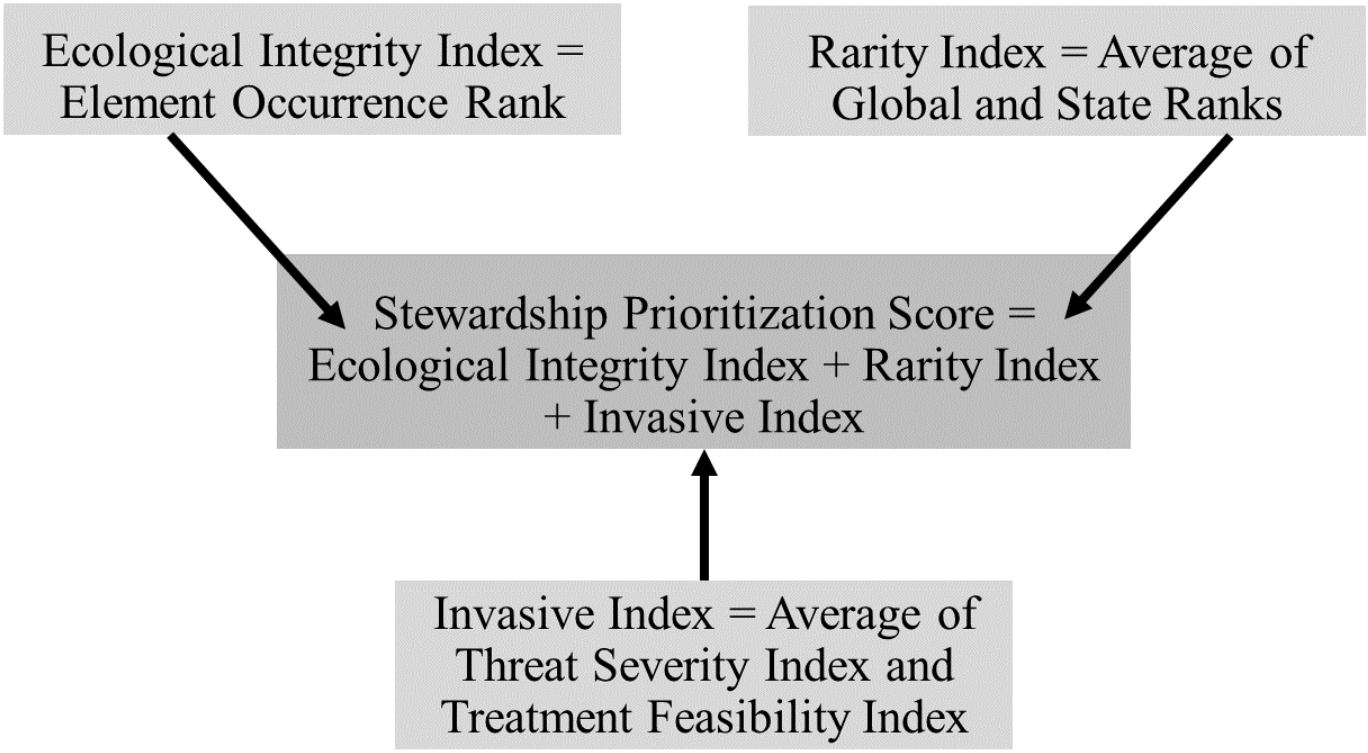


Figure 4. The Stewardship Prioritization score is the sum of the Ecological Integrity Index, Rarity Index, and Invasive Index. This prioritization scoring was derived to help focus finite resources for biodiversity stewardship and monitoring.

Survey Results

Four natural communities were surveyed during the 2025 and 2026 field season including alvar, boreal forest, limestone bedrock lakeshore, and limestone cobble shore (Figure 5). Table 1 lists the visited sites and their element occurrence ranks. We provide detailed **Site Summaries** for each of the natural community element occurrences surveyed on Thunder Bay Island.

The following site summaries summarize threats and management recommendations for each of the natural community element occurrences visited. In addition, we provide an overview of the natural community types adapted from MNFI's natural community classification (Cohen et al. 2015 and Cohen et al. 2025) and an accompanying ecoregional distribution map for each natural community type (Albert et al. 2008). For each site summary, we provide the following information:

a) site name
b) natural community type
c) global and state rank (see Appendix 1 for ranking criteria)
d) element occurrence rank
e) size
f) locational information
g) digital photograph(s)
h) site description
i) threat assessment
j) management recommendationa

Table 1. Natural community element occurrences (EOs) surveyed in 2025 and 2026 on Thunder Bay Island. EO rank abbreviations are as follows: AB, excellent to good estimated viability; B, good estimated viability; and C, fair estimated viability.

Community Type	EO ID	Site Name	Acreage	EO RANK
Alvar	28704	Thunder Bay Island	10	B
Boreal Forest	4501	Thunder Bay Island	87	C
Limestone Bedrock Lakeshore	201	Thunder Bay Island	30	AB
Limestone Cobble Shore	28703	Thunder Bay Island	34	C



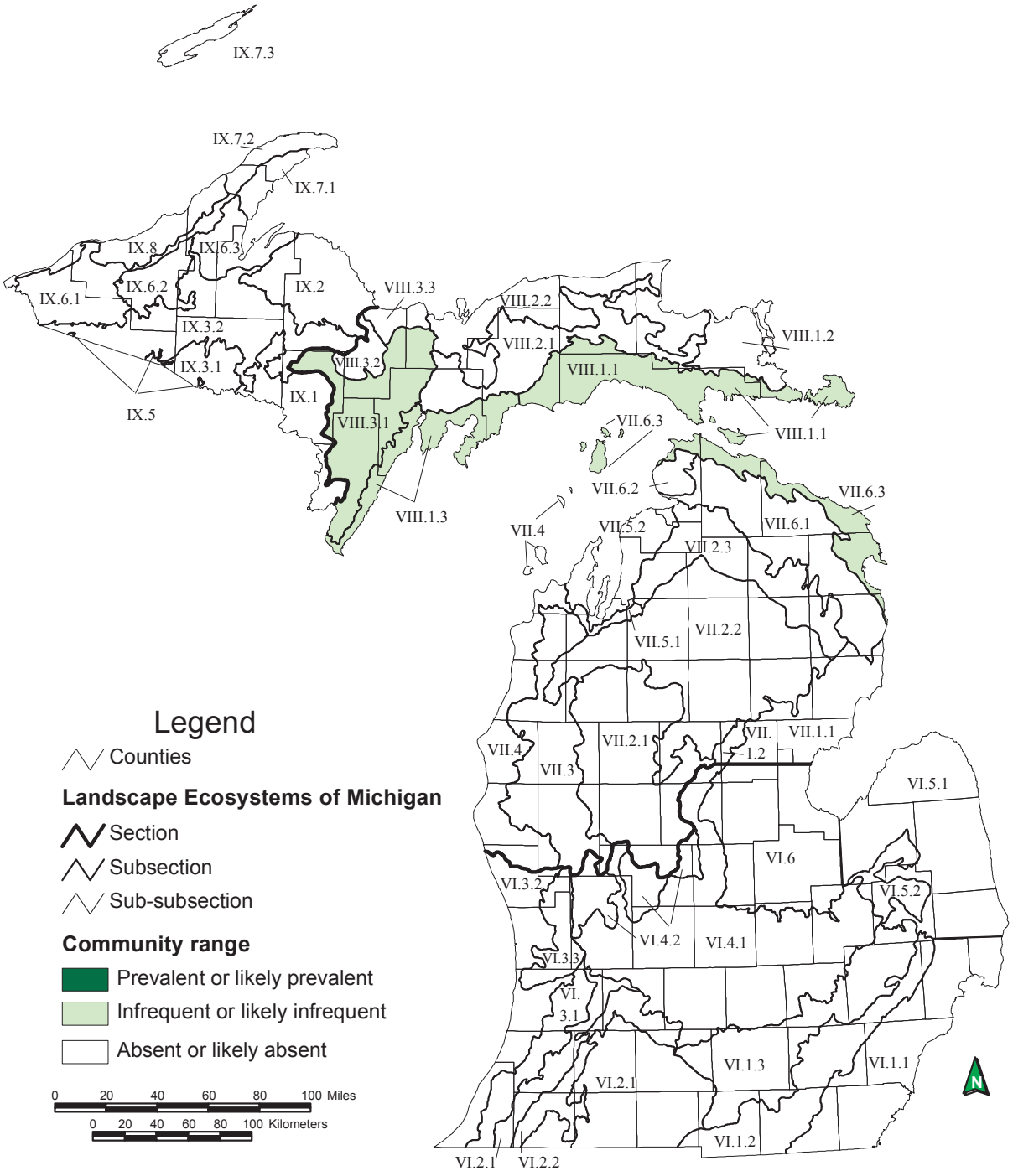
Limestone bedrock lakeshore, Thunder Bay Island. Photo by Joshua G. Cohen.



Figure 5. Natural community element occurrences on Thunder Bay Island.

ALVAR

Overview: Alvar is a grass- and sedge-dominated community that occurs on broad, flat expanses of calcareous bedrock (limestone or dolomite) near the shorelines of Lakes Huron and Michigan in the Upper Peninsula and northeastern Lower Michigan and locally along the Escanaba River in the central Upper Peninsula. The calcareous bedrock is often covered by a thin veneer of mildly to moderately alkaline loamy sand or sandy loam, but areas of exposed limestone and dolomite are common. Natural processes that influence species composition and community structure include extreme fluctuations in soil moisture ranging from inundation in spring to drought in summer, windthrow, and occasional fires. In addition to grasses, sedges, and forbs, alvar supports scattered patches of shrubs and trees, and mosses and lichens are locally prevalent (Cohen et al. 2015, Cohen et al. 2025).



Map 1. Distribution of alvar in Michigan (Albert et al. 2008).

1. Thunder Bay Island – Alvar
Natural Community Type: Alvar
Rank: G2? S1, likely globally imperiled and critically imperiled within the state
Element Occurrence Rank: B
Size: 9.7 acres (3.9 hectares)
Location: Thunder Bay Island, Bureau of Land Management and Alpena Township, Lake Huron, Michigan
Element Occurrence Identification Number: 28704

Site Description: Two distinct polygons of alvar occur on Thunder Bay Island in Lake Huron. This represents the first documented alvar in Michigan's Lower Peninsula and only the sixth known occurrence statewide. The alvar occurs inland from extensive limestone bedrock lakeshore, above the zone of high-water influence. Unlike the adjacent lakeshore, which is periodically scoured by storm waves and ice, the alvar experiences greater ecological stability, allowing soils to accumulate and persist across portions of the limestone pavement. These conditions support a diverse assemblage of native plants, including several rare species and numerous prairie plants, and distinguish the alvar from the more sparsely vegetated shoreline. The complex of alvar, limestone bedrock lakeshore, and limestone cobble shore are backed by boreal forest in the interior of Thunder Bay Island.

The alvar occurs on limestone of the Middle Devonian Traverse Group that is approximately 2,000 feet deep and was deposited 300 to 400 million years ago in a shallow marine environment. The soils of the alvar overlying the limestone bedrock are characterized by shallow (2-10 cm), alkaline (pH 7.8-8.0) organics and loams that accumulate in cracks, crevices, and depressions. A 40 cm northern white-cedar (*Thuja occidentalis*) was cored, and 133 growth rings were counted.

The alvar is dominated by graminoids with low shrubs prevalent and scattered tall shrubs and stunted trees. The herbaceous layer is variable, ranging from 25 to 70% cover with many areas dominated by open



Alvar, Thunder Bay Island. Photo by Joshua G. Cohen.

limestone pavement lacking vascular cover. Prevalent graminoids include big bluestem (*Andropogon gerardii*), blue-joint (*Calamagrostis canadensis*), hair grass (*Deschampsia cespitosa*), little bluestem (*Schizachyrium scoparium*), ticklegrass (*Agrostis scabra*), panic grasses (*Dichanthelium boreale*, *D. implicatum*, and *Panicum flexile*), sedges (*Carex viridula* and *C. buxbaumii*), twig-rush (*Cladium mariscoides*), golden-seeded spike rush (*Eleocharis elliptica*), and beak-rush (*Rhynchospora capillacea*). Bulrush sedge (*Carex scirpoidea*, State Threatened) and trisetum (*Graphephorum melicoides*, State Special Concern) occur locally within the alvar and butterwort (*Pinguicula vulgaris*, State Special Concern) occurs along the margin of wet depressions within the alvar. Characteristic forbs include silverweed (*Potentilla anserina*), grass-of-parnassus (*Parnassia glauca*), bastard-toadflax (*Comandra umbellata*), false asphodel (*Triantha glutinosa*), bird's-eye primrose (*Primula mistassinica*), wild strawberry (*Fragaria virginiana*), scarlet paintbrush (*Castilleja coccinea*), purple false foxglove (*Agalinis purpurea*), glaucous white lettuce (*Prenanthes racemosa*), white camas (*Anticlea elegans*), wild columbine (*Aquilegia canadensis*), balsam ragwort (*Packera paupercula*), and goldenrods (*Solidago nemoralis* and *S. ohioensis*).

Prevalent shrubs and tree seedlings in the low shrub layer (15-35%) include bearberry (*Arctostaphylos uva-ursi*), shrubby cinquefoil (*Dasiphora fruticosa*), bush-honeysuckle (*Diervilla lonicera*), sand cherry (*Prunus pumila*), Kalm's St. John's-wort (*Hypericum kalmianum*), creeping juniper (*Juniperus horizontalis*), sweet gale (*Myrica gale*), poison-ivy (*Toxicodendron rydbergii*), soapberry (*Shepherdia canadensis*), red-osier (*Cornus sericea*), ninebark (*Physocarpus opulifolius*), and northern white-cedar (*Thuja occidentalis*), balsam fir (*Abies balsamea*), and tamarack (*Larix laricina*) seedlings. Tall shrubs (2-8%) include and shadbush serviceberry (*Amelanchier spicata*), soapberry, red-osier, and ninebark. Scattered and stunted trees (1-5%) include northern white-cedar, tamarack, balsam fir, paper birch (*Betula papyrifera*), and white spruce (*Picea glauca*).

The Thunder Bay Island alvar was surveyed September 10th, 2025, and June 4th, 2026. Seventy-nine plant species were documented with 72 native species and 7 non-native species (Appendix 2.1). The total FQI was 46.2, the total native FQI was 48.4, and the total mean C value was 5.2.



The alvar occurs above the zone of high-water influence and is characterized by greater soil accumulation than the adjacent limestone bedrock lakeshore, which is subject to periodic scouring from storm waves and ice. As a result, the alvar is ecologically more stable and supports a unique floristic assemblage that includes numerous prairie plants, including big bluestem (*Andropogon gerardii*). Photo by Jesse M. Lincoln.



2022 aerial photograph of Thunder Bay Island alvar.

Threats: Species composition and vegetative structure of the alvar are patterned by natural processes. Non-native species found infrequently within the alvar include purple loosestrife (*Lythrum salicaria*), white sweet-clover (*Melilotus albus*), wild parsnip (*Pastinaca sativa*), fairy flax (*Linum catharticum*), curly dock (*Rumex crispus*), redtop (*Agrostis gigantea*), and Canada bluegrass (*Poa compressa*).

Management Recommendations: The main management recommendations are to allow natural processes to operate unhindered, retain an intact buffer of natural communities surrounding the alvar, and control and monitor for invasive species (i.e., purple loosestrife and white sweet-colver). In addition, the adjacent shoreline should be periodically monitored for invasive species infestations. Invasive species found in the nearby limestone bedrock lakeshore and limestone cobble shore should be controlled, particularly spotted knapweed (*Centaurea stoebe*) and narrow-leaved cat-tail (*Typha angustifolia*). An invasive management plan should include ongoing monitoring and follow-up treatment.

Increasing recreational interest in Thunder Bay Island presents an additional potential threat to the alvar. The shallow soils and sparse vegetation are vulnerable to trampling and repeated foot traffic, which can damage vegetation, encourage the establishment of informal or social trails, and facilitate the introduction and spread of invasive species. Recreational access and any future tourism development should be carefully planned to avoid the alvar and other sensitive natural communities. New trails, recreational infrastructure, and concentrated visitor use should be directed away from the alvar and limestone bedrock lakeshore, and existing access routes should be evaluated to minimize impacts. Maintaining the integrity of the alvar and limestone bedrock lakeshore should take precedence over expanding recreational access.



Alvar, Thunder Bay Island. Photo by Joshua G. Cohen.

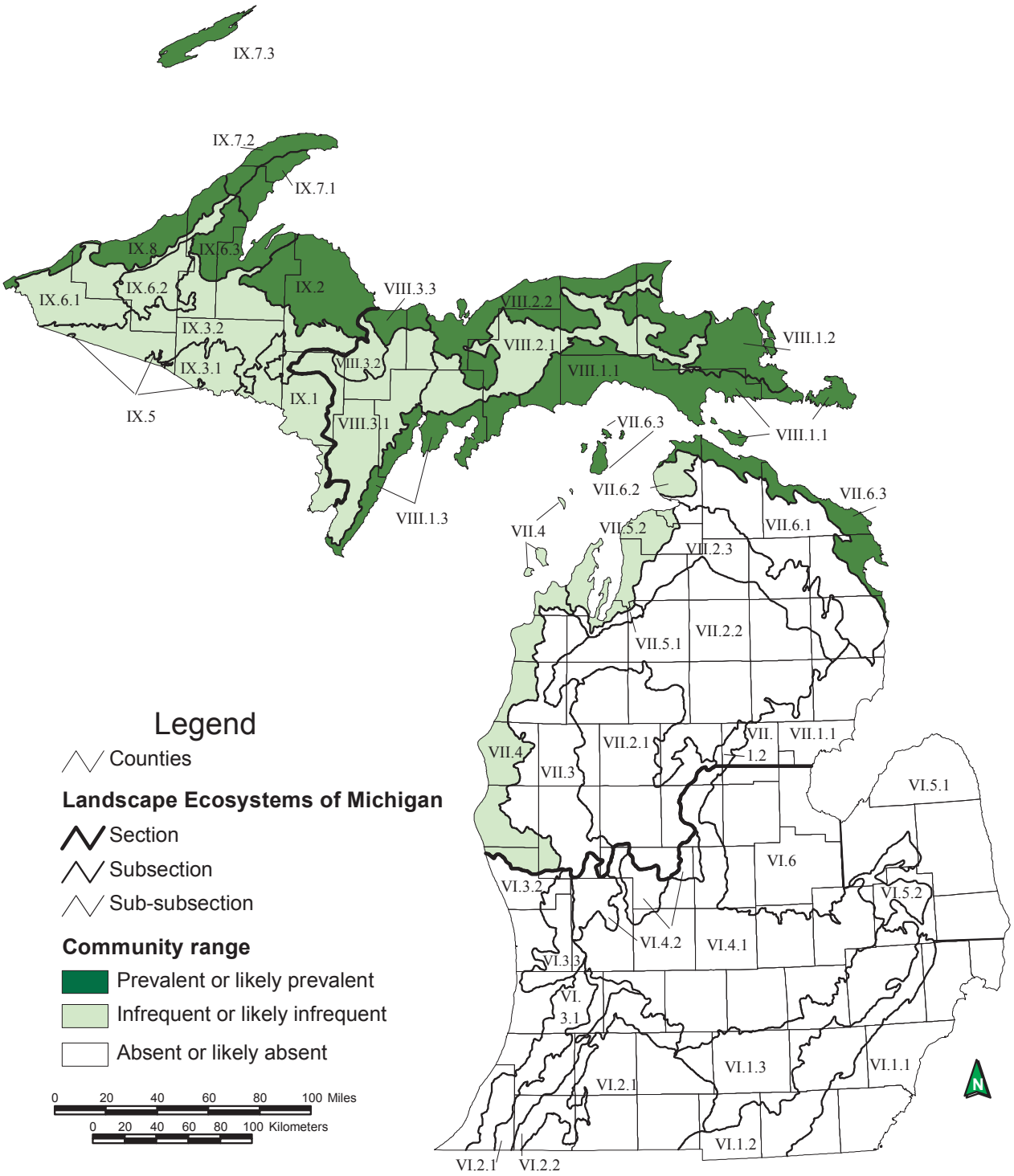


The alvar is floristically diverse with patches of prairie grasses along the upper margin (above) and localized areas of stunted and scattered conifers and shrubs occurring where soils are locally deeper (below). Photos by Jesse M. Lincoln (above) and Joshua G. Cohen (below.



BOREAL FOREST

Overview: Boreal forest is a conifer or conifer-hardwood forest type occurring on moist to dry sites characterized by species dominant in the Canadian boreal forest. It typically occupies upland sites along shores of the Great Lakes, on islands in the Great Lakes, and locally inland. The community occurs north of the climatic tension zone primarily on sand dunes, glacial lakeplains, and thin soil over bedrock or cobble. Soils of sand and sandy loam are typically moderately acid to neutral, but heavier soils and more acid conditions are common. Proximity to the Great Lakes results in high levels of windthrow and climatic conditions characterized by low summer temperatures and high levels of humidity, snowfall, and summer fog and mist. Additional important forms of natural disturbance include fire and insect epidemics (Cohen et al. 2015, Cohen et al. 2025).



Map 2. Distribution of boreal forest in Michigan (Albert et al. 2008).

2. Thunder Bay Island – Boreal Forest
Natural Community Type: Boreal Forest
Rank: GU S3, globally unrankable and vulnerable within the state
Element Occurrence Rank: C
Size: 87 acres (35 hectares)
Location: Thunder Bay Island, Michigan Islands National Wildlife Refuge and Alpena Township, Lake Huron, Michigan
Element Occurrence Identification Number: 4501

Site Description: Boreal forest occurs on Thunder Bay Island in Thunder Bay in Lake Huron. Thunder Bay is distinguished by frequent storm events. Windthrow is prevalent throughout the boreal forest, which is characterized by moderate levels of coarse woody debris. The coarse woody debris load is primarily composed of early-successional species, namely paper birch (*Betula papyrifera*). The boreal forest is characterized by flat to gently rolling topography. Soils are characterized by shallow (5-10 cm) loams mixed with organics that are alkaline (pH 7.8-8.0) over limestone cobble. Charring on tree boles and stumps indicates that wildfire has impacted this boreal forest and past fire events likely are correlated with land clearing and logging in the mid-1800s associated with the fishing village. A 43.5 cm white spruce (*Picea glauca*) was cored and 110 growth rings were counted. A 66.1 cm northern white-cedar (*Thuja occidentalis*) was cored and 116 growth rings were counted on a partial core. This tree is estimated to be over 200 years old.

The boreal forest includes a small inclusion of limestone bedrock glade and northern fen, which both occur along the east-central portion of the island. The limestone bedrock glade is dominated by scattered and stunted northern white-cedar. Within the limestone bedrock glade a 22.3 cm northern white-cedar was cored, and 366 growth rings were counted. In addition, a 21.5 cm northern white-cedar had 152 rings, and a 27 cm northern white-cedar had 167 rings. Soils within the limestone bedrock glade inclusion are shallow (2-5 cm) and also alkaline (pH 7.8-8.0). Soils within the northern fen inclusion are 10 cm of alkaline peat (pH 7.5-7.8) over limestone.



Boreal forest, Thunder Bay Island. Photo by Joshua G. Cohen.



2022 aerial photograph of Thunder Bay Island boreal forest.

Species composition and vegetative structure of the boreal forest on Thunder Bay Island is highly variable and is influenced by the interaction of depth to limestone cobble substrate and time and intensity of past disturbance factors including logging, windthrow, and fire. The canopy of the boreal forest is dominated by northern white-cedar with canopy associates including paper birch and white spruce. Canopy coverage ranges from 60 to 80% with some local patches having more open canopy (50-60%) where blowdown is more prevalent. Canopy trees typically range in diameter from 30 to 50 cm with some scattered northern white-cedar that range from 50 to 60 cm. The understory layer is patchy to locally dense (20-40%) with balsam fir (*Abies balsamea*), mountain maple (*Acer spicatum*), yew (*Taxus canadensis*), choke cherry (*Prunus virginiana*), round-leaved dogwood (*Cornus rugosa*), northern white-cedar, and red-berried elder (*Sambucus racemosa*). The low shrub layer is sparse to patchy (10-20%) with balsam fir, red maple (*Acer rubrum*), Canadian fly honeysuckle (*Lonicera canadensis*), and poison-ivy (*Toxicodendron rydbergii*). The ground cover is sparse to patchy (10-50%) with characteristic species including gay-wings (*Polygala paucifolia*), Canada mayflower (*Maianthemum canadense*), wild sarsaparilla (*Aralia nudicaulis*), star-flower (*Trientalis borealis*), woodferns (*Dryopteris carthusiana* and *D. marginalis)*, oak fern (*Gymnocarpium dryopteris*), and sedges (*Carex eburnea* and *C. pedunculata*). Ram's head lady-slipper (*Cypripedium arietinum*, State Special Concern) was documented in the boreal forest in 1970 and possible and vegetative plants were tentatively identified as ram's head lady-slipper during the 2026 surveys, but the species cannot be definitively identified in vegetative condition (Voss and Reznicek 2012). Feathermosses are common throughout the boreal forest on boles of trees and coarse woody debris.

The limestone bedrock glade inclusion within the boreal forest is dominated by scattered and stunted northern white-cedar. The understory includes northern white-cedar, balsam fir, and green ash (*Fraxinus pennsylvanica*). Prevalent species in the low shrub layer include bearberry (*Arctostaphylos uva-ursi*), soapberry (*Shepherdia canadensis*), sand cherry (*Prunus pumila*), white spruce, and balsam fir. Characteristic ground cover species include sedge (*Carex eburnea*), gay-wings, blue-joint (*Calamagrostis canadensis*), wild columbine (*Aquilegia*



The Thunder Bay Island boreal forest includes a unique inclusion of limestone bedrock glade that supports gnarled and twisted northern white-cedar (*Thuja occidentalis*) growing on shallow soils over limestone bedrock. A 22.3 cm northern white-cedar was cored and 366 growth rings were counted. Photo by Joshua G. Cohen.



Boreal forest, Thunder Bay Island. Photo by Joshua G. Cohen.

canadensis), bastard-toadflax (*Comandra umbellata*), and false asphodel (*Triantha glutinosa*). The northern fen pocket is dominated by wiregrass sedge (*Carex lasiocarpa*) with associates including blue-joint, silverweed (*Potentilla anserina*), and twig-rush (*Cladium mariscoides*) and scattered shrubs including shrubby cinquefoil (*Dasiphora fruticosa*), alder-leaved buckthorn (*Rhamnus alnifolia*), and red-osier (*Cornus sericea*).

The Thunder Bay Island boreal forest was surveyed September 10th, 2025, and June 4th, 2026. Forty-five plant species were documented with 38 native species and 7 non-native species (Appendix 2.2). The total FQI was 24.1, the total native FQI was 26.5, and the total mean C value was 4.3.

Threats: Species composition and vegetative structure of the boreal forest on Thunder Bay Island is highly variable and is influenced by the interaction of depth to limestone substrate and time and intensity of past disturbance factors including windthrow, fire, and logging. Thunder Bay Island has a long history of Euro-American settlement and land use. Construction of the lighthouse began in 1831, and by 1846, a commercial fishing settlement reportedly supported 160 residents and 31 fishing boats. Settlement, construction, and associated demand for fuelwood and building materials likely resulted in substantial clearing and selective cutting of the island's forests, although the extent of these disturbances is unknown. Much of the present boreal forest appears to have regenerated following historical disturbance, with canopy trees approximately 110 years old and scattered older trees occurring throughout. Localized areas with older trees, particularly the limestone bedrock glade, represent portions of the forest that escaped intensive clearing.

Non-native species, particularly garden forget-me-not (*Myosotis sylvatica*), are prevalent on the trail system, which serves as an epicenter for spread and a vector for future introductions. Additional non-native species

within the boreal forest include helleborine (*Epipactis helleborine*), king devil (*Hieracium caespitosum*), ox-eye daisy (*Leucanthemum vulgare*), wall lettuce (*Mycelis muralis*), tall buttercup (*Ranunculus acris*), and common dandelion (*Taraxacum officinale*).

Management Recommendations: The main management recommendations are to allow natural processes to operate unhindered, retain an intact buffer of natural communities surrounding the boreal forest, and control and monitor invasive species. The existing road bisecting the forest provides a corridor for invasive species establishment and spread, and non-native plant populations along this route should be prioritized for treatment and monitoring. Increased recreational use and potential infrastructure development poses additional threats to the integrity of the forest. New roads, trails, and recreational facilities should be avoided within the boreal forest, with visitor access concentrated along existing routes to minimize further fragmentation and disturbance.

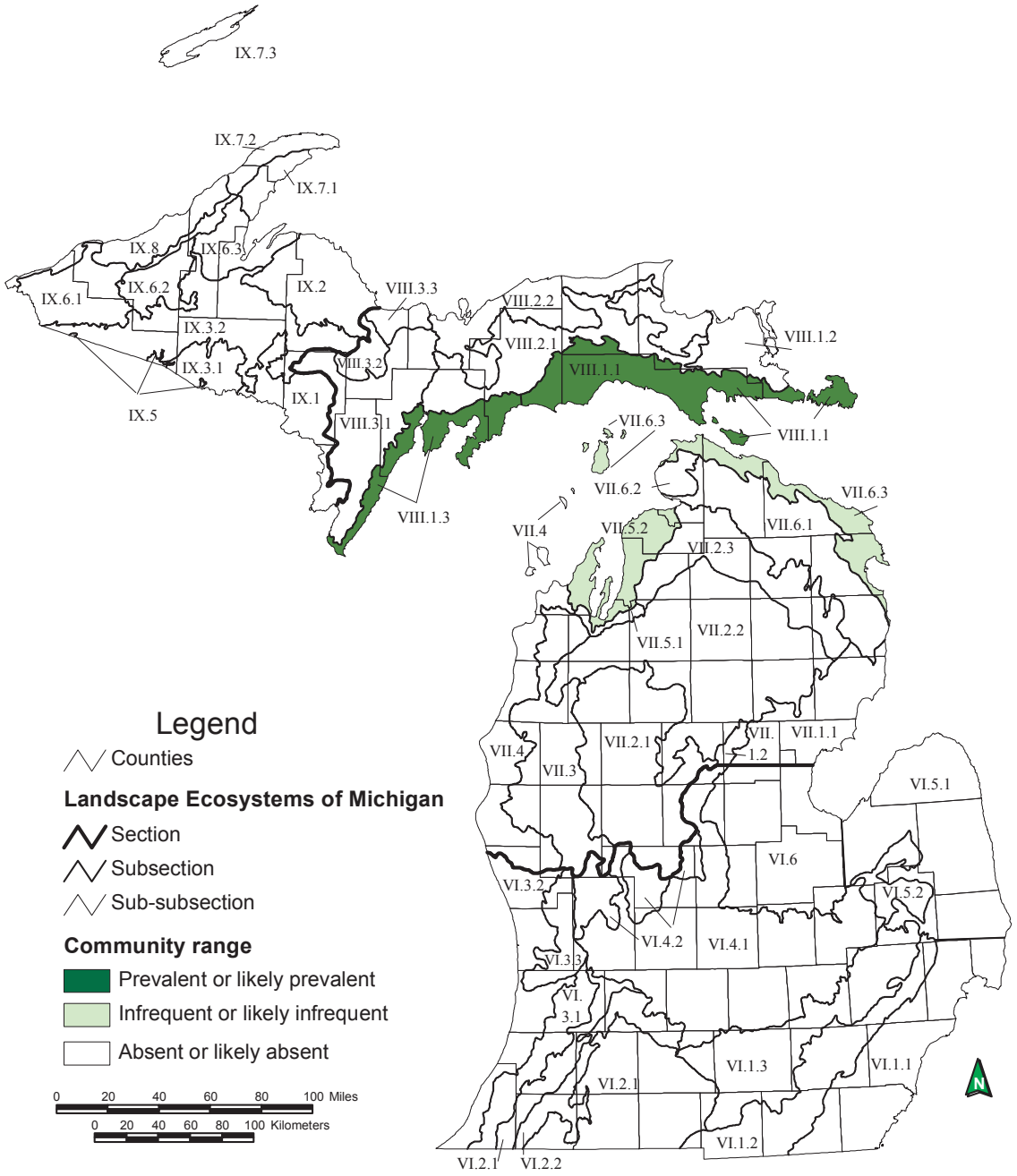
Particular care should be taken to protect the limestone bedrock glade and northern fen embedded within the forest. These small inclusions support distinctive vegetation and unique ecological conditions, including exceptionally old northern white-cedar within the glade. Both communities should be excluded from recreational development, trail construction, and other activities that could alter soils, hydrology, vegetation, or natural disturbance processes. Maintaining these sensitive inclusions within an intact forest matrix should be a high priority for long-term stewardship.



Boreal forest, Thunder Bay Island. Photo by Joshua G. Cohen.

LIMESTONE BEDROCK LAKESHORE

Overview: Limestone bedrock lakeshore is a sparsely vegetated natural community dominated by lichens, mosses, and herbaceous vegetation. This community, which is also referred to as alvar pavement and limestone pavement lakeshore, occurs along the shorelines of northern Lake Michigan and Lake Huron on broad, flat, horizontally bedded expanses of limestone or dolomite bedrock. On the Lake Michigan shoreline, limestone bedrock lakeshore is concentrated along the Garden Peninsula and adjacent islands and also occurs along the southern part of Schoolcraft County. Along Lake Huron, it is located east of the Les Cheneaux Islands, on Drummond Island, and on islands in Thunder Bay. Limestone bedrock lakeshore is subject to seasonal fluctuations in Great Lakes water levels, short-term changes due to seiches and storm surges, and long-term, multi-year lake level fluctuations. Storm waves frequently disturb limestone bedrock lakeshore, removing fine mineral sediments and organic soils. Winter storms scour vegetation from limestone bedrock lakeshore. Long-term cyclic fluctuations of Great Lakes water levels significantly influence vegetation patterns of limestone bedrock lakeshore, with vegetation and organic soils becoming well established during low-water periods and reduced or eliminated during high-water periods (Cohen et al. 2015, Cohen et al. 2025).



Map 3. Distribution of limestone bedrock lakeshore in Michigan (Albert et al. 2008).

3. Thunder Bay Island – Limestone Bedrock Lakeshore
Natural Community Type: Limestone Bedrock Lakeshore
Rank: G3 S2, vulnerable globally and imperiled within the state
Element Occurrence Rank: AB
Size: 30 acres (12 hectares)
Location: Thunder Bay Island, Michigan Islands National Wildlife Refuge, Lake Huron, Michigan
Element Occurrence Identification Number: 201

Site Description: Limestone bedrock lakeshore occurs along the eastern shoreline of Thunder Bay Island in Thunder Bay in Lake Huron. Frequent storms in Thunder Bay generate high wave activity along the shore of Thunder Bay Island. Limestone bedrock lakeshore and limestone cobble shore intergrade locally along the southern and northern end of Thunder Bay Island. Two pockets of alvar occur above the zone of high water influence adjacent to the limestone bedrock lakeshore. The complex of limestone bedrock lakeshore, limestone cobble shore, and alvar are backed by boreal forest. This coastal complex has been recently impacted by six years of high Great Lakes water levels (from 2015 to 2020) resulting in the decrease in woody cover along the limestone bedrock lakeshore and limestone cobble shore. Zones of high-water influence are characterized by the absence of vascular vegetation.

Limestone bedrock lakeshore is subject to seasonal fluctuations in Great Lakes water levels, short-term changes due to seiches and storm surges, and long-term, multi-year lake level fluctuations. Storm waves frequently disturb limestone bedrock lakeshore, removing fine mineral sediments and organic soils. Winter storms scour vegetation from limestone bedrock lakeshore. Long-term cyclic fluctuations of Great Lakes water levels significantly influence vegetation patterns of limestone bedrock lakeshore, with vegetation and organic soils becoming well established during low-water periods and reduced or eliminated during high-water periods. The soils of the limestone bedrock lakeshore are characterized by shallow (1-2 cm), alkaline (pH 8.0) organics that accumulate in cracks, crevices, and depressions. Shallow pools of water occur locally on the limestone bedrock lakeshore. The limestone bedrock lakeshore is also characterized by numerous low shelves.

The limestone bedrock lakeshore is sparsely vegetated and dominated by herbaceous plants (5-15%) with tree and shrub cover (1-2%) generally limited to the inland edge. Characteristic herbaceous species include


Limestone bedrock lakeshore, Thunder Bay Island. Photo by Joshua G. Cohen.



2022 aerial photograph of Thunder Bay Island limestone bedrock lakeshore.

silverweed (*Potentilla anserina*), yarrow (*Achillea millefolium*), wild strawberry (*Fragaria virginiana*), birds-eye primrose (*Primula mistassinica*), goldenrods (*Solidago canadensis*, *S. nemoralis*, and *S. ohioensis*), false asphodel (*Triantha glutinosa*), northern bog violet (*Viola nephrophylla*), limestone calamint *Clinopodium arkansanum*), scarlet paintbrush (*Castilleja coccinea*), harebell (*Campanula rotundifolia*), white camas (*Anticlea elegans*), blue-joint (*Calamagrostis canadensis*), cinnamon willow-herb (*Epilobium coloratum*), spotted touch-me-not (*Impatiens capensis*), rush (*Juncus balticus*), purple false foxglove (*Agalinis purpurea*), ticklegrass (*Agrostis scabra*), Kalm's hawkweed (*Hieracium kalmii*), northern panic grass (*Dichanthelium boreale*), glaucous white lettuce (*Prenanthes racemosa*), wild blue flag (*Iris versicolor*), bog lobelia (*Lobelia kalmii*), common water horehound (*Lycopus americanus*), panicled aster (*Symphyotrichum lanceolatum*), sensitive fern (*Onoclea sensibilis*), grass-of-parnassus (*Parnassia glauca*), and bigseed smartweed (*Persicaria pensylvanica*). Scattered trees and shrubs include balsam poplar (*Populus balsamifera*), quaking aspen (*Populus tremuloides*), northern white-cedar (*Thuja occidentalis*), paper birch (*Betula papyrifera*), white spruce (*Picea glauca*), tamarack (*Larix laricina*), ninebark (*Physocarpus opulifolius*), willows (*Salix bebbiana*, *S. candida*, *S. exigua*, and *S. petiolaris*), red-osier (*Cornus sericea*), soapberry (*Shepherdia canadensis*), shrubby cinquefoil (*Dasiphora fruticosa*), sweet gale (*Myrica gale*), Kalm's St. John's-wort (*Hypericum kalmianum*), and sand cherry (*Prunus pumila*). The sparse vegetation is restricted to cracks and crevices, and along the margins of splash pools. Bulrush sedge (*Carex scirpoidea*, State Threatened) occurs locally within the limestone bedrock lakeshore.

The Thunder Bay Island limestone bedrock lakeshore was surveyed September 10th, 2025, and June 4th, 2026. Seventy-eight plant species were documented with 70 native species and 8 non-native species (Appendix 2.3). The total FQI was 38, the native FQI was 40.2, and the total mean C value was 4.3.



Limestone bedrock lakeshore, Thunder Bay Island. Photo by Joshua G. Cohen.

Threats: Species composition and structure are patterned by natural processes, but non-native species occur locally within the limestone bedrock lakeshore. Purple loosestrife (*Lythrum salicaria*) occurs infrequently in the limestone bedrock lakeshore. Additional non-native species found within the limestone bedrock lakeshore include redtop (*Agrostis gigantea*), thyme-leaved sandwort (*Arenaria serpyllifolia*), great hairy willow-herb (*Epilobium hirsutum*), dog mustard (*Erucastrum gallicum*), common St. John's-wort (*Hypericum perforatum*), white sweet-clover (*Melilotus albus*), and Kentucky bluegrass (*Poa pratensis*).

Management Recommendations: Efforts to control invasive species (i.e., purple loosestrife, common St. John's-wort, and white sweet-clover) should be implemented and these control efforts should be monitored.

Increasing recreational interest in Thunder Bay Island presents an additional potential threat to the limestone bedrock lakeshore. The shallow soils and sparse vegetation are vulnerable to trampling and repeated foot traffic, which can damage vegetation, encourage the establishment of informal or social trails, and facilitate the introduction and spread of invasive species. Recreational access and any future tourism development should be carefully planned to avoid the limestone bedrock lakeshore and alvar. New trails, recreational infrastructure, and concentrated visitor use should be directed away from the alvar and limestone bedrock lakeshore, and existing access routes should be evaluated to minimize impacts. Maintaining the integrity of the alvar and limestone bedrock lakeshore should take precedence over expanding recreational access.



Limestone bedrock lakeshore, Thunder Bay Island. Photo by Joshua G. Cohen.

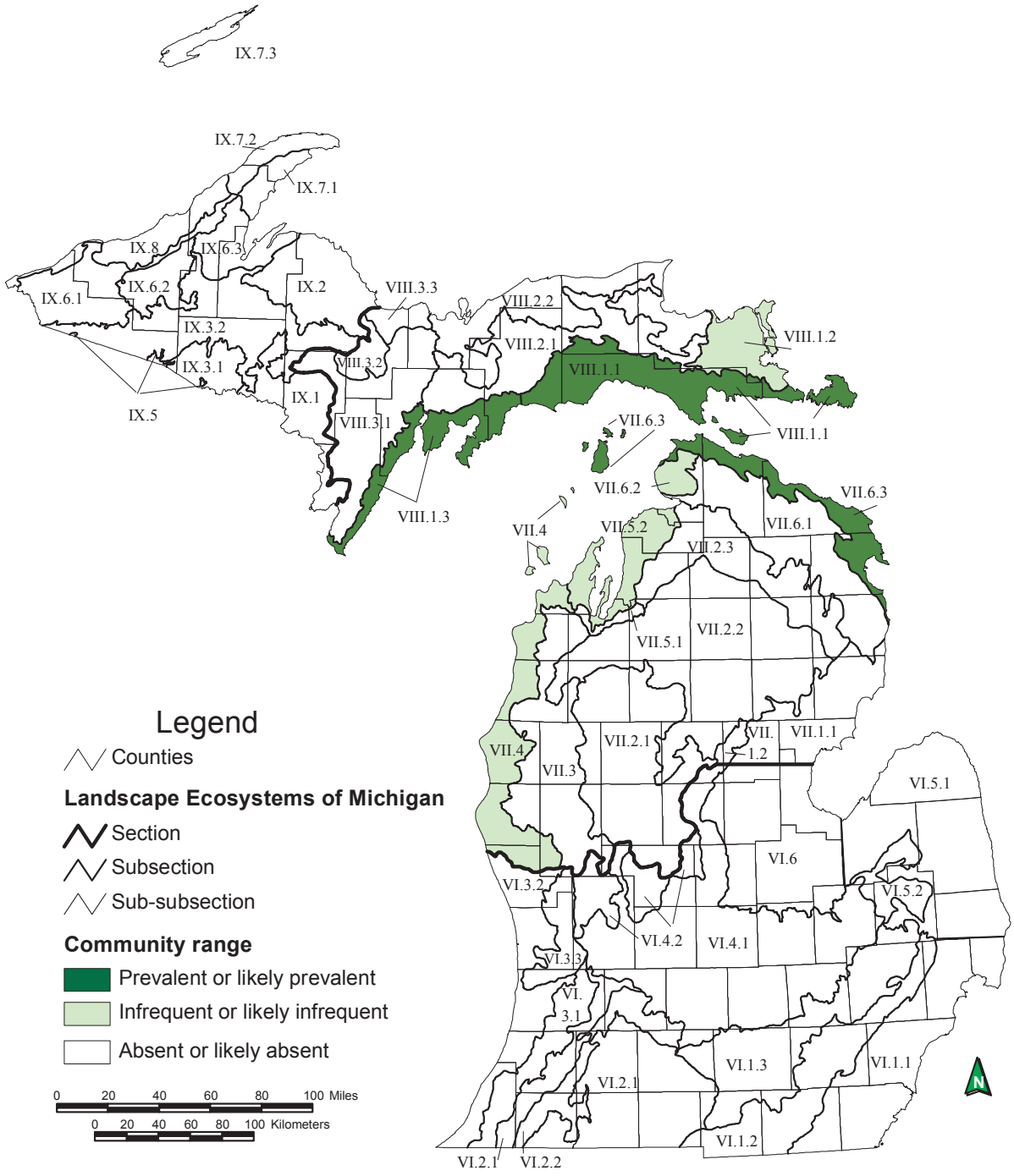


Limestone bedrock lakeshore, Thunder Bay Island. Photo by Joshua G. Cohen.



LIMESTONE COBBLE SHORE

Overview: Limestone cobble shore occurs along gently sloping shorelines of Lake Michigan and Lake Huron. The community is studded with cobbles and boulders and is frequently inundated by storms and periods of high water. Limestone cobble shore is typically sparsely vegetated, because cobbles cover most of the surface and storm waves and ice scour prevent the development of a diverse, persistent plant community. Soils are neutral to slightly alkaline mucks and sands that accumulate between cobbles and boulders. Limestone cobble shore is subject to seasonal fluctuations in Great Lakes water levels, short-term changes due to seiches and storm surges, and long-term, multi-year lake level fluctuations. Storm waves frequently disturb limestone cobble shore, reconfiguring the substrate and removing fine mineral sediments and organic soils. Long-term cyclic fluctuations of Great Lakes water levels significantly influence vegetation patterns of limestone cobble shore, with vegetation and organic soils becoming well established during low-water periods and reduced or eliminated during high-water periods (Cohen et al. 2015, Cohen et al. 2025).



Map 4. Distribution of limestone cobble shore in Michigan (Albert et al. 2008).

4. Thunder Bay Island – Limestone Cobble Shore
Natural Community Type: Limestone Cobble Shore
Rank: G2G3 S3, imperiled to vulnerable globally and vulnerable within the state
Element Occurrence Rank: C
Size: 34 acres
Location: Thunder Bay Island, Michigan Islands National Wildlife Refuge, Lake Huron, Michigan
Element Occurrence Identification Number: 28703

Site Description: Limestone cobble shore occurs along the shoreline of Thunder Bay Island in Thunder Bay in Lake Huron. Frequent storms in Thunder Bay generate high wave activity along the shore. Along the eastern shore of Thunder Bay Island, limestone cobble shore grades to limestone bedrock lakeshore. Limestone cobble shore and limestone bedrock lakeshore are backed by boreal forest. This coastal complex has been recently impacted by six years of high Great Lakes water levels (from 2015 to 2020). High water levels have caused the dieback of trees and shrubs within the limestone cobble shore.

Limestone cobble shore is subject to seasonal fluctuations in Great Lakes water levels, short-term changes due to seiches and storm surges, and long-term, multi-year lake level fluctuations. Storm waves frequently disturb limestone cobble shore, reconfiguring the substrate and removing fine mineral sediments and organic soils. Long-term cyclic fluctuations of Great Lakes water levels significantly influence vegetation patterns of limestone cobble shore, with vegetation and organic soils becoming well established during low-water periods and reduced or eliminated during high-water periods. Rocks within the limestone cobble shore range from small cobble to large boulders and the underlying substrate is limestone cobble and bedrock. Surficial cobble includes a mix dominated by limestone with granite, basalts, pudding stones, and fossils. Wet gravelly, alkaline (pH 7.8-8.0) sands mixed with organics occur between and beneath the cobble.


Limestone cobble shore, Thunder Bay Island. Photo by Joshua G. Cohen.



2022 aerial photograph of Thunder Bay Island limestone cobble shore.

Vegetation within the limestone cobble shore is sparse, occurring patchily between cobbles and concentrated along the upper margin of the shore. Characteristic ground cover (10-20%) species include silverweed (*Potentilla anserina*), panic grasses (*Dichanthelium boreale*, *D*. *implicatum*, and *D*. *lindheimeri*), boneset (*Eupatorium perfoliatum*), grass-leaved goldenrod (*Euthamia graminifolia*), sedges (*Carex hystericina*, *C*. *stricta*, and *C*. *viridula*), cinnamon willow-herb (*Epilobium coloratum*), spotted touch-me-not (*Impatiens capensis*), beak-rush (*Rhynchospora capillacea*), northern bog violet (*Viola nephrophylla*), blue-joint (*Calamagrostis canadensis*), goldenrods (*Solidago canadensis* and *S*. *ohioensis*), limestone calamint (*Clinopodium arkansanum*), rushes (*Juncus* spp.), common water horehound (*Lycopus americanus*), bird's-eye primrose (*Primula mistassinica*), purple false foxglove (*Agalinis purpurea*), ticklegrass (*Agrostis scabra*), wild strawberry (*Fragaria virginiana*), bigseed smartweed (*Persicaria pensylvanica*), threesquare (*Schoenoplectus pungens*), panicled aster (*Symphyotrichum lanceolatum*), and water speedwell (*Veronica anagallis-aquatica*).

The sparse (2-6%) low shrub layer supports shrubby cinquefoil (*Dasiphora fruticosa*), Kalm's St. John's-wort (*Hypericum kalmianum*), red-osier (*Cornus sericea*), sand cherry (*Prunus pumila*), ninebark (*Physocarpus opulifolius*), and willows (*Salix* spp.) and seedling northern white-cedar (*Thuja occidentalis*) and paper birch (*Betula papyrifera*). The scattered understory (2-4%) and overstory (1-2%) are characterized by willows, paper birch, northern white-cedar, green ash (*Fraxinus pennsylvanica*), white spruce (*Picea glauca*), and balsam poplar (*Populus balsamifera*) with a high percentage of woody species having died recently following six years of high water levels from 2015 through 2025.

The Thunder Bay Island limestone cobble shore was surveyed September 10th, 2025, and June 4th, 2026. Ninety-eight plant species were documented with 79 native species and 19 non-native species (Appendix 2.4). The total FQI was 34.6, the native FQI was 39.1, and the total mean C value was 3.5.



Limestone cobble shore, Thunder Bay Island. Photo by Joshua G. Cohen.

Threats: Species composition and structure are patterned by natural processes but are being impacted by non-native species. Non-native species are common within the limestone cobble shore and include spotted knapweed (*Centaurea stoebe*), bull thistle (*Cirsium vulgare*), common St. John's-wort (*Hypericum perforatum*), purple loosestrife (*Lythrum salicaria*), wild parsnip (*Pastinaca sativa*), reed canary grass (*Phalaris arundinacea*), Canada bluegrass (*Poa compressa*), narrow-leaved cat-tail (*Typha angustifolia*), common mullein (*Verbascum thapsus*), yellow rocket (*Barbarea vulgaris*), reedgrass (*Calamagrostis epigejos*), queen-Anne's-lace (*Daucus carota*), great hairy willow-herb (*Epilobium hirsutum*), hemp-nettle (*Galeopsis tetrahit*), black medick (*Medicago lupulina*), wall lettuce (*Mycelis muralis*), curly dock (*Rumex crispus*), mossy stonecrop (*Sedum acre*), and bittersweet nightshade (*Solanum dulcamara*). The limestone cobble shore is especially weedy near where the portable dock is established along the west side of the island and also near the Lighthouse on the south side of the island.

Management Recommendations: Efforts to control invasive species—particularly spotted knapweed, purple loosestrife, narrow-leaved cat-tail, and wild parsnip—should be implemented. These control efforts should be monitored and paired with surveys for new invasive species.



Limestone cobble shore and limestone bedrock lakeshore intergrade along the southern shoreline of Thunder Bay Island. Photo by Joshua G. Cohen.

Stewardship Prioritization Results

The stewardship scores for each natural community EO on Thunder Bay Island are presented in Table 2. We sorted the EOs by their stewardship prioritization scores and assigned them a high (≥ 10; red), medium (≥ 9 and < 10; yellow), or low (< 9; blue) stewardship priority. The highest-ranking natural community EO is alvar. Alvar is likely imperiled globally (G2?) and is critically imperiled in Michigan (S1) with only 6 documented high-quality occurrences in the state. The Thunder Bay Island alvar is characterized by good integrity (EO Rank B) but has localized pockets of non-native speciess that should be controlled by invasive species experts trained in both invasive and rare plant identification. All control efforts should be monitored to gauge the effectiveness of intervention as well as the impacts to native vegetation and the overall integrity of the alvar. The second highest ranking natural community is the limestone bedrock lakeshore, which is globally rare (G3) and imperiled in Michigan (S2). The Thunder Bay Island limestone bedrock glade is characterized by high integrity (EO Rank AB) but is locally impacted by non-natives. The limestone cobble shore received a medium stewardship prioritization score. This natural community type is rare globally and in Michigan (G3 S3), and this particular example has fair integrity (EO Rank C) with numerous non-native plants. Treatment of invasive plants within this limestone cobble shore is still recommended because it can help reduce the overall presence of non-native species along the shoreline and thereby reduce the non-native seed source and threats to the adjacent limestone bedrock lakeshore and nearby alvar. The boreal forest, which is characterized by fair integrity (EO Rank C) and a low threat score, has the lowest stewardship prioritization score. We recommend treating non-native species along the trail that passes through the boreal forest.

Table 2. Stewardship prioritization for natural community element occurrences on Thunder Bay Island. Element occurrences are sorted by their stewardship prioritization scores and assigned a high (red), medium (yellow), or low (blue) stewardship priority. Global and state ranks are provided in Appendix 1.

EO ID	Natural Community	EO Rank	Ecological Integrity Index	Gobal Rank	Global Rank Score	State Rank	State Rank Score	Rarity Index	Invasive Threat Severity	Treatment Feasability	Invasive Index	Stewardship Priority Score
28704	Alvar	B	4	G2?	4	S1	5	4.5	2	4	3	11.5
201	Limestone Bedrock Lakeshore	AB	4.5	G3	3	S2	4	3.5	2	4	3	11
28703	Limestone Cobble Shore	C	3	G2G3	3.5	S3	3	3.25	3	4	3.5	9.75
4501	Boreal Forest	C	3	GU	3	S3	3	3	1	1	1	7



The alvar on Thunder Bay Island ranked as the highest stewardship and monitoring priority. Photo by Joshua G. Cohen.

Conclusion

We evaluated the ecological integrity of high-quality natural communities on Thunder Bay Island. We documented two new element occurrences on Thunder Bay Island including alvar and limestone cobble shore and updated two element occurrences including boreal forest and limestone bedrock lakeshore. The documentation of alvar on Thunder Bay Island is significant in that this natural community is globally imperiled and critically imperiled in the state. In addition, this record represents the first documented high-quality alvar in Michigan's Lower Peninsula and only the sixth occurrence of this natural community type across the state. Alvars are only known from three areas of the world: the Baltic region of northern Europe, Counties Clare and Galway of northwest Ireland, and the Great Lakes region south of the Canadian Shield (Cohen et al. 2025).

This report provides site-based assessments of these four natural community element occurrences. Threats and management needs specific to each individual site have been discussed. The baseline information presented in the report provides resource managers with an ecological foundation for prescribing site-level biodiversity stewardship, monitoring these management activities, and implementing landscape-level biodiversity planning to prioritize management efforts. The framework for prioritizing stewardship and monitoring efforts across sites will help facilitate difficult decisions regarding the distribution of finite stewardship resources for site-based management. Based on our stewardship prioritization framework, we recommend focusing invasive plant species control efforts and monitoring on the alvar and limestone bedrock lakeshore. Implementation of stewardship efforts within prioritized areas will need to be followed by monitoring to gauge the success of biodiversity management efforts and refine future stewardship prioritization efforts. Given the increasing recreational pressure on Thunder Bay Island, we emphasize the importance of carefully planning recreational access and infrastructure to avoid impacts to sensitive natural communities, particularly the alvar, limestone bedrock lakeshore, and limestone bedrock glade within the boreal forest. In addition, we recommend targeted rare plant surveys across Thunder Bay Island and continued natural community surveys of Great Lakes islands within Lake Huron to inform regional conservation planning and prioritization of stewardship efforts.

Across the Great Lakes region, natural habitats are declining due to habitat destruction and are eroding in ecological integrity due to habitat fragmentation. Pervasive threats associated with habitat fragmentation on the mainland include invasive species infestation, deer herbivory, mesopredator predation, and fire suppression. Great Lakes islands, especially uninhabited ones, provide unique and essential refuges for native biodiversity. Though these islands face less pressure from habitat destruction and fragmentation, they are still susceptible to many of the threats prevalent on the mainland, especially invasive species. Biodiversity stewardship actions within these isolated and less disturbed settings have a high likelihood of success if they are prompt and decisive.

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Appendix 1 - Global and State Element Ranking Criteria

GLOBAL RANKS

G1 = critically imperiled: at very high risk of extinction due to extreme rarity (often 5 or fewer occurrences), very steep declines, or other factors.

G2 = imperiled: at high risk of extinction due to very restricted range, very few occurrences (often 20 or fewer), steep declines, or other factors.

G3 = vulnerable: at moderate risk of extinction due to a restricted range, relatively few occurrences (often 80 or fewer), recent and widespread declines, or other factors.

G4 = apparently secure: uncommon but not rare; some cause for long-term concern due to declines or other factors.

G5 = secure: common; widespread.

GU = currently unrankable due to lack of information or due to substantially conflicting information about status or trends.

GX = eliminated: eliminated throughout its range, with no restoration potential due to extinction of dominant or characteristic species.

G? = incomplete data.

STATE RANKS

S1 = critically imperiled in the state because of extreme rarity (often 5 or fewer occurrences) or because of some factor(s) such as very steep declines making it especially vulnerable to extirpation from the state.

S2 = imperiled in the state because of rarity due to very restricted range, very few occurrences (often 20 or fewer), steep declines, or other factors making it very vulnerable to extirpation from the state.

S3 = vulnerable in the state due to a restricted range, relatively few occurrences (often 80 or fewer), recent and widespread declines, or other factors making it vulnerable to extirpation.

S4 = uncommon but not rare; some cause for long-term concern due to declines or other factors.

S5 = common and widespread in the state.

SX = community is presumed to be extirpated from the state. Not located despite intensive searches of historical sites and other appropriate habitat, and virtually no likelihood that it will be rediscovered.

S? = incomplete data.

Appendix 2 - Floristic Quality Assessments

For each high-quality natural community, floristic data were compiled into the Universal Floristic Quality Assessment Calculator (Reznicek et al. 2014, Freyman et al. 2016) to determine the Floristic Quality Index (FQI) for each natural community element occurrence. The floristic quality assessment is derived from a mean coefficient of conservatism and floristic quality index. Each native species is assigned a coefficient of conservatism (C), a value of 0 to 10 based on probability of its occurrence in a natural versus degraded habitat. Species restricted to a specialized or undisturbed habitat are assigned a value of 10, implying the species has extremely strong fidelity to a specific habitat. Native species that are not particular or indicative of natural conditions are assigned a low value of 0 or 1. The coefficient of conservatism is determined by experts on the flora of a region, and so may vary for a given plant species from region to region. We employed a regionally appropriate FQA for Michigan (Reznicek et al. 2014). From the total list of plant species for an area, a mean C value is calculated and then multiplied by the square root of the total number of plant species to calculate the FQI. In addition, each species is assigned a coefficient of wetness (W) based on its affinity to wetland or upland habitat. Michigan sites with an FQI of 35 or greater possess sufficient conservatism and richness that they are considered floristically important from a statewide perspective (Herman et al. 2001). FQI scores greater than 50 indicate exceptional sites with extremely high conservation value (Herman et al. 2001).

For each high-quality natural community element occurrence, we generated a floristic quality assessment (FQA). The FQA includes a comprehensive list of the species documented in the element occurrence along with each species' C and W values. In addition, for each site we present the accompanying conservatism-based metrics, species richness, species wetness, physiognomy metrics, and duration metrics. Within the plant lists for each natural community element occurrence, non-native species have been highlighted in bold. Of the 4 natural community element occurrences surveyed, 3 had native FQI values greater than 35. Within the 4 natural community element occurrences, over the course of two field days across two field seasons, MNFI Ecologists documented 174 plant species with 143 native species and 31 non-native species.

We used the Michigan FQA (Reznicek et al. 2014) and nomenclature within the species lists follows Michigan Flora (Voss and Reznicek 2012). We provide a crosswalk of Anishinaabemowin or Ojibwe names to scientific and common names in Appendix 3 for all plant species observed on Thunder Bay Island that are listed in "Plants used by the Great Lakes Ojibwa" (Meeker et al. 1993).

Appendix 2.1. Thunder Bay Island Alvar FQA

Conservatism-Based Metrics:

Total Mean C:	5.2
Native Mean C:	5.7
Total FQI:	46.2
Native FQI:	48.4
Adjusted FQI:	54.4
% C value 0:	10.1
% C value 1-3:	24.1
% C value 4-6:	27.8
% C value 7-10:	38
Native Tree Mean C:	3.2
Native Shrub Mean C:	5.9
Native Herbaceous Mean C:	5.9

Species Richness:

Total Species:	79	
Native Species:	72	91.10%
Non-native Species:	7	8.90%

Species Wetness:

Mean Wetness:	-1
Native Mean Wetness:	-1.2

Physiognomy Metrics:

Tree:	6	7.60%
Shrub:	14	17.70%
Vine:	4	5.10%
Forb:	33	41.80%
Grass:	11	13.90%
Sedge:	9	11.40%
Rush:	1	1%
Fern:	1	1.30%
Bryophyte:	0	0%

Duration Metrics:

Annual:	5	6.30%
Perennial:	71	89.90%
Biennial:	3	3.80%
Native Annual:	4	5.10%
Native Perennial:	67	84.80%
Native Biennial:	1	1.30%

Appendix 2.1. Thunder Bay Island Alvar FQA (continued)

Scientific Name	Common Name	Acronym	Native?	C	W
Abies balsamea	balsam fir	ABIBAL	native	3	0
Agalinis purpurea	purple false foxglove	AGAPUR	native	7	-3
Agrostis gigantea	**redtop**	**AGRGIG**	**non-native**	**0**	**-3**
Agrostis scabra	ticklegrass	AGRSCA	native	4	0
Amelanchier spicata	shadbush serviceberry	AMESPI	native	4	3
Andropogon gerardii	big bluestem	ANDGER	native	5	0
Anticlea elegans	white camas	ANTELE	native	10	-3
Aquilegia canadensis	wild columbine	AQUCAN	native	5	3
Arctostaphylos uva-ursi	bearberry	ARCUVA	native	8	5
Asclepias syriaca	common milkweed	ASCSYR	native	1	5
Betula papyrifera	paper birch	BETPAP	native	2	3
Calamagrostis canadensis	blue-joint	CALCAN	native	3	-5
Carex buxbaumii	sedge	CXBUXB	native	10	-5
Carex crawei	sedge	CXCRAE	native	10	-3
Carex scirpoidea	bulrush sedge	CXSCIR	native	10	3
Carex sterilis	sedge	CXSTER	native	10	-5
Carex stricta	sedge	CXSTRI	native	4	-5
Carex viridula	sedge	CXVIRU	native	4	-5
Castilleja coccinea	indian paintbrush	CASCOC	native	8	0
Cladium mariscoides	twig-rush	CLAMAR	native	10	-5
Comandra umbellata	bastard-toadflax	COMUMB	native	5	3
Cornus sericea	red-osier	CORSER	native	2	-3
Cypripedium parviflorum	yellow lady-slipper	CYPPAR	native	5	0
Dasiphora fruticosa	shrubby cinquefoil	DASFRU	native	8	-3
Deschampsia cespitosa	hair grass	DESCES	native	9	-3
Dichanthelium boreale	northern panic grass	DICBOR	native	7	0
Dichanthelium implicatum	panic grass	DICIMP	native	3	0
Diervilla lonicera	bush-honeysuckle	DIELON	native	4	5
Eleocharis elliptica	golden-seeded spike rush	ELEELL	native	6	-5
Equisetum hyemale	scouring rush	EQUHYE	native	2	0
Fragaria virginiana	wild strawberry	FRAVIR	native	2	3
Fraxinus pennsylvanica	red ash	FRAPEN	native	2	-3
Gentianopsis virgata	small fringed gentian	GENVIR	native	8	-5
Geranium robertianum	herb robert	GERROB	native	3	3
Graphephorum melicoides	trisetum	GRAMEL	native	10	-3
Hypericum kalmianum	kalms st. johns-wort	HYPKAL	native	10	-3
Iris versicolor	wild blue flag	IRIVER	native	5	-5
Juncus brachycephalus	rush	JUNBRP	native	7	-5
Juniperus horizontalis	creeping juniper	JUNHOR	native	10	3
Larix laricina	tamarack	LARLAR	native	5	-3
Lathyrus palustris	marsh pea	LATPAL	native	7	-3
Linum catharticum	**fairy flax**	**LINCAT**	**non-native**	**0**	**3**
Lonicera dioica	red honeysuckle	LONDIO	native	5	3
Lonicera hirsuta	hairy honeysuckle	LONHIR	native	6	0
Lycopus americanus	common water horehound	LYCAME	native	2	-5

Appendix 2.1. Thunder Bay Island Alvar FQA (continued)

Scientific Name	Common Name	Acronym	Native?	C	W
Lythrum salicaria	**purple loosestrife**	**LYTSAL**	**non-native**	**0**	**-5**
Maianthemum stellatum	starry false solomon-seal	MAISTE	native	5	0
Melilotus albus	**white sweet-clover**	**MELALB**	**non-native**	**0**	**3**
Myrica gale	sweet gale	MYRGAL	native	6	-5
Packera paupercula	balsam ragwort	PACPAU	native	3	0
Panicum flexile	panic grass	PANFLE	native	8	-3
Parnassia glauca	grass-of-parnassus	PARGLA	native	8	-5
Pastinaca sativa	**wild parsnip**	**PASSAT**	**non-native**	**0**	**5**
Physocarpus opulifolius	ninebark	PHYOPU	native	4	-3
Picea glauca	white spruce	PICGLA	native	3	3
Pinguicula vulgaris	butterwort	PINVUL	native	10	-5
Poa compressa	**canada bluegrass**	**POACOM**	**non-native**	**0**	**3**
Potentilla anserina	silverweed	POTANS	native	5	-3
Prenanthes racemosa	glaucous white lettuce	PRERAC	native	8	-3
Primula mistassinica	birds-eye primrose	PRIMIS	native	10	-3
Prunella vulgaris	self-heal	PRUVUL	native	0	0
Prunus pumila	sand cherry	PRUPUM	native	8	5
Rhynchospora capillacea	beak-rush	RHYCAL	native	10	-5
Rudbeckia hirta	black-eyed susan	RUDHIR	native	1	3
Rumex crispus	**curly dock**	**RUMCRI**	**non-native**	**0**	**0**
Salix pedicellaris	bog willow	SALPED	native	8	-5
Salix petiolaris	slender willow	SALPET	native	1	-3
Schizachyrium scoparium	little bluestem	SCHSCO	native	5	3
Shepherdia canadensis	soapberry	SHECAN	native	7	5
Solidago nemoralis	old-field goldenrod	SOLNEM	native	2	5
Solidago ohioensis	ohio goldenrod	SOLOHI	native	8	-5
Spiranthes cernua	nodding ladies-tresses	SPICER	native	4	-3
Symphyotrichum lanceolatum	panicled aster	SYMLAN	native	2	-3
Thalictrum dasycarpum	purple meadow-rue	THADAS	native	3	-3
Thuja occidentalis	arbor vitae	THUOCC	native	4	-3
Toxicodendron rydbergii	poison-ivy	TOXRYD	native	3	0
Triantha glutinosa	false asphodel	TRIGLU	native	10	-5
Viola nephrophylla	northern bog violet	VIONEP	native	8	-3
Vitis aestivalis	summer grape	VITAES	native	6	3

Appendix 2.2. Thunder Bay Island Boreal Forest FQA

Conservatism-Based Metrics:

Total Mean C:	3.6
Native Mean C:	4.3
Total FQI:	24.1
Native FQI:	26.5
Adjusted FQI:	39.5
% C value 0:	20
% C value 1-3:	24.4
% C value 4-6:	44.4
% C value 7-10:	11.1
Native Tree Mean C:	3.4
Native Shrub Mean C:	4.5
Native Herbaceous Mean C:	4.7

Species Richness:

Total Species:	45	
Native Species:	38	84.40%
Non-native Species:	7	15.60%

Species Wetness:

Mean Wetness:	1.8
Native Mean Wetness:	1.6

Physiognomy Metrics:

Tree:	10	22.20%
Shrub:	10	22.20%
Vine:	0	0.00%
Forb:	20	44.40%
Grass:	0	0.00%
Sedge:	2	4.40%
Rush:	0	0%
Fern:	3	6.70%
Bryophyte:	0	0%

Duration Metrics:

Annual:	0	0.00%
Perennial:	44	97.80%
Biennial:	1	2.20%
Native Annual:	0	0.00%
Native Perennial:	38	84.40%
Native Biennial:	0	0.00%

Appendix 2.2. Thunder Bay Island Boreal Forest FQA (continued)

Scientific Name	Common Name	Acronym	Native?	C	W
Abies balsamea	balsam fir	ABIBAL	native	3	0
Acer rubrum	red maple	ACERUB	native	1	-3
Acer spicatum	mountain maple	ACESPI	native	5	-3
Actaea rubra	red baneberry	ACTRUB	native	7	0
Aquilegia canadensis	wild columbine	AQUCAN	native	5	3
Aralia nudicaulis	wild sarsaparilla	ARANUD	native	5	0
Arctostaphylos uva-ursi	bearberry	ARCUVA	native	8	-3
Betula alleghaniensis	yellow birch	BETALL	native	7	3
Betula papyrifera	paper birch	BETPAP	native	2	5
Carex eburnea	sedge	CXEBUR	native	7	5
Carex pedunculata	sedge	CXPEDU	native	5	3
Clinopodium vulgare	wild-basil	CLIVUL	native	3	-5
Corallorhiza striata	striped coral-root	CORSTR	native	6	-5
Cornus rugosa	round-leaved dogwood	CORRUG	native	6	-3
Cornus sericea	red-osier	CORSER	native	2	3
Cypripedium parviflorum	yellow lady-slipper	CYPPAR	native	5	-5
Dryopteris carthusiana	spinulose woodfern	DRYCAR	native	5	-5
Dryopteris marginalis	marginal woodfern	DRYMAR	native	5	-5
Epipactis helleborine	**helleborine**	**EPIHEL**	**non-native**	**0**	**0**
Fraxinus pennsylvanica	red ash	FRAPEN	native	2	-5
Gymnocarpium dryopteris	oak fern	GYMDRY	native	5	3
Hieracium caespitosum	**king devil**	**HIECAE**	**non-native**	**0**	**-3**
Leucanthemum vulgare	**ox-eye daisy**	**LEUVUL**	**non-native**	**0**	**0**
Lonicera canadensis	canadian fly honeysuckle	LONCAN	native	5	-3
Maianthemum canadense	canada mayflower	MAICAN	native	4	-3
Maianthemum stellatum	starry false solomon-seal	MAISTE	native	5	0
Mycelis muralis	**wall lettuce**	**MYCMUR**	**non-native**	**0**	**0**
Myosotis sylvatica	**garden forget-me-not**	**MYOSYL**	**non-native**	**0**	**5**
Picea glauca	white spruce	PICGLA	native	3	-5
Pinus strobus	white pine	PINSTR	native	3	0
Polygala paucifolia	gay-wings	POLPAU	native	7	3
Prunella vulgaris	self-heal	PRUVUL	native	0	-3
Prunus virginiana	choke cherry	PRUVIR	native	2	-5
Ranunculus abortivus	small-flowered buttercup	RANABO	native	0	3
Ranunculus acris	**tall or common buttercup**	**RANACR**	**non-native**	**0**	**-3**
Rubus parviflorus	thimbleberry	RUBPAR	native	6	-3
Sambucus racemosa	red-berried elder	SAMRAC	native	3	-5
Sorbus decora	mountain-ash	SORDEC	native	4	-5
Taraxacum officinale	**common dandelion**	**TAROFF**	**non-native**	**0**	**3**
Taxus canadensis	yew	TAXCAN	native	5	-3
Thuja occidentalis	arbor vitae	THUOCC	native	4	-3
Toxicodendron rydbergii	poison-ivy	TOXRYD	native	3	3
Trientalis borealis	star-flower	TRIBOR	native	5	3
Trillium cernuum	nodding trillium	TRICER	native	5	0
Viburnum trilobum	american highbush-cranberry	VIBTRI	native	5	-5

Appendix 2.3. Thunder Bay Island Limestone Bedrock Lakeshore FQA

Conservatism-Based Metrics:

Total Mean C:	4.3
Native Mean C:	4.8
Total FQI:	38
Native FQI:	40.2
Adjusted FQI:	45.5
% C value 0:	15.4
% C value 1-3:	30.8
% C value 4-6:	24.4
% C value 7-10:	29.5
Native Tree Mean C:	2.7
Native Shrub Mean C:	5
Native Herbaceous Mean C:	5.1

Species Richness:

Total Species:	78	
Native Species:	70	89.70%
Non-native Species:	8	10.30%

Species Wetness:

Mean Wetness:	-1.3
Native Mean Wetness:	-1.5

Physiognomy Metrics:

Tree:	7	9.00%
Shrub:	13	16.70%
Vine:	2	2.60%
Forb:	38	48.70%
Grass:	6	7.70%
Sedge:	6	7.70%
Rush:	3	4%
Fern:	3	3.80%
Bryophyte:	0	0%

Duration Metrics:

Annual:	10	12.80%
Perennial:	66	84.60%
Biennial:	2	2.60%
Native Annual:	8	10.30%
Native Perennial:	61	78.20%
Native Biennial:	1	1.30%

Appendix 2.3. Thunder Bay Island Limestone Bedrock Lakeshore FQA (continued)

Scientific Name	Common Name	Acronym	Native?	C	W
Achillea millefolium	yarrow	ACHMIL	native	1	3
Agalinis purpurea	purple false foxglove	AGAPUR	native	7	-3
Agrostis gigantea	**redtop**	**AGRGIG**	**non-native**	**0**	**-3**
Agrostis scabra	ticklegrass	AGRSCA	native	4	0
Ambrosia artemisiifolia	common ragweed	AMBART	native	0	3
Amelanchier spicata	shadbush serviceberry	AMESPI	native	4	3
Andropogon gerardii	big bluestem	ANDGER	native	5	0
Anticlea elegans	white camas	ANTELE	native	10	-3
Arenaria serpyllifolia	**thyme-leaved sandwort**	**ARESER**	**non-native**	**0**	**0**
Betula papyrifera	paper birch	BETPAP	native	2	3
Bidens frondosa	common beggar-ticks	BIDFRO	native	1	-3
Calamagrostis canadensis	blue-joint	CALCAN	native	3	-5
Campanula rotundifolia	harebell	CAMROT	native	6	3
Carex buxbaumii	sedge	CXBUXB	native	10	-5
Carex crawei	sedge	CXCRAE	native	10	-3
Carex scirpoidea	bulrush sedge	CXSCIR	native	10	3
Carex sterilis	sedge	CXSTER	native	10	-5
Carex stricta	sedge	CXSTRI	native	4	-5
Castilleja coccinea	indian paintbrush	CASCOC	native	8	0
Clinopodium arkansanum	limestone calamint	CLIARK	native	10	-3
Conyza canadensis	horseweed	CONCAN	native	0	3
Cornus sericea	red-osier	CORSER	native	2	-3
Dasiphora fruticosa	shrubby cinquefoil	DASFRU	native	8	-3
Dichanthelium boreale	northern panic grass	DICBOR	native	7	0
Diervilla lonicera	bush-honeysuckle	DIELON	native	4	5
Eleocharis elliptica	golden-seeded spike rush	ELEELL	native	6	-5
Epilobium coloratum	cinnamon willow-herb	EPICOL	native	3	-5
Epilobium hirsutum	**great hairy willow-herb**	**EPIHIR**	**non-native**	**0**	**-3**
Equisetum hyemale	scouring rush	EQUHYE	native	2	0
Equisetum variegatum	variegated scouring rush	EQUVAR	native	6	-3
Erucastrum gallicum	**dog mustard**	**ERUGAL**	**non-native**	**0**	**3**
Eupatorium perfoliatum	boneset	EUPPER	native	4	-3
Fragaria virginiana	wild strawberry	FRAVIR	native	2	3
Fraxinus pennsylvanica	red ash	FRAPEN	native	2	-3
Gentianopsis virgata	small fringed gentian	GENVIR	native	8	-5
Hieracium kalmii	kalms hawkweed	HIEKAL	native	3	5
Hypericum kalmianum	kalms st. johns-wort	HYPKAL	native	10	-3
Hypericum perforatum	**common st. johns-wort**	**HYPPER**	**non-native**	**0**	**5**
Impatiens capensis	spotted touch-me-not	IMPCAP	native	2	-3
Iris versicolor	wild blue flag	IRIVER	native	5	-5
Juncus balticus	rush	JUNBAL	native	4	-5
Juncus brachycephalus	rush	JUNBRP	native	7	-5
Juncus dudleyi	dudleys rush	JUNDUD	native	1	-3
Larix laricina	tamarack	LARLAR	native	5	-3
Lobelia kalmii	bog lobelia	LOBKAL	native	10	-5

Appendix 2.3. Thunder Bay Island Limestone Bedrock Lakeshore FQA (continued)

Scientific Name	Common Name	Acronym	Native?	C	W
Lonicera dioica	red honeysuckle	LONDIO	native	5	3
Lonicera hirsuta	hairy honeysuckle	LONHIR	native	6	0
Lycopus americanus	common water horehound	LYCAME	native	2	-5
Lythrum salicaria	**purple loosestrife**	**LYTSAL**	**non-native**	**0**	**-5**
Maianthemum stellatum	starry false solomon-seal	MAISTE	native	5	0
Melilotus albus	**white sweet-clover**	**MELALB**	**non-native**	**0**	**3**
Myrica gale	sweet gale	MYRGAL	native	6	-5
Onoclea sensibilis	sensitive fern	ONOSEN	native	2	-3
Packera paupercula	balsam ragwort	PACPAU	native	3	0
Parnassia glauca	grass-of-parnassus	PARGLA	native	8	-5
Persicaria pensylvanica	bigseed smartweed	PERPEN	native	0	-3
Physocarpus opulifolius	ninebark	PHYOPU	native	4	-3
Picea glauca	white spruce	PICGLA	native	3	3
Poa pratensis	**kentucky bluegrass**	**POAPRA**	**non-native**	**0**	**3**
Populus balsamifera	balsam poplar	POPBAL	native	2	-3
Populus tremuloides	quaking aspen	POPTRE	native	1	0
Potentilla anserina	silverweed	POTANS	native	5	-3
Potentilla norvegica	rough cinquefoil	POTNOR	native	0	0
Prenanthes racemosa	glaucous white lettuce	PRERAC	native	8	-3
Primula mistassinica	birds-eye primrose	PRIMIS	native	10	-3
Prunus pumila	sand cherry	PRUPUM	native	8	5
Salix bebbiana	bebbs willow	SALBEB	native	1	-3
Salix candida	hoary willow	SALCAN	native	9	-5
Salix exigua	sandbar willow	SALEXI	native	1	-3
Salix petiolaris	slender willow	SALPET	native	1	-3
Shepherdia canadensis	soapberry	SHECAN	native	7	5
Solidago canadensis	canada goldenrod	SOLCAN	native	1	3
Solidago nemoralis	old-field goldenrod	SOLNEM	native	2	5
Solidago ohioensis	ohio goldenrod	SOLOHI	native	8	-5
Symphyotrichum lanceolatum	panicled aster	SYMLAN	native	2	-3
Thuja occidentalis	arbor vitae	THUOCC	native	4	-3
Triantha glutinosa	false asphodel	TRIGLU	native	10	-5
Viola nephrophylla	northern bog violet	VIONEP	native	8	-3

Appendix 2.4. Thunder Bay Island Limestone Cobble Shore

Conservatism-Based Metrics:

Total Mean C:	3.5
Native Mean C:	4.4
Total FQI:	34.6
Native FQI:	39.1
Adjusted FQI:	39.5
% C value 0:	25.5
% C value 1-3:	29.6
% C value 4-6:	21.4
% C value 7-10:	23.5
Native Tree Mean C:	2.7
Native Shrub Mean C:	4.9
Native Herbaceous Mean C:	4.4

Species Richness:

Total Species:	98	
Native Species:	79	80.60%
Non-native Species:	19	19.40%

Species Wetness:

Mean Wetness:	-0.4
Native Mean Wetness:	-1

Physiognomy Metrics:

Tree:	6	6.10%
Shrub:	14	14.30%
Vine:	2	2.00%
Forb:	55	56.10%
Grass:	11	11.20%
Sedge:	7	7.10%
Rush:	2	2%
Fern:	1	1.00%
Bryophyte:	0	0%

Duration Metrics:

Annual:	14	14.30%
Perennial:	75	76.50%
Biennial:	9	9.20%
Native Annual:	12	12.20%
Native Perennial:	65	66.30%
Native Biennial:	2	2.00%

Appendix 2.4. Thunder Bay Island Limestone Cobble Shore (continued)

Scientific Name	Common Name	Acronym	Native?	C	W
Abies balsamea	balsam fir	ABIBAL	native	3	0
Agalinis purpurea	purple false foxglove	AGAPUR	native	7	-3
Agrostis scabra	ticklegrass	AGRSCA	native	4	0
Ambrosia artemisiifolia	common ragweed	AMBART	native	0	3
Anemone canadensis	canada anemone	ANECAN	native	4	-3
Anemone cylindrica	thimbleweed	ANECYL	native	6	5
Aquilegia canadensis	wild columbine	AQUCAN	native	5	3
Arctostaphylos uva-ursi	bearberry	ARCUVA	native	8	5
Asclepias syriaca	common milkweed	ASCSYR	native	1	5
Barbarea vulgaris	**yellow rocket**	**BARVUL**	**non-native**	**0**	**0**
Betula papyrifera	paper birch	BETPAP	native	2	3
Bidens frondosa	common beggar-ticks	BIDFRO	native	1	-3
Calamagrostis canadensis	blue-joint	CALCAN	native	3	-5
Calamagrostis epigeios	**reedgrass**	**CALEPI**	**non-native**	**0**	**3**
Carex eburnea	sedge	CXEBUR	native	7	3
Carex hystericina	sedge	CXHYST	native	2	-5
Carex stricta	sedge	CXSTRI	native	4	-5
Carex viridula	sedge	CXVIRU	native	4	-5
Centaurea stoebe	**spotted knapweed**	**CENSTO**	**non-native**	**0**	**5**
Cirsium vulgare	**bull thistle**	**CIRVUL**	**non-native**	**0**	**3**
Clinopodium arkansanum	limestone calamint	CLIARK	native	10	-3
Comandra umbellata	bastard-toadflax	COMUMB	native	5	3
Conyza canadensis	horseweed	CONCAN	native	0	3
Coreopsis lanceolata	sand coreopsis	CORLAN	native	8	3
Cornus sericea	red-osier	CORSER	native	2	-3
Dasiphora fruticosa	shrubby cinquefoil	DASFRU	native	8	-3
Daucus carota	**queen-annes-lace**	**DAUCAR**	**non-native**	**0**	**5**
Dichanthelium boreale	northern panic grass	DICBOR	native	7	0
Dichanthelium implicatum	panic grass	DICIMP	native	3	0
Dichanthelium lindheimeri	panic grass	DICLID	native	8	-5
Eleocharis elliptica	golden-seeded spike rush	ELEELL	native	6	-5
Epilobium coloratum	cinnamon willow-herb	EPICOL	native	3	-5
Epilobium hirsutum	**great hairy willow-herb**	**EPIHIR**	**non-native**	**0**	**-3**
Erechtites hieraciifolius	fireweed	EREHIE	native	2	3
Eupatorium perfoliatum	boneset	EUPPER	native	4	-3
Euthamia graminifolia	grass-leaved goldenrod	EUTGRA	native	3	0
Fragaria virginiana	wild strawberry	FRAVIR	native	2	3
Fraxinus pennsylvanica	red ash	FRAPEN	native	2	-3
Galeopsis tetrahit	**hemp-nettle**	**GALTET**	**non-native**	**0**	**3**
Gentianopsis virgata	small fringed gentian	GENVIR	native	8	-5
Geranium robertianum	herb robert	GERROB	native	3	3
Hypericum kalmianum	kalms st. johns-wort	HYPKAL	native	10	-3
Hypericum perforatum	**common st. johns-wort**	**HYPPER**	**non-native**	**0**	**5**
Impatiens capensis	spotted touch-me-not	IMPCAP	native	2	-3
Juncus brachycephalus	rush	JUNBRP	native	7	-5

Appendix 2.4. Thunder Bay Island Limestone Cobble Shore (continued)

Scientific Name	Common Name	Acronym	Native?	C	W
Juncus dudleyi	dudleys rush	JUNDUD	native	1	-3
Lactuca canadensis	tall lettuce	LACCAN	native	2	3
Lobelia spicata	pale spiked lobelia	LOBSPI	native	4	0
Lonicera dioica	red honeysuckle	LONDIO	native	5	3
Lycopus americanus	common water horehound	LYCAME	native	2	-5
Lythrum salicaria	**purple loosestrife**	**LYTSAL**	**non-native**	**0**	**-5**
Maianthemum stellatum	starry false solomon-seal	MAISTE	native	5	0
Medicago lupulina	**black medick**	**MEDLUP**	**non-native**	**0**	**3**
Mycelis muralis	**wall lettuce**	**MYCMUR**	**non-native**	**0**	**5**
Oenothera biennis	common evening-primrose	OENBIE	native	2	3
Panicum capillare	witch grass	PANCAP	native	0	0
Parnassia glauca	grass-of-parnassus	PARGLA	native	8	-5
Pastinaca sativa	**wild parsnip**	**PASSAT**	**non-native**	**0**	**5**
Persicaria pensylvanica	bigseed smartweed	PERPEN	native	0	-3
Phalaris arundinacea	**reed canary grass**	**PHAARU**	**non-native**	**0**	**-3**
Phragmites australis var. americanus	reed	PHRAUM	native	5	-3
Physocarpus opulifolius	ninebark	PHYOPU	native	4	-3
Picea glauca	white spruce	PICGLA	native	3	3
Poa compressa	**canada bluegrass**	**POACOM**	**non-native**	**0**	**3**
Polygala paucifolia	gay-wings	POLPAU	native	7	3
Polygonum ramosissimum	bushy knotweed	POLRAM	native	7	0
Populus balsamifera	balsam poplar	POPBAL	native	2	-3
Potentilla anserina	silverweed	POTANS	native	5	-3
Potentilla norvegica	rough cinquefoil	POTNOR	native	0	0
Primula mistassinica	birds-eye primrose	PRIMIS	native	10	-3
Prunella vulgaris	self-heal	PRUVUL	native	0	0
Prunus pumila	sand cherry	PRUPUM	native	8	5
Rhamnus alnifolia	alder-leaved buckthorn	RHAALN	native	8	-5
Rhus typhina	staghorn sumac	RHUTYP	native	2	3
Rhynchospora capillacea	beak-rush	RHYCAL	native	10	-5
Rubus strigosus	wild red raspberry	RUBSTR	native	2	0
Rudbeckia hirta	black-eyed susan	RUDHIR	native	1	3
Rumex crispus	**curly dock**	**RUMCRI**	**non-native**	**0**	**0**
Salix bebbiana	bebbs willow	SALBEB	native	1	-3
Salix petiolaris	slender willow	SALPET	native	1	-3
Schoenoplectus pungens	threesquare	SCHPUN	native	5	-5
Sedum acre	**mossy stonecrop**	**SEDACR**	**non-native**	**0**	**5**
Selaginella selaginoides	spikemoss	SELSEL	native	10	-3
Shepherdia canadensis	soapberry	SHECAN	native	7	5
Sisyrinchium mucronatum	slender blue-eyed-grass	SISMUC	native	10	0
Solanum dulcamara	**bittersweet nightshade**	**SOLDUL**	**non-native**	**0**	**0**
Solidago canadensis	canada goldenrod	SOLCAN	native	1	3
Solidago ohioensis	ohio goldenrod	SOLOHI	native	8	-5
Sphenopholis intermedia	slender wedgegrass	SPHINT	native	4	0
Symphyotrichum lanceolatum	panicled aster	SYMLAN	native	2	-3

Appendix 2.4. Thunder Bay Island Limestone Cobble Shore (continued)

Scientific Name	Common Name	Acronym	Native?	C	W
Thuja occidentalis	arbor vitae	THUOCC	native	4	-3
Toxicodendron rydbergii	poison-ivy	TOXRYD	native	3	0
Typha angustifolia	**narrow-leaved cat-tail**	**TYPANG**	**non-native**	**0**	**-5**
Verbascum thapsus	**common mullein**	**VERTHA**	**non-native**	**0**	**5**
Verbena hastata	blue vervain	VERHAS	native	4	-3
Veronica anagallis-aquatica	water speedwell	VERANA	native	4	-5
Viburnum trilobum	american highbush-cranberry	VIBTRI	native	5	-3
Viola nephrophylla	northern bog violet	VIONEP	native	8	-3

Appendix 3 - Ojibwe Names for Plants Observed on Thunder Bay Island

This appendix includes a crosswalk between Anishinaabemowin or Ojibwe names, scientific names, and common English names for all plant species observed on Thunder Bay Island that are listed in “Plants used by the Great Lakes Ojibwa” (Meeker et al. 1993). Within the crosswalk, when multiple Ojibwe names are known for the same plant, the Ojibwe names are separated by a semi-colon. Many names were originally documented by non-Ojibwe speakers and the spellings of some of the names were not restored by Ojibwe speakers so are reproduced here phonetically. We indicate whether or not a plant has been restored. Note that we do not reproduce accents (diacritical marks) for names included only under a phonetic name in Meeker et al. (1993) and this may affect pronunciation (for example, some “s” = “zh”). Multiple scientific names separated by semi-colons indicate closely related species we have crosswalked to a single Ojibwe name. The first scientific name listed is the species listed in Meeker et al. (1993). If Meeker et al. (1993) lists a synonym or only includes a closely related species, then the scientific name used in Meeker et al. (1993) is listed in parentheses with an asterisk (*) indicating different but closely related species. Page numbers within the crosswalk indicate the page in Meeker et al. (1993) where the plant is referenced. We provide this crosswalk alphabetized by Ojibwe names first (**Appendix 3.1**) and then alphabetized by scientific names second (**Appendix 3.2**).

Appendix 3.1. Crosswalk between Ojibwe names and scientific and English names alphabetized by Ojibwe names.

Ojibwe Name	Restored	Page	Scientific Name	English Name
aninaandag, -oog; ininaandag, -oog; bigiwaandag, -oog; zhinbog, --g; zhingobaaandag, -oog; zhingob bigiwaandag	Yes	313	*Abies balsamea*	balsam fir
zhiishiiginewanzh, iig; zhiishiigimiiwanzh, -iig	Yes	229	*Acer rubrum*	red maple
zhaashaagobiimag	Yes	315	*Acer spicatum*	mountain maple
ajidamoowaanow; waabigwan	Yes	93	*Achillea millefolium*	yarrow
ojiibikens; waashkobijiibikak; wiishkbobijiibik	Yes	316	*Actaea rubra*	red baneberry
gozwgwaakominagaawanzh (plant); gozigwaakomin, -ag (berry); ozagadigom; zazigaakominagaawamzh	Yes	231	*Amelanchier arborea; A. bartramiana; A. interior; A. sanguinea; A. spicata (*A. laevis)*	serviceberries
muckode 'kanes	Yes	62	*Andropogon gerardii*	big bluestem
midewijiibik	Yes	155	*Anemone canadensis*	canada anemone
gaanda'igwaasoning ezhinaagwak	Yes	206	*Anemone cylindrica*	thimbleweed
zaesikanibowin	No	92	*Anticlea elegans (Zigadenus e.)*	white camas
misudidjeebik	No	234	*Aquilegia canadensis*	wild columbine
?bebaamaabiig; okaaadaak; waaboozojiibik	Yes	235	*Aralia nudicaulis*	wild sarsaparilla
apaakozigan; miskwaabiimag	Yes	18	*Arctostaphylos uva-ursi*	bearberry
ininiwa/inzh; zhaabozigan	Yes	99	*Asclepias syriaca*	common milkweed
wiinizik	Yes	277	*Betula alleghaniensis*	yellow birch
wiigwaas, -an, -ag; wiigwaasaatig; wiigwaasi-mitig; wiigwaasimizh	Yes	239	*Betula papyrifera*	paper birch
(g)odotaagaans; ?ziiginise; ziiginis (e)	Yes	35	*Campanula rotundifolia*	harebell
?wenabozhoo nookomis wiinizisan; ?nenzbozh ookomisan miinizisan	Yes	159	*Castilleja coccinea*	scarlet paintbrush
(gi)chi-mazaanashk	Yes	103	*Cirsium vulgare*	bull thistle
waabigwan	Yes	104	*Conyza canadensis*	horseweed
miskoobimizh; miskwaabiimizh	Yes	340	*Cornus rugosa (*C. sericea)*	round-leaved dogwood
miskoobimizh; miskwaabiimizh	Yes	340	*Cornus sericea*	red-osier
makizin	Yes	376	*Cypripedium parviflorum (C. calceolus)*	yellow lady-slipper
wezauskwagmik; osawa ' skanet	No	245	*Diervilla lonicera*	bush-honeysuckle
ana ' ganuck	No	378	*Dryopteris carthusiana (*D. cristata)*	spinulose woodfern
ana ' ganuck	No	378	*Dryopteris fragrans; D. intermedia; D. marginalis (*D. cristata)*	woodferns
jasibonskok; aiankosing; gezibnusk; giji ' binusk	No	107	*Equisetum arvense*	common horsetail

Appendix 3.1. Crosswalk between Ojibwe names and scientific and English names alphabetized by Ojibwe names (continued)

Ojibwe Name	Restored	Page	Scientific Name	English Name
jasibonskok; aiankosing; gezibnusk; giji ' binusk	No	107	*Equisetum variegatum (*E. arvense)*	common horsetail
niya 'wibukuk '; siabuksing, sasabwaksing; piskagamisag	No	163	*Eupatorium perfoliatum*	boneset
wezaawaaskoneg	Yes	41	*Euthamia graminifolia*	flat-topped goldenrod
ode'imin, -an; ode'iminjiibik	Yes	109	*Fragaria virginiana*	wild strawberry
aagimaak	Yes	358	*Fraxinus pennsylvanica*	red ash
bezhigoojiibik; ozaawaaskoniins	Yes	290	*Geranium bicknellii; G. robertianum (*G. maculatum)*	geraniums
waabigwan; memisku 'nakuk	No	20	*Hieracium aurantiacum, H. caespitosum; H. piloselloides; H. scabrum; H. umbellatum (*H. kalmii)*	hawkweeds
waabigwan; memisku 'nakuk	No	20	*Hieracium kalmii*	kalms hawkweed
ozaawashkojiibik	Yes	360	*Impatiens capensis*	spotted touch-me-not
nabagashk; wiikenh; zhaabozigan	Yes	170	*Iris versicolor*	wild blue flag
odjici ' gomin	No	362	*Lactuca canadensis*	tall lettuce
mashkiigwaatig	Yes	381	*Larix laricina*	tamarack
bebezhigooganshii-mashkiki	Yes	172	*Lathyrus palustris*	marsh pea
sabankuk	No	215	*Lonicera dioica*	red honeysuckle
aandegopin	Yes	174	*Lycopus americanus (*L. asper)*	common water horehound
agongosimin, -an, -ag	Yes	326	*Maianthemum canadense*	canada mayflower
wa 'sawasni 'mike	No	175	*Myrica gale*	sweet gale
a ' nana ' ganuck	No	344	*Onoclea sensibilis*	sensitive fern
pigwe 'wunusk	Yes	118	*Pastinaca sativa*	wild parsnip
pebigumskike	No	178	*Persicaria pensylvanica; polygonum p.*	bigseed smartweed
aaboojigan	Yes	145	*Phragmites australis var. americanus*	reed
miskwazi-wusk	No	47	*Physocarpus opulifolius*	Rosaceae
gaawaandag; gaawaandagwaatig; mina'ig; wadab; zesegaandag	Yes	327	*Picea glauca*	white spruce
zhingwaak	Yes	220	*Pinus strobus*	white pine
tikizidgeebikohnse	Yes	24	*Polygala paucifolia*	gay-wings
azaadi(i); maanazaadi(i)	Yes	328	*Populus balsamifera*	balsam poplar
azaadi(i); azaadiins	Yes	253	*Populus tremuloides*	quaking aspen
gichi-ode'iminjiibik	Yes	49	*Potentilla norvegica*	rough cinquefoil
doodooshaabonjiibik; zhiishiigwebik	Yes	254	*Prenanthes alba*	white lettuce
baasibagak; nameswashk; namewashkoons	Yes	120	*Prunella vulgaris*	self-heal
sewa 'komin	No	50	*Prunus pumila*	sand cherry
asa/isaweminagaawanzh (plant); asa/isawemin (berry)	Yes	256	*Prunus virginiana*	choke cherry
baakwaanaatig; baakwaanimizh	Yes	28	*Rhus typhina*	staghorn sumac

Appendix 3.1. Crosswalk between Ojibwe names and scientific and English names alphabetized by Ojibwe names (continued)

Ojibwe Name	Restored	Page	Scientific Name	English Name
miskominagaawanzh; miskwiminagaawanzh; miskomin, -ag; miskimin, -ag	Yes	125	*Rubus hispidus; R. strigosus (R. idaeus)*	raspberries
miskominagaawanzh; miskwiminagaawanzh; miskomin, -ag; miskimin, -ag	Yes	125	*Rubus parviflorus (*R. strigosus)*	timbleberry
wezawab-gonik	No	84	*Rudbeckia hirta*	black-eyed susan
ginoozhewashk; ozawijiibik; zhiiwibag	Yes	127	*Rumex crispus*	curly dock
oziisigobimizh	Yes	200	*Salix candida*	hoary willow
kokbenognik keya; sasgob-mins	No	54	*Salix exigua*	sandbar willow
oziisigobimizh	Yes	386	*Salix pedicellaris*	bog willow
kokbenognik keya; sasgob-mins	No	54	*Salix spp. (*Salix exigua)*	willows
papshkisiganak; papskatciksi ' gana 'tig	Yes	305	*Sambucus racemosa*	red-berried elder
naubishkaukoot	No	129	*Sisyrinchium montanum*	mountain blue-eyed-grass
ajidamoowaanow; giiziso-mashkiki	Yes	349	*Solidago canadensis*	canada goldenrod
ajidamoowaanow; giiziso-mashkiki	Yes	349	*Solidago spp.*	goldenrods
ah-o-je-mahg (adjimag)	No	333	*Sorbus americana; Sorbus decora*	mountain-ash
wiiniziikens	Yes	157	*Symphyotrichum spp. (*S. puniceus)*	asters
doodooshaaboojiibik; mindimooyenh	Yes	134	*Taraxacum officinale*	common dandelion
ne 'bagandag '; pebamabid-singup	No	335	*Taxus canadensis*	yew
giizhik, -ag; gizhikens, -ag; giizhikenh	Yes	387	*Thuja occidentalis*	arbor vitae
animikiibag	Yes	135	*Toxicodendron radicans; T. rydbergi*	poison-ivy
nawo 'buguk; wunukibugauh	No	336	*Trientalis borealis*	star-flower
ini 'niwin'dibige'gun; baushkindjibgwaun	No	308	*Trillium cernuum (*T. grandiflorum)*	nodding trillium
apakway; apakweshk; apakweshkway; nabagashk	Yes	152	*Typha latifolia*	broad-leaved cat-tail
zhawaseshkoohnse	No	186	*Verbena hastata*	blue vervain
aditeminagaanwanzh (plant); atiteminagaawanzh (plant); aditemin (berry); atitemin (berry)	Yes	267	*Viburnum edule (*V. lentago)*	squashberry
aniibimin, -an (berry); aniibiminagaawashk (plant)	Yes	351	*Viburnum trilobum (V. opulus)*	american highbush-cranberry
maskwi ' widzhi ' wiko 'kok	No	312	*Viola nephrophylla; V. renifolia (*V. canadensis)*	violets

Appendix 3.2. Crosswalk between Ojibwe names and scientific and English names alphabetized by scientific names.

Ojibwe Name	Restored	Page	Scientific Name	English Name
(g)odotaagaans; ?ziiginise; ziiginis (e)	Yes	35	*Campanula rotundifolia*	harebell
(gi)chi-mazaanashk	Yes	103	*Cirsium vulgare*	bull thistle
?bebaamaabiig; okaaadaak; waaboozojiibik	Yes	235	*Aralia nudicaulis*	wild sarsaparilla
?wenabozhoo nookomis wiinizisan; ?nenzbozh ookomisan miinizisan	Yes	159	*Castilleja coccinea*	scarlet paintbrush
a ' nana ' ganuck	No	344	*Onoclea sensibilis*	sensitive fern
aaboojigan	Yes	145	*Phragmites australis var. americanus*	reed
aagimaak	Yes	358	*Fraxinus pennsylvanica*	red ash
aandegopin	Yes	174	*Lycopus americanus (*L. asper)*	common water horehound
aditeminagaanwanzh (plant); atiteminagaawanzh (plant); aditemin (berry); atitemin (berry)	Yes	267	*Viburnum edule (*V. lentago)*	squashberry
agongosimin, -an, -ag	Yes	326	*Maianthemum canadense*	canada mayflower
ah-o-je-mahg (adjimag)	No	333	*Sorbus americana; Sorbus decora*	mountain-ash
ajidamoowaanow; giiziso-mashkiki	Yes	349	*Solidago canadensis*	canada goldenrod
ajidamoowaanow; giiziso-mashkiki	Yes	349	*Solidago spp.*	goldenrods
ajidamoowaanow; waabigwan	Yes	93	*Achillea millefolium*	yarrow
ana ' ganuck	No	378	*Dryopteris carthusiana (*D. cristata)*	spinulose woodfern
ana ' ganuck	No	378	*Dryopteris fragrans; D. intermedia; D. marginalis (*D. cristata)*	woodferns
aniibimin, -an (berry); aniibiminagaawashk (plant)	Yes	351	*Viburnum trilobum (V. opulus)*	american highbush-cranberry
animikiibag	Yes	135	*Toxicodendron radicans; T. rydbergi*	poison-ivy
aninaandag, -oog; ininaandag, -oog; bigiwaandag, -oog; zhinbog, --g; zhingobaaandag, -oog; zhingob bigiwaandag	Yes	313	*Abies balsamea*	balsam fir
apaakozigan; miskwaabiimag	Yes	18	*Arctostaphylos uva-ursi*	bearberry
apakway; apakweshk; apakweshkway; nabagashk	Yes	152	*Typha latifolia*	broad-leaved cat-tail
asa/isaweminagaawanzh (plant); asa/isawemin (berry)	Yes	256	*Prunus virginiana*	choke cherry
azaadi(i); azaadiins	Yes	253	*Populus tremuloides*	quaking aspen
azaadi(i); maanazaadi(i)	Yes	328	*Populus balsamifera*	balsam poplar
baakwaanaatig; baakwaanimizh	Yes	28	*Rhus typhina*	staghorn sumac
baasibagak; nameswashk; namewashkoons	Yes	120	*Prunella vulgaris*	self-heal
bebezhigooganshii-mashkiki	Yes	172	*Lathyrus palustris*	marsh pea

Appendix 3.2. Crosswalk between Ojibwe names and scientific and English names alphabetized by scientific names.

Ojibwe Name	Restored	Page	Scientific Name	English Name
bezhigoojiibik; ozaawaaskoniins	Yes	290	*Geranium bicknellii; G. robertianum (*G. maculatum)*	geraniums
doodooshaabonjiibik; zhiishiigwebik	Yes	254	*Prenanthes alba*	white lettuce
doodooshaaboojiibik; mindimooyenh	Yes	134	*Taraxacum officinale*	common dandelion
gaanda'igwaasoning ezhinaagwak	Yes	206	*Anemone cylindrica*	thimbleweed
gaawaandag; gaawaandagwaatig; mina'ig; wadab; zesegaandag	Yes	327	*Picea glauca*	white spruce
gichi-ode'iminijiibik	Yes	49	*Potentilla norvegica*	rough cinquefoil
giizhik, -ag; gizhikens, -ag; giizhikenh	Yes	387	*Thuja occidentalis*	arbor vitae
ginoozhewashk; ozawijiibik; zhiiwibag	Yes	127	*Rumex crispus*	curly dock
gozwgwaakominagaawanzh (plant); gozigwaakomin, -ag (berry); ozagadigom; zazigaakominagaawamzh	Yes	231	*Amelanchier arborea; A. bartramiana; A. interior; A. sanguinea; A. spicata (*A. laevis)*	serviceberries
ini 'niwin'dibige'gun; baushkindjibgwaun	No	308	*Trillium cernuum (*T. grandiflorum)*	nodding trillium
ininiwa/inzh; zhaabozigan	Yes	99	*Asclepias syriaca*	common milkweed
jasibonskok; aiankosing; gezibnusk; giji ' binusk	No	107	*Equisetum arvense*	common horsetail
jasibonskok; aiankosing; gezibnusk; giji ' binusk	No	107	*Equisetum variegatum (*E. arvense)*	common horsetail
kokbenognik keya; sasgob-mins	No	54	*Salix exigua*	sandbar willow
kokbenognik keya; sasgob-mins	No	54	*Salix spp. (*Salix exigua)*	willows
makizin	Yes	376	*Cypripedium parviflorum (C. calceolus)*	yellow lady-slipper
mashkiigwaatig	Yes	381	*Larix laricina*	tamarack
maskwi ' widzhi ' wiko 'kok	No	312	*Viola nephrophylla; V. renifolia (*V. canadensis)*	violets
midewijiibik	Yes	155	*Anemone canadensis*	canada anemone
miskominagaawanzh; miskwiminagaawanzh; miskomin, -ag; miskimin, -ag	Yes	125	*Rubus hispidus; R. strigosus (R. idaeus)*	raspberries
miskominagaawanzh; miskwiminagaawanzh; miskomin, -ag; miskimin, -ag	Yes	125	*Rubus parviflorus (*R. strigosus)*	timbleberry
miskoobimizh; miskwaabiimizh	Yes	340	*Cornus rugosa (*C. sericea)*	round-leaved dogwood
miskoobimizh; miskwaabiimizh	Yes	340	*Cornus sericea*	red-osier
miskwazi-wusk	No	47	*Physocarpus opulifolius*	Rosaceae
misudidjeebik	No	234	*Aquilegia canadensis*	wild columbine
muckode 'kanes	Yes	62	*Andropogon gerardii*	big bluestem
nabagashk; wiikenh; zhaabozigan	Yes	170	*Iris versicolor*	wild blue flag

Appendix 3.2. Crosswalk between Ojibwe names and scientific and English names alphabetized by scientific names.

Ojibwe Name	Restored	Page	Scientific Name	English Name
naubishkaukoot	No	129	*Sisyrinchium montanum*	mountain blue-eyed-grass
nawo 'buguk; wunukibugauh	No	336	*Trientalis borealis*	star-flower
ne 'bagandag '; pebamabid-singup	No	335	*Taxus canadensis*	yew
niya 'wibukuk '; siabuksing, sasabwaksing; piskagamisag	No	163	*Eupatorium perfoliatum*	boneset
ode'imin, -an; ode'iminijiibik	Yes	109	*Fragaria virginiana*	wild strawberry
odjici ' gomin	No	362	*Lactuca canadensis*	tall lettuce
ojiibikens; waashkobijiibikak; wiishkbobijiibik	Yes	316	*Actaea rubra*	red baneberry
ozaawashkojiibik	Yes	360	*Impatiens capensis*	spotted touch-me-not
oziisigobimizh	Yes	200	*Salix candida*	hoary willow
oziisigobimizh	Yes	386	*Salix pedicellaris*	bog willow
papshkisiganak; papskatciksi ' gana 'tig	Yes	305	*Sambucus racemosa*	red-berried elder
pebigumskike	No	178	*Persicaria pensylvanica; polygonum p.*	bigseed smartweed
pigwe 'wunusk	Yes	118	*Pastinaca sativa*	wild parsnip
sabankuk	No	215	*Lonicera dioica*	red honeysuckle
sewa 'komin	No	50	*Prunus pumila*	sand cherry
tikizidgeebikohnse	Yes	24	*Polygala paucifolia*	gay-wings
wa 'sawasni 'mike	No	175	*Myrica gale*	sweet gale
waabigwan	Yes	104	*Conyza canadensis*	horseweed
waabigwan; memisku 'nakuk	No	20	*Hieracium aurantiacum, H. caespitosum; H. piloselloides; H. scabrum; H. umbellatum (*H. kalmii)*	hawkweeds
waabigwan; memisku 'nakuk	No	20	*Hieracium kalmii*	kalms hawkweed
wezaawaaskoneg	Yes	41	*Euthamia graminifolia*	flat-topped goldenrod
wezauskwagmik; osawa ' skanet	No	245	*Diervilla lonicera*	bush-honeysuckle
wezawab-gonik	No	84	*Rudbeckia hirta*	black-eyed susan
wiigwaas, -an, -ag; wiigwaasaatig; wiigwaasi-mitig; wiigwaasimizh	Yes	239	*Betula papyrifera*	paper birch
wiiniziikens	Yes	157	*Symphyotrichum spp. (*S. puniceus)*	asters
wiinizik	Yes	277	*Betula alleghaniensis*	yellow birch
zaesikanibowin	No	92	*Anticlea elegans (Zigadenus e.)*	white camas
zhaashaagobiimag	Yes	315	*Acer spicatum*	mountain maple
zhawaseshkoohnse	No	186	*Verbena hastata*	blue vervain
zhiishiiginewanzh, iig; zhiishiigimiiwanzh, -iig	Yes	229	*Acer rubrum*	red maple
zhingwaak	Yes	220	*Pinus strobus*	white pine